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We Care: Implementation of Service Learning on Learners Diversity to Enhance Students’ Soft Skills

Hemarani A/P Munisamy
SMPK Vokasional Indahpura
School of Education, Faculty of Social Science and Humanities, Universiti Teknologi Malaysia
henira83@yahoo.com

Mohd Rustam Mohd Rameli
School of Education, Faculty of Social Science and Humanities, Universiti Teknologi Malaysia
mrustam2@utm.my

Najua Syuhada Ahmad Alhassora
School of Education, Faculty of Social Science and Humanities, Universiti Teknologi Malaysia
najuasyuhada@utm.my

Abstract
Service learning (SL) Program is becoming a powerful educational tool that helps students to develop their soft skills. Accordingly, there have been no studies conducted on the implementation of service learning on learning disability students to enhance students’ soft skills to meet the 21st century workplace’s challenges. Soft skills fulfil an important role in shaping an individual’s personality. It is of high importance for every student to acquire adequate skills beyond academic or vocational knowledge. The objective of this study is to investigate the impact of SL Program (We Care Day) on students’ awareness towards learning disability students and to investigate the impact of SL Program (We Care Day) on students’ soft skills. Service Learning (SL) Program (We Care Day) involved 292 students from School of Education and School of Mechanical Engineering, UTM together with 36 students and 10 teachers from Sekolah Menengah Pendidikan Khas Vokasional Indah Pura. To measure the effectiveness of the SL program, the participants are required to write the self-reflection. The findings proved that SL Program (We Care Day) has a positive impact on both students’ awareness towards learning disability and also students’ soft skills in the aspect of communication skills, critical thinking skills and also leadership skills. These methods place a high value on social interaction, compared to those encouraging individual learning in line with the current trends of Blended Learning in education. Implications of these findings for classroom practice and further research are discussed.

Keywords: Service Learning; Learners Diversity; Students’ Soft Skills.

Introduction
Service-Learning (S-L) is an educational philosophy that directs learning to the well-being of the community and is currently earning its well-deserved popularity in contemporary pedagogy. In its most basic definition, S-L incorporates learning while an individual is serving others. S-L is focusing on developing students’ potential (soft skills), provides students with a unique opportunity to learn outside of the traditional classroom by engaging with an organization or the community. Several studies have examined service-learning and discovered that service-learning enriches students’ academic experience and learning. For example, S-L contributes to students meeting general education outcomes, applying concepts to real world contexts, increasing students’ multicultural skills, and civic engagement, amongst other benefits. Implementation of S-L help students to be active learners via experience, able to connect the ideas, helped shape a student’s understanding of their experience while connecting it to learning and help students to prepare required job skills. This will help the students to understand via “transformation of experience” by applying what was learned to similar experiences in the future. This research emphasises on student-centred instructional method that implements the Service Learning approaches in accordance with the New Academia Learning Innovation (NALI). Many researchers implemented S-L in mainstream education rather than special need education. The students have become more productive, creative, and innovative when conducting S-L. S-L is proven able to engage students in active learning and also in solving problem creatively, collaboratively. In this way, students will be able to understand the problem better when conducting S-L which involve critical thinking, and simultaneously able to improve their soft skills such as communication skills, teamwork skills, problem solving, as well as continuous and self-directed learners. At the same time, it will also foster the development of students’ thinking and improve their abilities in learning. In some cases, S-L has also proven able to facilitate thinking and problem solving, assist the mastery learning, inspiring, and engaging the students. This involvement helps the teacher to have better understand the problems the students are facing and address them directly in lecture as well in real life too.
Research Objectives

This study aims:
1. To investigate the impact of SL Program (We Care Day) on students’ awareness towards learning disability students.
2. To investigate the impact of SL Program (We Care Day) on students’ soft skills.

Research Methodology

We Care Day Program (SL) involved two group of participants from UTM. The first group was students’ who are taking SPPP 1012 Educational Psychology Course (n=106) while the others group were taking UHAK 1012 Graduate Success Attributes Course (n=40). Both groups were required to conduct We Care Day Program two times. The first time was held at UTM involving 36 students with learning disability and 10 teachers while the second time was held at TJ Mart, Kulai which involve community.

The activities conducted in the We Care Day Program includes sharing session entitle “I’m Proud to Be a Special Education Teacher” by one of SMPKVIP’s teachers, who shared her teaching experiences and sharing techniques for teaching special education students. There was also a poster competition on awareness of special education students in which 23 posters were contested and evaluated by eight invited judges from SMPKVIP and also by the Lecturer of the School of Education, UTM. In addition, the showcase by SMPKVIP students became a major attraction for the We Care Day Program. A total of seven exhibition booths consisted of badge printing booths, fruit carving booths and cup decorations, hairdressing booths, housekeeping booths, reflexology booths, haircuts booths and nail treatment booths. Interestingly, all exhibitions and services offered are conducted by Special Education students with visual, hearing and learning problems. These students are students in the program of Aesthetics, Hairdressing, Food Preparation, Housekeeping Operation and Desktop Publishing.

There are three stages implemented to conduct the service learning: (1) planning, (2) implementation, and (3) reflection. Firstly, planning activities and providing students with the knowledge and skills needed. The planning process include: identifying the community need(s) to be addressed, selecting and planning the specific service to be completed. Secondly, the implementation on the service activities need to be meaningful and explicitly connected to the objectives of the course. The students maintain regular contact with the community agency throughout the duration of the service-learning project. Students adhere to all established regulations and guidelines, along with adhere to agreed-upon scheduling and expectations.

Thirdly, reflection activities also provide additional opportunities to link academic work with the service activities. The students explain that reflection is an integral component of the service-learning project and stimulates students to think critically about the experience and to put it in his or her own words. In this study, participants are required to write their reflection on how this program would enhance their awareness towards students’ with learning disability and also enhance their soft skills.

Findings and Discussion

Respondents’ awareness towards learning disability students through implementation of SL Program (We Care Day) are as below:

**Reflection of student 1**: I can improve my skills in producing a poster. Not only that, I found a lot of useful information related to hearing problems ...... convey important information to the public through posters ...... After participating in the we care day program, I learned that hearing problems can be divided into several types. Before I joined the program I didn’t know that there were some types of hearing problems. Next, I am well aware of the causes of hearing loss. These include often hearing too much noise. This can be used as a guide to avoid getting involved in hearing loss. Before participating in the program, I was not careful about actions or things that could cause hearing problems.

**Reflection of student 2**: We Care Day Program really helped me get to know these special education students. Originally, I thought this student was studying in school just to learn the basics of life like taking care of foods, drinks and the basic academic matter. However, I was mistaken because some of them could go as far as normal people around them. They are able to work beyond their expectations if properly guided. The program also drives me to understand their actual situation and to learn the language they use such as sign language. Through this program, I realized that they are no different from us and that they are also capable of living a perfect life, just like ours. They are part of the function of our society and it is imperative for us as a society to dispel the mentality that treats them as individuals different from others.

**Reflection of student 3**: We Care Day Program helped me understand on students with special needs. Although they have health and learning problems, they are capable in their specialties and talents in certain areas. It is this talent that will help them survive in the work life. In addition, the poster competition taught me more about autism, hyperactive and ADHD. I now know more about the features and causes of the disease. Before joining the program, I was often confused and could not distinguish the features of this disease.

The impact of SL Program (We Care Day) on students’ soft skills are as below:
Reflection of student A: From the We Care Day program, since most of us were divided in smaller groups to perform specific tasks, I’ve managed to practice my leadership skills while conducting the group. While working as a team, and collectively with other teams, all of us involved could sharpen our soft skills by communicating with each other. We also had a hands on experience of handling an event through which we could enhance our critical thinking skills of dealing with real time events and working our way around it. Overall, I’ve equipped a lot of skills by participating in the We Care Day event.

Reflection of student B: By conducting such program as we care day, communication skill is definitely improved because we need to communicate in order to make the program successful. Our communication skill also improved when we need to communicate with learning disability students. Communicating with those type of students was not easy because we need to make clear as possible our instructions to them with patience. Next, our critical thinking skill is also improved because when the program was conducted, unexpected problem came and we need to settle it fast, so we improve our critical thinking skill through the program. Lastly, we learned to lead a team no matter how big the team was, but it is a good thing as we were improving our leadership skill to conduct and participate in activities.

Reflection of student C: I was the leader of the food unit for the we care day program, I divided all the job in food unit evenly to my unit members and lead them to do their job so that this unit can be done easily and faster. In order to prepare food for our program committees, I learnt to prepare a Google form to collect the data as some of them had to avoid some food. At here our group face a problem which our committees cannot open the Google form. Then me and another unit member quickly found out the problem of the website and fixed it. I also learnt to communicate and discuss the menu that suitable for our committees with the person in charge of the cafeteria.

Reflection of student D: Handling We Care Day absolutely taught me to work in a team such as everyone are given each responsibility and need to do it accordingly that absolutely make works easier. Next is job skill, we learnt that a result of every action should be taken by making a report. By doing so our working quality is assured. Next is critical thinking skill can be improved by mapping a plan of works and achieve the plan with any circumstances without difficulty. Last but not least handling this event help me to build a feeling of humanity and give what best for human that in need of help.

Reflection of student E: Since our department gathers of two groups, it’s more difficult to distribute the task evenly over all members. All of us need to cooperate each other to make the program smooth because it involved many student and other staff that judge the posters. We need to help judging panel with all the criteria given base on each poster. Many things to do on that program. However, all given task completed by each judging unit members. With that, all of us can improve our soft skills, leadership and even critical thinking skills by doing this program.

In sum, the implementation of We Care Day Program has impact on both students’ awareness towards learning disability and also students’ soft skills in the aspect of communication skills, critical thinking skills and also leadership skills.

Conclusion

SL Program (We Care Day) can be used to enhance the basic knowledge in soft skills. In addition, the effectiveness of SL Program (We Care Day) can be studied to determine its strengths and weaknesses, especially in vocational education towards learning disability students. More importantly, the teacher can also use SL Program (We Care Day) as an authentic tool for the students to increase their performance and activate the students’ schema to construct the meaning and to provide critical thinking. This study also proven that SL Program (We Care Day) able to increased students’ conceptual understanding and increases student engagement. Related to this, previous studies have shown that there is a positive relation between SL Program and students’ achievements and performances. For examples, improve student’s critical and structured thinking, strong work ethic, etiquette and good manners, organisational skills, courtesy, professionalism, inter and intra-personal skills, responsibility, conflict management, honesty/integrity, willingness to learn, following directions, negotiating skills, cultural awareness, teamwork capability, empathy, time management, self-esteem, sociability and self-confidence. The findings from the reflection also suggests that student’s has better awareness towards learning disability students, and therefore engage in the course at a higher level. It is also synergistic with the other 21st century skills serving as an authentic goal of communication (discussed above), and enhancing critical thinking and creativity. SL Program (We Care Day) is a meaningful and multi-disciplinary activity which can promote active engagement and incorporate a wide range of affective, collaborative and practical skills while requiring a strong sense of problem-solving, creativity and critical thinking. As such it offers the ability to promote the dispositions and ‘soft skills’ that will make our learners successful participants in society. The findings of this study could also serve as a guide to the Ministry of Education, in particular to the Teacher Training Division, to encourage all vocational teachers to implement SL Program (We Care Day) in developing skills like Problem-solving skills, making real-world connections and using multiple representations among learning disability students, which in turn will increase the success rate of learners. Secondly, the consideration should be given to implementing SL Program (We Care Day) programs/philosophy by encouraging business organizations to support student’s diversity and lastly the cooperative effort involving stakeholders and the other institutions and communities should strengthen to provide opportunities for students’ exposure in the development of their skills through SL Program (We Care Day).
References


MySL Learning Science (MySL-LS)

Zaidatun Tasir  
Department of Educational Sciences, Mathematics and Creative Multimedia, School of Education, Faculty of Social Sciences and Humanities, Universiti Teknologi Malaysia, 81310 Skudai, Johor, Malaysia.  
p-zaida@utm.my

Nurul Farhana Jumaat  
Department of Educational Sciences, Mathematics and Creative Multimedia, School of Education, Faculty of Social Sciences and Humanities, Universiti Teknologi Malaysia, 81310 Skudai, Johor, Malaysia  
nfarhana@utm.my

Ana Haziqah A Rashid  
Department of Educational Sciences, Mathematics and Creative Multimedia, School of Education, Faculty of Social Sciences and Humanities, Universiti Teknologi Malaysia, 81310 Skudai, Johor, Malaysia  
anahaziqaharashid@gmail.com

Nur Jannah Jamil  
Department of Educational Sciences, Mathematics and Creative Multimedia, School of Education, Faculty of Social Sciences and Humanities, Universiti Teknologi Malaysia, 81310 Skudai, Johor, Malaysia  
jann.ah501@gmail.com

Highlights

Hearing Impaired (HI) students always need more attention from teachers or instructors during learning process. MySL Learning Science (MySL-LS) is introduced to cater this need where students can learn Science with the aid and guidance from mobile applications. This will minimise the attention and guidance which required by the students from their teachers or instructors. MySL-LS is a mobile application that helps HI students learning Science subject through sign language videos. The sign language videos in MySL-LS also have graphical illustrations that help HI students to have better understanding on Science concepts. There are also learning activities provided in the MySL-LS for HI students to practice their understanding after learning from the sign language videos.

Key words: Mobile Applications; Hearing Impaired Students; Learning Performance; Sign Language Videos; Science

Introduction

Hearing impaired (HI) students face problems, including maintaining concentration levels in class, getting the best out of knowledge sources and communicating and adapting in the classroom environment (Jaafar and Mee, 2010). Accessible educational materials for HI students in Malaysian schools are under-developed, especially educational materials that relate to assistive technology. The existing educational materials that are available in the market, however, are not suitable to be incorporated in the formal education of HI students, because the content is not consistent with curriculum design of the Ministry of Education. Moreover, using products that have been developed based on foreign values and perspectives will probably be ineffective for HI students in Malaysian schools. Therefore, alternative-learning materials namely MySL Learning Science has been introduced, in order to overcome these problems faced by HI students in learning Science.

Content

MySL Learning Science (MySL-LS) is an innovative mobile application that aims for helping hearing impaired (HI) students learning Science subject especially for Malaysian Form 4 students. This is because HI students have literacy problem and it will become worse when they have to do multiple tasks in a limited time. The words used in books require lingual explanation, which is difficult for HI students, since they lack access to their native language (Wauters et al, 2003). Hence, MySL-LS offers alternative ways for HI students by providing sign language videos in the mobile application that helps in translating the text blocks into videos of sign language notations. MySL-LS also aims in attracting HI students’ interest towards STEM subject especially Science instead of other technical or vocational subject. Unlike any other mobile applications for learning, MySL-LS provides sign language videos in order to help HI students in understanding Science concepts better. MySL-LS comes in 8 series where each series represents one chapter of Form 4 Science subject. Each series of the applications consists of several scenarios with real-life examples.
for students to learn about Science and was presented in sign language videos with the aid of graphical illustrations. MySL-LS also allows students to revise what they have learned by doing some activities regarding the Science concepts that have been learned through the sign language videos.

MySL-LS was developed based on thorough research works that integrates both pedagogy and technology; specifically emphasized on problem solving and scenario-based learning concepts. The development of MySL-LS also being guided with the R2D2 instructional design model. R2D2 is an ID model introduced by Willis (2009) and it is based on constructivist principles. The non-linearity of the model allows entry to the procedures from any position. This instructional development model is in accordance with the problem-solving principles. MySL-LS also has been tested to HI students in the special education school. Findings have proved that MySL-LS has the potential to provide the needs of HI students in learning Science subject and as a result, their academic performance has been improved. Figure 1 shows the results of HI students’ learning performance for Science topic after using MySL-LS. MySL-LS also gives benefit to teachers since it can assist them without the need to repeat the conventional sign language learning process and just guide the HI students to study and revise without any hassles.

Figure 1: HI students’ learning performance for science topic after using MySL-LS for one week

All 8 series of MySL-LS also have been copyrighted under the Universiti Teknologi Malaysia. MySL-LS can help HI students improving their Science knowledge and, thereby, can enhance the quality of education in Malaysia. In addition, the mobile applications embedded with a sign language video for learning Science are useful to students, teachers and parents, for learning, teaching and training purposes. The applications also support the STEM Initiative in the Malaysia Education Blueprint 2013-2025 and assist persons with disabilities to access education in Malaysia. This is also supported the agenda of Sustainable Development Goals, where schools should build and upgrade education for disabled students by providing effective learning environments for suits their learning needs.

Acknowledgement

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References


Appendix 1 – Screenshot of mobile application

Screenshot of MySQL Learning Science

Apps 1: Eksplorasi Sains!

Mari belajar subjek Sains Tingkatan 4 dengan aplikasi EKSPORASI SAINS!

Arahah: Sila pilih jawapan yang betul
Apakah langkah terakhir yang perlu dilakukan dalam penyiasatan saintifik?

a. Membuat kesimpulan
b. Menulis laporan
c. Membuat hipotesis
Apps 2 : Fahami sistem badan anda!

Mari belajar subjek Sains Tingkatan 4 dengan aplikasi FAHAMI SISTEM BADAN ANDA!

Amir merupakan pelajar yang aktif!

ARAHAN: Siri isikan jawapan yang betul!

Berdasarkan senario tadi, Amir terus merembeskan air lumunya tanpa dia sedari setelah dia menghidu bau kari yang enak. Apakah noma tindakan yang dilakukan oleh Amir itu?

*SILAHKAN KIRIM JAWAPAN BESAR

SEMAK JAWAPAN
Apps 3 : Eksplorasi keturunan anda!

Mari belajar subjek Sains Tingkatan 4 dengan aplikasi EKPLORASI KETURUNAN ANDA!

Arahan : Sila pilih jawapan yang betul
Berdasarkan kisah Alin, kromosom Y pada seorang anak lelaki diwarisi daripada

a. ibu dan ayahnya
b. ibunya
c. ayahnya
Apps 4 : Bila titanic menghentam bongkah ais!

Arohan : Sila pilih jawapan yang betul
Antara penyertaan berikut, yang manakah betul tentang sifat-zarah dalam pesepakat?

a. zarah-zarah tidak tersusun sekata
b. zarah-zarah bergerak bebas
c. zarah-zarah tersusun rapat
Apps 5 : Kejap ada kejap tak ada!

Mari belajar subjek Sains Tingkatan 4 dengan aplikasi KEJAP ADA KEJAP TAK ADA!

kerana tidak mau terlepas dalam

Arahan: Sila pilih jawapan yang betul

Tenaga haba dipecahkan dalam bahaya tindakan bala kepada persekitaran yang menyebabkan suhu sekitar ________.

a. meningkat
b. tidak berubah
c. menurun
Apps 6: Tenaga nuclear: mitos vs fakta!

Arahah: Sila isikan jawapan yang betul
Dalam proses pembelahan nukleus atom Uranium-235, proses pembelahan nukleus oleh neutron secara berterusan dan perlu dikawal dipanggil _________.

Sila isikan jawapan di kotak yang didefinisikan dibawah.

SEMAK JAWAPAN
Apps 7 : Melihat dunia menerusi lensa!

Mari belajar subjek Sains Tingkatan 4 dengan aplikasi MELIHAT DUNIA MENERUSI LENSA!

Arahan: Sila pilih jawapan yang betul

Berpapah bilangan kanta yang digunakan dalam teleskop?

a. Tiga
b. Dua
c. Satu
Apps 8: Terima kasih en kimia!

Mari belajar subjek Sains Tingkatan 4 dengan aplikasi TERIMA KASIH EN KIMIA

Arahan: Sila pilih jawapan yang betul
Bagoimanakah cara yang paling sesuai dilakukan untuk mengurangkan sisa pepejal?

a. Pembakaran
b. 3R iaitu Reduce (Pengurangan), Reuse (Penggunaan Semula) dan Recycle (Kitar Semula)
c. Peneutralan
Appendix 2 – Copyright of the mobile application

Apps 1: Eksplorasi Sains!
Apps 2 : Fahami sistem badan anda!

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Pengarah,

Pusat Inovasi & Pengembangan (ICC)
Universiti Teknologi Malaysia
07-509 1160
Fax: 07-509 1160

s.k.:

TIMBAHAN DEKAM:
(Penjelajahan, Inovasi Pembangunan dan Alumn)
Fakulti Sains Sosial dan Komunikasi
Sekolah Pendidikan

: Dr. Nurlizan Fauzi bin Jamil
: Pn. Ana Hazliah binti A. Rashid
: Pn. Nur Jamaliah binti Jamil

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Ylgp. Prof. Dr. Zabdatul binti Tadzir
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[PROF. DR. MOHD. SHAHIR SHAMSIR BIN OMAR]
Pengarah,
Pusat Inovasi & Pengkomersialan (ICC)
Universiti Teknologi Malaysia
07 856 1500
UT : shahir@utm.my

5. PENGAMANAN:
(TMbild DOKUMEN)
Ylgp. Prof. Dr. Zabdatul binti Tadzir

[PROF. DR. MOHD. SHAHIR SHAMSIR BIN OMAR]
Pengarah,
Pusat Inovasi & Pengkomersialan (ICC)
Universiti Teknologi Malaysia
07 856 1500
UT : shahir@utm.my

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Pn. Nurdajah binti A. Rashid
(Fakultas, Sains, Sosial dan Kemurnian)
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Universiti Teknologi Malaysia.

[07-556 1500]

[mail@utm.my]

--

TIMBULAH DEWAN:
(Pemegang, Inovasi, Pembangunan dan Alumni)
Fakulti Sains, Sosial dan Komunikasi
Cik. Pendekaran,

Dr. Nurlai Farhana binti Jumadat
Pn. Ani Matiah binti A. Rawaid
Fakulti Sains, Sosial dan Kemasyarakatan
Cik. Pendekaran,

UTM JOHOR BAHRU.
Implementation of Hands - On Learning in Electronic System Course

Zaharah Johari, M. A. Abdul Rahim, Camallil Omar, Johari Kassim and Siti Zaleha Abdul Hamid

School of Electrical Engineering, Faculty of Engineering, Universiti Teknologi Malaysia. 81310 UTM Johor Bahru
zaharahj@utm.my, arif@utm.my, camallil@utm.my, joharikasim@utm.my and szaleha@utm.my

Azmahani Abdul Aziz

School of Civil Engineering, Faculty of Engineering, Universiti Teknologi Malaysia. 81310 UTM Johor Bahru
azmahani@utm.my

Highlights

This paper describes the implementation of new academia teaching and learning (T & L) strategies in electronic system course using hands – on learning to improve students’ content knowledge, skill development and motivation in electronic system course among electrical engineering students. This study was conducted at School of Electrical Engineering (SKE), Faculty of Engineering, Universiti Teknologi Malaysia. The hand – on learning activities is designed for specific topic which is analog to digital (ADC) and digital to analog converter (DAC) and also can be used in other topic in electronic system course. Hands – on learning is implement as (T & L) method to improve student knowledge about the content of the course, skills development and motivation to learn. Feedbacks from students are used as tools to evaluate the outcome of the course. The thematic analysis done indicates that the learning environment has improves students’ content knowledge, skills and motivation to learnt getting them ready for industry 4.0 revolution. In summary, hands – on learning is an effective experiential learning tool and can be apply to other electronic related course.

Key words: station rotational; hands-on learning; experiential learning

Introduction

The implementation of new academia (T & L) strategies as part of the New Academia Learning Innovation (NAU) in higher education is necessary to direct the teaching and learning to a more student centered approach particularly for engineering students (Makhoka et al.1997). This is in line with 21st century skills to produce graduates that are creative, able to communicate effectively, think critically and collaborate with others. The traditional lecture based is no longer feasible as the majority of the teaching delivery is only one way. As a result, student become more passive and tends to memorize without having conceptual understanding. Electronic system course content involve a lot of circuit system and requires students’ skill to analyze and design circuit using theorem and method. Feedbacks from lecturer teaching the course commented that student tend to memorize without having to understand the working principle and operation. Therefore, effective teaching and learning strategy is necessary to assist student learning. There are numbers of way on how (T & L) can be done effectively through active and cooperative learning. For example, Mitchell et al. 2012 have attempt problem based learning (PBL) approach; scenario based learning (Thomson et al. 2008), collaborative learning (Denis et al. 2001) and experiential learning (Ayob et al. 2012). This study attempted to investigate if the hands – on learning help student improving content knowledge, develop skills and enhance motivation in studying electronic system. For this purpose, we select one topic within the syllabus which is ADC/DAC topic. The learning was done in laboratory where it involves circuit construction and use of measurement instrument. Hands – on learning is one of the essential components in experiential learning where student learnt through concrete experience, reflective observation, abstract conceptualization and active experimentation according to Kolb’s experiential learning theory (Kolb 1984).

Educational Theories

Experiential learning is underpinning in this study to investigate the effectiveness of implementing hands – on learning in electronic system course to enhance student content knowledge, development of skills and motivation. Kolb’s experiential learning theory defines experiential learning as the process whereby knowledge is created through transformation of experience. Knowledge results from the combination of grasping and transforming experience. The criteria outlined by Anderson et al 2000 have to be fulfilled to ensure effective implementation of experiential learning. During laboratory work, the student will construct the circuit and observe the system behavior. At this stage, student will notice what is happening to the system and try to relate to past experience and conceptual understanding. The next cycle the student when through is the experimentation where they have to test the circuit functionality including using and testing the information they receive for other types of circuit system. This learning model showed in Figure 1 (a – b) was implemented to evaluate the effectiveness of implementing hands – on learning for enhancing student content knowledge, skills development and motivation in studying electronic system course.
NAI Approach Implemented in ADC/DAC Topic in Electronic System Course

The design framework for T&L ADC/DAC in electronic system course is shown in Figure 1(a) as adapted from NALI in hands – on learning activities, student will have to go through all the four process shown in Figure 1(a). Students’ will need to construct the ADC/DAC system according to the circuit in the lab sheet and use the measurement instrument to evaluate the functionality of the system. Figure 1(b) displayed the operational framework. Student will go through in class T & L as well as assessment using quizzes and tutorials. Students’ will be doing the hands – on activity in lab by constructing the system for ADC and DAC circuit namely, binary weighted resistor (BWR) circuit, R2R ladder network (R2RLN), ADC 0804 or DAC 0808 according to what have been assigned to their group. Using station rotational model, the group will rotate to other station to attempt other types of experiment. All groups will have to attempt the experiment for all the four system. After doing the hands – on learning activity, student improvement on content of knowledge, skills and motivation will be evaluated.

Figure 1(a): Framework of Teaching and Learning Electronic System Course for Topic on ADC/DAC

Figure 1 (b): Operational Framework for Hands – on learning in Electronic System Course for Topic on ADC/DAC

Student Perception on Content of Knowledge, Skills Development & Motivation

After the session, student was required to submit their reflections. Students’ perception on content knowledge, skills development and motivations was extracted. Statement from student reflection taken individually and in group as listed in Table 1. From the feedback, the majority of the students responded that they manage to improve their understand on ADC and DAC well. Furthermore, the students’ has also recommend that the hands-on session should be done for other topics as well

<table>
<thead>
<tr>
<th>Table 1: Sample of Student’s Perception of Content of Knowledge</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Respondent</strong></td>
</tr>
<tr>
<td>R1</td>
</tr>
<tr>
<td>R4</td>
</tr>
<tr>
<td>R13</td>
</tr>
<tr>
<td>R17</td>
</tr>
<tr>
<td>R12</td>
</tr>
<tr>
<td>G2</td>
</tr>
</tbody>
</table>
Apart from improving students’ content of knowledge, the implementation of hands-on learning able to develop their communication and collaborations skills. As the design of the hands-on learning activity requires them to assemble the circuit and testing, it requires troubleshooting when the circuit fails to function correctly. Apart from acquiring collaborative skill to solve the problem, the learnt to communicate effectively among team members to overcome the problem. The development of effective communication skills is also evident when members from other station able to explain well on topic that they have done. Table 2 listed some examples of statement from students’ reflections indicating the skills they have use throughout the hands-on activity.

<table>
<thead>
<tr>
<th>Respondent</th>
<th>Student’s Perception of content of knowledge</th>
</tr>
</thead>
<tbody>
<tr>
<td>R4</td>
<td>“Although I have encountered a lot of problems, but with the help of and commitment from my group mates we manage to overcome the problem”</td>
</tr>
<tr>
<td>R14</td>
<td>“I also gain knowledge from my groups but also from other group”</td>
</tr>
<tr>
<td>R16</td>
<td>“Some groups explain their experiment very well”</td>
</tr>
</tbody>
</table>

Table 2: Sample of Student’s Perception Evident of Skills Used

The hand-on learning activity has improved student motivation to learn the electronic system course. This is because they able to have conceptual understanding and reflect on what they have learnt in class. Some of the student reflection statement evident for improving motivation can be found in Table 3.

<table>
<thead>
<tr>
<th>Respondent</th>
<th>Student’s Perception of content of knowledge</th>
</tr>
</thead>
<tbody>
<tr>
<td>R3</td>
<td>“I like the activity and I enjoy the process”</td>
</tr>
<tr>
<td>R5</td>
<td>“The best part is going around learning from other groups and understand the function of new types of ADC/DAC”</td>
</tr>
<tr>
<td>R14</td>
<td>“It is interesting for us to have a practical compared to just listening to the theory in lecture”</td>
</tr>
<tr>
<td>R23</td>
<td>“we had fun learning from other groups”</td>
</tr>
<tr>
<td>R27</td>
<td>“I become more excited and get chance to improve my knowledge on the subject”</td>
</tr>
<tr>
<td>R32</td>
<td>“I found it very helpful because my friends are very supportive in explaining their parts”</td>
</tr>
</tbody>
</table>

Table 3: Sample of Student’s Perception on Motivation

A part from the success of the hands-on learning implementation in system electronic course, there are few shortcomings identified. First, students’ should be clearly explained on the method use to ensure smooth flow during the station rotation. Due to large number of students, the control of the class becomes more challenging. In addition, since the activities involve circuit implementation and testing, proper time management is needed.

Conclusion

In summary, the implementation hands-on learning in electronic system course for ADC/DAC topic has improved student understanding on the topic. Besides that, the skills used such as collaborative skills to solve problem they also learnt on how to communicate effectively to explain. The hands-on learning also improve student motivation learning the course. The approach implemented here can be used as an alternative teaching tool to ensure effective delivery of the course. Further improvement is needed in the implementation of the hands-on learning approach in electronic system course.

Acknowledgement

We would like to thanks Universiti Teknologi Malaysia for providing excellent teaching and learning environment. Also thanks to UTLLEAD for providing teaching and learning courses.

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Invisible Confusions: Infrared Spectral Interpretation

Norazah Basar, Siti Aminah Setu, Sheela Chandren, Che Rozid Mamat
Department of Chemistry, Faculty of Science, 81310 UTM Johor Bahru, Johor
norazahb@utm.my

Highlights
Students’ misconceptions become a major concern because its influence how students learn new scientific knowledge in acquiring correct body of knowledge. Teaching methods and new teaching materials should be devised and presented to help student to gain complete understanding of the abstract concepts. In this approach, the interactive IR (Infrared) Card with implementation of in situ learning environment to replace conventional teaching strategies will be introduced.

Key words: Confusions; IR card; interpretation

Introduction (Project or Innovation)
Infrared spectroscopy is widely used in industry as well as in research. It is a simple and reliable technique for measurement and a common task of practicing chemists. Student observance denotes that Infrared (IR) spectral interpretation is difficult. The IR spectra look very complicated, but student should grasp what are the important things they need to know. In order to transform student perception, teaching materials should be produced with interactive element to attract student interest. Student are introduced with a series of questions (randomly chosen script from previous student during assessment) with solution in a form of IR Card. This teaching materials can help students to ascertain their misunderstanding in spectra analysis. In addition, contextualize of knowledge which provide the why and when inquiry make it easier for the student to remember. The in-situ learning environment are more effective when students are forced to confront and correct their misperceptions.

Content (Project or Innovation)

1. Project or innovation objectives
Chemistry is one of the most important branches of science and has been regarded as one of the difficult course. The reason behind this is due to the topics are very abstract and the language used give different meanings which require higher order thinking skills for enlightenment. Students’ misconceptions at all levels constitute a major problem of concern to science educators. The challenge to identify students’ understandings and misconceptions is the aims to look for especially in the topic of infrared spectral interpretation. Cognitive level of knowledge are essential to achieve the objectives towards development skill in the recognition of characteristic absorption bands by investigation of its infrared spectra. Having in mind to achieve those skills the intended teaching materials are introduced to fulfil the mission.

2. NALI approach implemented in the research (e.g. novelty, creativity, innovativeness, applicability and impact)
Inquiry-based learning embedded with peer instruction implementation are the most powerful combination of teaching strategies that was applied in the classroom. Peer Instruction (PI) is an interactive teaching approach that focuses on student-centered learning while inquiry-based learning triggers student curiosity that encourage student to construct their own meaning of understanding.

3. Research Methodology
Implementation of this approach involve innovative teaching strategies that improve student engagement by hands-on activities and collaborative discussion with peers. Student are divided to a small group depending on inquiry-based learning or jigsaw strategies implemented in the classroom. These teaching strategies encourage students to use their imagination to dig deep when engaging with the content of the lesson. The students are actively involved with the learning and can work with their peers in collaborative groups to showcase their learning. Topics in infrared are divided to carbonyl and non-carbonyl functionalities as this is the substantial highlight in infrared spectra interpretation. Student data sheet is used as instrument of assessment to evaluate the level of student understanding and misconceptions. Feedback on the chosen teaching strategies will also documented as reference for continual quality improvement (CQI) purposes.

4. Finding and discussion of the project or innovation
Pertain on the quote of ‘confusion is a necessary state in learning’ brings to the idea on how to counterpart the
suitable teaching methods and materials in correcting misconceptions in infrared spectral interpretation. What should we do to help students with these learning misconceptions? The best plan is to make sure that student are expose to element of confusion along with a dose knowledge building. Students can eliminate their misconceptions by providing an adequate knowledge base and clear understanding of the concepts by the help of lecturer. This view highlights the impact of learners’ preconceptions and misconceptions on the process of developing new knowledge.

Figure 1 shows the example of infrared card of alkyne functionalities for unknown organic compound. Similar infrared spectrum with answer from student script of previous year were given to the current student. The wrong answer showed the misconception of the information. Students are asked to predict what would be the correct facts before being presented with information that demonstrates the common misconceptions and the scientific conception.

Misconceptions affect subsequent learning process. Remediation of students’ misconceptions is important to extent student level of understanding. By having focus on student – centred learning approach, it can give new learning environment in terms of materials and method used to explain the confusions in this topic. It also provide a variety of learning resources that can be accessed at any time by students in order to accommodate the student’s learning style. In parallel to textbooks, guide materials and new teaching materials may help to growth students’ understanding.

5. Other relevant information (e.g. commercialization potential, awards received (title of project, exhibition and year))

This teaching materials can be developed to a form of learning modules. Collaboration with computer experts might contribute to transform the IR card display together with a QR code that comes with solutions for each spectral analysis.

Acknowledgement

We are grateful to our student for their cooperation to be part in this activity. We also acknowledge the Ministry of Education (MOE) under Fundamental Research Grant Scheme (FRGS) (R.J130000.7826.4F955) along with Research University Grant (RUG) (Q.J130000.2526.16H93) provided by Universiti Teknologi Malaysia (UTM).

References


Implementation of an Effective Online Peer Review using Moodle E-learning System

Goh Chin Fei
Azman Hashim International School, Universiti Teknologi Malaysia, Johor Bahru, Malaysia
gcf@utm.my

Hii Puong Koh
Azman Hashim International School, Universiti Teknologi Malaysia, Johor Bahru, Malaysia
hiipuongkoh@gmail.com

Leong Choi Meng
Faculty of Business & Information Science, UCSI University, 93450 Kuching, Sarawak
leongcm@ucsiuniversity.edu.my

Tan Owee Kowang
Azman Hashim International School, Universiti Teknologi Malaysia, Johor Bahru, Malaysia
Oktan@utm.my

Highlights
An online reciprocal peer review approach that resembles to scholarly peer review using Moodle e-learning system is proposed. Specifically, this study investigated the interrelations among engagement with providing peer feedback, engagement with responding to peer feedback, learner-content interaction and learning outcomes. The study starts with the participants to provide peer review report on peer’s research proposal reciprocally. Thereafter, participants are required to revise their proposal along with a response letter that highlighting the changes were made. The results show that engagement with learner-content interaction fully mediates the relationship between engagement with providing peer feedback and learning outcomes.

Key words: Peer review; Engagement with providing peer feedback; Engagement with responding to peer feedback; Learner-content interaction; Learning outcomes

Introduction
Peer feedback is a powerful instructional method to engage learners in effective learning. Peer feedback is also known as one type of formative peer assessment that provides an intermediate evaluation on learning performance. Peer feedback is a form of collaborative learning that can establish dialogues among learners through learning activities. In a reciprocal peer feedback activity, learners assume the role of a reviewer to provide feedback to their peer and vice versa. However, prior studies have recognized our understanding about mechanisms of peer review are inadequate.

Prior studies have found that the effect of received peer feedback on learning performance is mixed (e.g. Cho & Cho, 2011; Gielen, Peeters, Dochy, Onghena, & Struyven, 2010; Li, Liu, & Steckelberg, 2010; Mulder, Pearce, & Baik, 2014). There are two possible causes to explain why learners are less engage with the responding to peer feedback. First, learners believe that they have engaged in reflective critical thinking and develop a good understanding on the discipline knowledge and key criteria through providing peer feedback process. Learners, particularly those are overconfidence, believe that they can improve the final works independently and may ignore the peer feedback.

Second, learners tend to have a lower level of confidence level on peer feedback compared to feedback from instructors.

Peer feedback and assessment resemble providing feedback in many professional practices. For example, peer review is the underpinning pillar to guarantee the quality of an academic journal. The quality of peer feedback, particularly those with constructive comments, has been shown to be beneficial in the publication process in academic society. With regard to pedagogy, there is lack of understanding on the effect of learners respond to the feedback in peer review literature (Baker, 2016).

Despite the pervasive studies on the peer review, the role of learner-content interaction in influencing learning performance is rarely explored. Learner-content interaction is an indicator of learners’ commitment to their learning
in terms of their engagement with instructional material and activities (Bolliger & Armier Jr, 2013). This study draws on the belief that peer review can enhance learner-content interaction. It is assumed that learner’s engagement with providing peer feedback (EPP) and engagement with responding to peer feedback (ERP) may affect learner-content interaction (LC), which in turn, enable learner-content interaction to affect learning outcomes (LO).

Specifically, the following research questions were asked:

1. What is the impact of EPP on LO?
2. What is the impact of ERP on LO?
3. What is the impact of EPP on LC?
4. What is the impact of ERP on LC?
5. Does LC mediates the effect of EPP and ERP on LO?

Method

This study adopted the recommendation by Baker (2016) to require learners to write a statement to respond to peer feedback. Marks were allocated to the peer review report, response letter and final proposal as the incentives to motivate learners to construct an internal plan to revise the initial proposal. Such interventions address the problem that learners may over emphasized on providing feedback process and not responding to received feedback. All participants followed the same peer review process in the Moodle e-learning system (see figure 1). Participants are 45 students enrolled in the undergraduate research methods course.

Results and discussion

Two-sample independent t-test and Wilcoxon signed rank sum test shows there is a statistical difference between the scores of first and final research proposals with a positive improvement. This confirms the preliminary evidence that the engagement in online peer review can enhance learning performance.

Table 1: Assessment of structural model in PLS-SEM

<table>
<thead>
<tr>
<th>Endogenous constructs</th>
<th>R-Square</th>
<th>Q-Square</th>
</tr>
</thead>
<tbody>
<tr>
<td>LC</td>
<td>0.34</td>
<td>0.25</td>
</tr>
<tr>
<td>LO</td>
<td>0.48</td>
<td>0.15</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Relation</th>
<th>Path Coefficient (t-value)</th>
<th>Biased Correct Confidence Interval</th>
<th>Effect Size (F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EPP → LC</td>
<td>0.46 ***</td>
<td>(0.14, 0.73)</td>
<td>0.25</td>
</tr>
<tr>
<td>ERP → LC</td>
<td>0.20 n.s.</td>
<td>(-0.19, 0.51)</td>
<td>0.05</td>
</tr>
<tr>
<td>EPP → LO</td>
<td>0.04 n.s.</td>
<td>(-0.35, 0.33)</td>
<td>0.00</td>
</tr>
<tr>
<td>ERP → LO</td>
<td>0.23 *</td>
<td>(-0.07, 0.47)</td>
<td>0.08</td>
</tr>
<tr>
<td>LC → LO</td>
<td>0.54 ***</td>
<td>(0.18, 0.77)</td>
<td>0.37</td>
</tr>
</tbody>
</table>

*** p < 0.01; ** p < 0.05; + p < 0.10; n.s. non-significant

In the partial Least Square-Structural Equation Modelling (PLS-SEM) analysis, the results show ERP is not related to learner-content interaction (see Table 1). Nevertheless, it is positively related to LC with a mild statistical significance (p < 0.10). It can be interpreted that learners have engaged in metacognitive reflection during reviewing the peer proposal. In this experimental study, the learners were informed the pre-defined review criteria and attended the relevant peer review workshop. Learners developed self-assessment skills to respond to peer feedback. Analyzing
peer feedback leads to learners to integrate useful revisions into the final proposal.

The results show that EPP is positively related to learner-content interaction. Such a finding is consistent with the notion that learners tend to engage with peer feedback will engage with a self-study with course materials. LC is an active learning that enables learners to develop cognitive structure and perspectives. Thus, peer review can enhance self-regulation among learners and leads to effective learning.

It is noted that LC is positively related to LO. Peer review can enhance self-regulation among learners and leads to effective learning. Stated differently, learners tend to develop cognitive structure and perspectives with engaging with course content. LC denotes that learners perform internal didactic conversation through talking to themselves when they extract information from course materials. EPP enables learners to perform reflective critical thinking and develop a good understanding on the discipline knowledge and key criteria. Thus, a higher level of engagement with course materials leads to better LO.

Overall, above results suggest that LC may intervene (or mediate) the causal relationship between EPP and LC. In this study, EPP is positively related to LC; the latter is also positively related to LO. Thus, a mediating analysis is performed. The analysis shows that indirect effect from EPP to LO is significant. Additionally, the variance account for (VAF) analysis shows a full mediation which leads to non-significant relationship between EPP and LC.

There are two important implications for the above full mediation result. First, LO can be enhanced if there is a high level of EPP among learners. The rising of EPP, however, is insufficient because LC fully mediates the positive effect of EPP on LO. Second, the role of EPP will enhance the learner motivation to intensify their learning from the course material. Thus, learners will have a higher level of subject knowledge and achieve a better learning performance. From the teaching and learning perspectives, e-learning practitioners who engage with online peer review should first construct a high quality of course materials to enhance learning outcomes.

Finally, the effect size analysis shows that LO has a large effect size on LO, i.e., the magnitude of the observed effect between LC and LC is substantive. On the other hand, EPP has a moderate effect size on LO whereas ERP has zero effect size on LO. From the practical perspective, it is noted that ERP is not as much of important due to its small effect size on the LO. However, e-learning practitioners should augment the EPP to maximize the LC because the latter has a substantive impact on LO.

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References


Development of personalized digital learning objects to enhance students' learning behaviours in e-learning

Kew Si Na
Language Academic, Faculty of Social Science and Humanities, Universiti Teknologi Malaysia
snkew@utm.my

Zaidatun Tasir
School of Education, Faculty of Social Science and Humanities, Universiti Teknologi Malaysia
p-zaida@utm.my

Highlights
The role of Learning Analytics Intervention is important in university to assist at-risk students. However, not many researches are carried out to develop Learning Analytics Intervention to provide personalised learning objects to students. Hence, this research designed a Learning Analytics Intervention to provide personalised learning objects and applied it to e-learning environment. This research also investigated how students accessed learning objects and behaved in e-learning embedded with Learning Analytics Intervention. The results show that the students accessed their personalised learning objects and behaved differently e-learning.

Key words: Learning Analytics Intervention; E-learning; Personalised Learning Objects, Learning Behaviours

Introduction
The development of technology and the arrival of big data era reform the educational field. This has make Learning Analytics (LA) emerged, which makes use of the data-driven approach to enhance the teaching and learning practice. The intervention in Learning Analytics is an indispensable bridge between big data and the learning demands of students with different learning style with the purpose of overcoming one-size fit all problem in e-learning.

LA is described as ”the measurement, collection, analysis, and reporting of data about learners and their contexts, for purposes of understanding and optimizing learning and the environments in which it occurs” (Fournier et al, 2011, p. 3). One of the LA goals is to provide assistance for educators or instructors to understand and optimize learning via an environment tailored to each student’s level of demand and ability in close-to-real-time (Aguiar et al., 2014).

Nonetheless, the development of LA Intervention is still insufficient (Wu et al., 2015), particularly the provision of personalized learning objects to students to meet their learning need. Thus, this project has filled in the gap to develop a Learning Analytics Intervention and implemented it in e-learning to improve the quality of learning and teaching practices. Meanwhile, students’ learning behaviors were analyzed by using log files generated by students in e-learning to understand how students accessed learning objects and behaved in e-learning. This project is new designedly because there is none of the design of LA Intervention to provide personalized learning objects in e-learning with the intention to enhance students’ involvement and success (Kew and Tasir, 2017), and less studies focused on how students behaved in e-learning embedded with LA Intervention.

This project is also an improved innovation as its basic theory used is based on Learning Analytics Cycle proposed by Clow (2012). To make the intervention more effective and innovated, Felder-Silverman model (Felder and Silverman, 1978a) and Keller’s ARCS model (Keller, 1987a) are integrated to this Learning Analytics Cycle. This project has matched the aims of NALI model by designing and providing meaningful and interactive learning materials in e-learning environment for students to meet the needs of students with the different learning style and to motivate students to be more active in their learning process.

Research Objectives
The objectives of the research are formed, which are
1. To develop personalized learning objects of Learning Analytics Intervention in e-learning
2. To analyse how students behave in e-learning embedded with Learning Analytics Intervention:
   i) Log-in number
   ii) Post number
   iii) View number
NALI Approach

This project is aligned to the purpose of NALI to create meaningful and interactive learning materials, which are personalized learning objects of LA Intervention in e-learning. The intervention designed in this project is focused on students-centered because the learning objects in this intervention were designed based on students’ learning styles in e-learning.

Research Methodology

Fifty undergraduate students were selected as respondents. Log files collected from Learning Management System and their log-in, view and post number were measured by using descriptive analysis method.

Findings and Discussions

The result of this project indicated that students behaved differently in e-learning in terms of log-in, view and post number according to different learning styles. This is because they were “provided more” personalised learning objects and activities integrated with motivation elements in their learning process in e-learning. Therefore, it enables students to engage more in e-learning.

Conclusion

Students took greater responsibility for their learning by becoming aware of their behavior in terms of number of log in, views and posts. This can help educators understand more about their learning behaviors. Besides that, this project has shed the light on the part of LA Intervention, which is a not known yet important area in LA as less attention has been paid on intervention design for students (Wise, 2014) and investigated how students behaved in e-learning embedded with LA Intervention.

Acknowledgement

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References


Higher education 4.0: Evaluation on the innovation and readiness to implement Industrial Revolution 4.0 for undergraduate Mechanical Engineering students

N. S. M. Nor
Universiti Teknologi Malaysia
nursafwati@utm.my

M. Mohamad
Universiti Teknologi Malaysia
maziah@mail.fkm.utm.my

M. Z. Md Zain
Universiti Teknologi Malaysia
zarhamdy@mail.fkm.utm.my

C. T. Howe Hing
Universiti Teknologi Malaysia
tanghh@utm.my

Highlights

The application of active learning through Higher Education 4.0 (MyHE 4.0) encourages undergraduate students to explore and engage with subject material, leading to improved learning efficiency, flexibility and marketability in the labour market. The MyHE 4.0 approach is applied to Mechatronics subject to evaluate innovation impact and readiness to meet IR 4.0 challenges. Using current IR 4.0 technology, the learning infrastructure incorporates relevant aspects of the subject material. MyHE 4.0 will inculcate social and collaborative skills which supplement technical skills developed upon subject completion. Challenges pertaining to MyHE 4.0 are identified and worked on, and readiness to achieve its objectives is measured based on evaluation results.

Key words: Teaching and learning innovation; higher education 4.0; industrial revolution 4.0; student-centered

Content

The objective of this project is to evaluate the impact of active learning via the MyHE 4.0 innovation on a group of undergraduate students majoring in Mechanical Engineering, identify, consider and work on challenges posed by the implementation of MyHE 4.0 as a viable model for effective learning, and assess the readiness of the educational institution to meet the objectives set by MyHE 4.0 for successful implementation. Secondary to that, this project also aims to examine and support university efforts in implementing MyHE 4.0 towards creating an innovation-drive institution.

Based on the New Academia Learning Innovation (NALI) approach, this project seeks to propose a new model of learning aimed at delivering an effective, holistic learning experience to undergraduate students as compared to traditional lecture-based learning using the core concepts and principles posited by the MyHE 4.0 model. This project aims to improve upon conventional learning methods by actively involving students in the learning process via several different expedients, in particular by assigning a group project based around an open-ended problem which students were required to solve collaboratively.

A number of different initiatives were applied in order to facilitate an effective, holistic student centered learning experience which can be universally deployed with minimal modification. Specific to a pedagogical perspective, this project examines the impact of a learning model based on outcome-based education, problem-based learning, scenario-based learning and high impact educational practices (HIEPs), with the aid of university digital resources (UTM Open Courseware, UTM-MIT Blossoms and UTM e-Learning). A viable model of student centered learning revolving around the abovementioned initiatives, together with MyHE 4.0 core concepts is developed and applied in order to evaluate its effectiveness.

For the academic year 2018/19, a student-centred teaching and learning in which third year undergraduate students majoring in Mechanical Engineering from Universiti Teknologi Malaysia (UTM) who registered for the subject SKMM 3252 (Mechatronics) were selected as the subjects of this project. Throughout the duration of the semester this project was carried out, students were taught based on an active learning approach based on the MyHE 4.0 model, which includes the various initiative specified in the preceding paragraph.
The five lecturers responsible for this specific subject were asked to issue an Arduino-based group project which students were required to complete as part of their subject coursework, to be used as a key performance index (KPI) for measuring the degree of completion of the project objectives. Groups consisting of five students each were assigned to one of three project titles — T-shirt folding machine, vending machine and process stamping/painting machine for fabric — and asked to design a functional mechatronic solution which would solve engineering problems in the manufacturing industry. A selected group of secondary school students, monitored by an assigned supervisor, were also assigned the same tasks. UTM students were assigned as mentors to these secondary school students, while several UTM lecturers conducted a one-day Arduino workshop in order to guide them towards the completion of their solutions.

The objectives of this group project were to provide exposure to students and prepare them on the use of modern tools in the era of Industrial Revolution 4.0, to promote UTM and provide social services to primary/secondary schools, hence establishing potential research links with these schools, and to inculcate and assess team working generic skills for the teaching and learning of the Mechatronics subject.

For T-shirt folding machine, students were asked to design a machine that folds, stacks and counts 3 T-shirt within one cycle. Students assigned to the vending machine title were required to design a machine that accepts coins and deliver a selected product, and students working on process stamping/painting machine for fabric were required to design a machine that stamps or paints a logo on fabric at a pre-specified location.

Assessment of the submitted projects was based on a scoring rubric, with a maximum score of 50, designed to evaluate student knowledge of the subject, with four distinct categories considered (project idea, material used, project functionality and smart technology implementation), as well as evaluating student capabilities to embrace modern tools and teamwork in solving the posed mechatronic problem. Each item within the aforementioned categories were scored by judges on a scale of 1 to 5, with 1 being the minimum and 5 being the maximum score.

The projects completed by students were presented and demonstrated on 11th May 2019 at the Mechatronics Challenge 2019, held at E07, UTM. Challenge participants included 197 third year undergraduate students split into 38 groups from UTM and 15 secondary school students split into 3 groups from SKM Skudai, SMK Bandar Uda Utama and SKM Sri Perling. The challenge was judged by a total of 7 judges — two lecturers from the School of Electrical Engineering, three lecturers from the School of Mechanical Engineering, and industry representatives from Dyson Manufacturing and TDK Electronics. The objectives of this challenge were to discuss industry acceptances of

Figure 1: Project/research methodology
Industrial Revolution 4.0 with representatives of Dyson Manufacturing and TDK Electronics, to train secondary school students on the usage of Arduino microcontroller for automation and Internet of Things (IoT) applications, as well as to assess student understanding of the conducted workshop and to solve industry-based problems.

It was found that a large majority of students were able to present effective, functional solutions to the open-ended problem discussed above, highlighting the efficiency of the implementation. Students were also observed to act in a collaborative manner throughout the duration of the project, clearly showing logical and appropriate division of responsibilities in order to achieve effective, efficient and holistic task completion matching predefined project criteria. In terms of student improvement, we observed that the subjects of this project exhibited improved social, collaborative and technical skills relative to students taught under a traditional lecture-based model. It is hypothesised that this is due to the nature of the group-based project necessitating a considered division of responsibility for a number of distinct tasks while maintaining constant, open-ended communication with their group members in order to assemble a functional solution.

Students also developed more specialised technical skills due to their involvement with the project. In the process of constructing their solution to the posed problem, they were required to apply pre-existing knowledge in tandem with fresh knowledge derived from other sources, primarily digital resources, which further supplemented the students’ pre-existing knowledge and improved their ability to come up with elegant and complete solutions to problems diverse in nature. As a consequence, participating students were able to improve their critical thinking skills, flexibility and dynamism in the problem-solving process, translating to greater marketability in the labour market upon graduation. Figure 2 and 3 illustrate the data from end of course survey which are the feedback from the students taking this course in the 2017/18 and 2018/19 academic year. The graphs show students are satisfied with the course conducted in 2018/19 academic year better than the 2017/18 academic year.

![The Course Achieved Its Attended Target](Image)

**Figure 2** Student’s response during end of course survey for two consecutive academic years (Item 1).
The Assessment of Coursework was Appropriate and Fair
1- Very Not Agree : 2- Not Agree : 3- Not Sure : 4- Agree : 5- Very Agree

2017/18 Academic Year
2018/19 Academic Year

Figure 2 Student’s response during end of course survey for two consecutive academic years (Item 2).
The Periodic Table Game for Interactive Learning in Chemistry

Siti Aminah Setu
Department of Chemistry, Faculty of Science, Universiti Teknologi Malaysia
sitiaminahsetu@kimia.fs.utm.my

Norazah Basar
Department of Chemistry, Faculty of Science, Universiti Teknologi Malaysia
norazah@kimia.fs.utm.my

Highlights:
Chemistry is regarded as a difficult subject for students. The difficulties may lie in human learning as well as in the intrinsic nature of the subject. The teacher-centered teaching method in the classroom will lose students’ attention, while the abstract nature of chemistry with lots of facts and theories causes difficulty for students to understand the subject. As a consequence, students will lose interest and motivation in learning chemistry. Periodic Table Game is a game designed for students to learn the chemistry of the Periodic Table elements through entertainment. The game is simple yet interactive and flexible where the learning content can be modified according to the teaching plan. Application of augmented reality technology makes the game more informative where some videos explaining the related theories were embedded and could be revealed using a simple smartphone app. The game is also designed to stimulate cooperative and active learning, activate students’ minds and enrich experiential learning in discovering chemistry knowledge. This teaching method has shown some improvement in students’ interest and motivation in learning chemistry.

Keywords: Game-based education; augmented reality technology; cooperative learning; active learning.

Introduction (Project or Innovation)
Science plays a crucial role in the lives of individuals as well as in the development of mankind and society. However, previous studies showed that students still have a lack of interest in learning science, especially chemistry (Johnstone, 2000; Tsaparis, 2017). This could be attributed to the intrinsic nature of the subject itself where it is full of complex terminology, concepts, processes and scientific theories. The concepts like ‘element’ or ‘compound’, ionic and covalent bonding and the Periodic Table elements are abstract from that of the normal world. Additionally, the styles and methods of teaching practice by the teachers in school can influence students’ interest and attitude towards chemistry. The teacher-centered teaching method in the classroom will lose students’ attention. On the other hand, the use of interactive teaching and learning activities can raise the students’ interest and motivation in chemistry. Conducting hands-on activities, active learning and cooperative learning (Ellis, et. al., 2009) for examples, can enhance students’ understanding because they can apply and adapt to the theory that they have learned in the classroom into real problems besides learning from their peers.

Here, we developed a game-based teaching tool for students to learn the chemistry of the Periodic Table elements in a fun and simple way, yet effective. The game provides an immediate and useful platform for students to learn and apply their knowledge in chemistry to progress while playing the game.

Content
Finding new ways to grab the attention of learners and engaging them in the learning process is one of the main issues nowadays. Students won’t be able to gain any information and skills out of dull learning process, but they understand the application of skills and knowledge to solve real-life problems with the help of an effective learning process. Therefore, this teaching innovation is aim to increase students’ interest and motivation in learning chemistry by providing them an interactive and effective learning platform. The Periodic Table Game applies the concept of game-based education, where it combines the learning objectives with the fun, interactive game. The game is designed based on the Snake and Ladder game but used the Periodic Table as the playing board (see Figure 1). It can be played in a group or as an individual.

The purposes are to motivate self-learning and problem-solving skills to a great extent. The game encourages students to collaborate, communicate, interact and work in teams to move while playing. Besides, the game will improve the functioning of the brain as the students have to solve the problems given immediately. In general, the Periodic Table Game has shown an increase in students’ interest and motivation in learning chemistry.
The Periodic Table Game

How to play the game:
1. The game was designed based on the Snake and Ladder game but used the Periodic Table as the play board.
2. The game can be played in group or individual. Each player will be given a counter.
3. To determine the turn, each player should throw a dice. The turn is determined from the highest number shown on the dice.
4. The game starts at the “START” box and ends at the “FINISH” box. Move forward according to the proton number of the element in the Periodic Table.
5. The player needs to throw the dice to move forward. Move according to the number shown on the dice.
6. If the counter lands at these box, follow the following instructions:

   - Oh no! Your experiment went “POP”. Go backward 3 elements.
   - Oh no! Your experiment went “BANG”. Go backward 5 elements.
   - Yes! Your experiment went well. Move forward 5 elements.
   - IQ test. Pick a card and answer a question.

7. To answer the question – pick 1 question card (green card) from the top and answer the question within a given time (for example 1 minute). Meanwhile, the other player check the answer through the answer card (blue card).

Example of Question card

Example of Answer card

8. If the answer given is correct, the player will be awarded a few steps forward (please refer to the answer card). If the answer given is wrong go backward 3 elements.

9. The first player reaches the “FINISH” box is the winner of the game.

Figure 1: The Periodic Table Game, (a) the playboard (b) example of question and answer card (c) instruction on how to play the game and (d) images showing the implementation of the game on school students.
Others

Award: Bronze Medal – INATEX 2019
Commercialization strategy – a collaboration with Telaga Biru Sdn. Bhd to market the product to the targeted consumers (e.g., school teachers and students, Matriculation students).

References


Visible the Invisible: An opportunity for experiential learning to nurture graduate success attributes

Corrienna Abdul Talib
Universiti Teknologi Malaysia
corienna@utm.my

Kang Hooi Siang
Universiti Teknologi Malaysia
kanghs@utm.my

Marlina Ali
Universiti Teknologi Malaysia
p-marlina@utm.my

Siti Norlilana Mohammad
Universiti Teknologi Malaysia
norlina@utm.my

Hasnah Md Amin
Universiti Teknologi Malaysia
p-hasnah@utm.my

Nur Wahidah Ab Hakim
Universiti Teknologi Malaysia
nwahidah0121@gmail.com

Highlights

In nurturing the success attributes in graduate students it is important to enhance their leadership skills, teamwork and thinking skills, and empathy and ethics, all of which are important traits of global citizen that are responsible and digital. Therefore, the Visible The Invisible project was undertaken to provide experiential learning opportunities through a real-world experience that offers students the chance to be involved with underprivileged and homeless people. Such features in learning are difficult to capture in textbooks. About 90 undergraduate students who enrolled in one of the core courses, participated in the program. The findings of the program’s effectiveness were based on a report of the student’s reflections on global citizenship and enterprising skills. Based on the results received, the program increased their awareness about homelessness and developed the success attributes necessary for graduation in the future.

Key words: attributes; graduate, experiential learning

Introduction

People who are homeless are most often unable to acquire and maintain regular, safe, secure and adequate housing. Homelessness is a mark of failure for communities in providing this basic security. Based on UN-Habitat, report (2015), about 2% of the world’s population may be homeless and another 20% lacks adequate housing. The issue of homelessness in Malaysia is not new, but the growing numbers signify a bigger problem. In a survey conducted by Kuala Lumpur City Hall during the last two years, the number of homeless people in the city has risen significantly. In 2014, the number stood at 600. In 2016, this figure was closer to 2,000.

According to the United Nations Centre, in 2005 an estimated 100 million people were homeless worldwide. As many as 1.6 billion people lacked adequate housing (Habitat, 2015). Although Malaysia has been categorized as a developing country, the statistics about homeless people within the country is alarming and need to be given due attention by local citizens. Table 1 shows the statistics of homeless by age group, ethnicity and gender, showing that the number of homeless is high among those aged 18 years and above. Studies conducted by the U.S Conference of Mayors (2005) show that 51% of the homeless are men while 17% are women. Children are by no means an exception to the problem of homelessness. Some of them run away from home while others live with parents on the roadside due to financial and other problems (Sharifah & Alifatul, 2012).

Table 1

<table>
<thead>
<tr>
<th>Age group</th>
<th>Malays</th>
<th>Chinese</th>
<th>Indian</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>F</td>
<td>M</td>
<td>F</td>
</tr>
<tr>
<td>Children</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Below 4 yrs</td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>4-6 yrs</td>
<td>5</td>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>7-12 yrs</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>13-15 yrs</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>16-17 yrs</td>
<td>9</td>
<td>8</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Adult</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18-29 yrs</td>
<td>5</td>
<td>7</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>30-39 yrs</td>
<td>5</td>
<td>4</td>
<td>2</td>
<td>7</td>
</tr>
</tbody>
</table>
The homeless are the invisible people of a city because we often dismiss or ignore them. As the number of people living in poverty in Malaysia and abroad continues to rise, higher education has a moral imperative to educate students on the issues surrounding poverty and homelessness using multiple pedagogies. Young people need to experience and be involved in important community activities that are growing in popularity. Through this involvement, the youths are able to contribute positively to the development of their communities.

Engaging in social responsibility activities also is seen as offering future generations an alternative to destructive activities, such as drug and alcohol abuse. The idea of social responsibility is aimed at developing young people’s social skills and to appreciate community involvement, the environment and their participation in the social and political processes to achieve a developed nation status. Best practices seek to transform students who will go into the world and serve others. This transformation often happens when students are engaged in the classroom and also immersed in co-curricular experiences. The School of Education of UTM has addressed these issues of poverty through both academic and co-curricular programs by instilling a sense of social responsibility within students. Therefore, the Visible the Invisible program was conceived as UTM understands that responsible corporate behavior, not only enhances and changes sharing knowledge, but also contributes returning dividends back to the society. This program seeks to educate UTM students on issues of homelessness through experiential learning together with key strategic partners in raising awareness of homelessness and educating the community about it.

**Project objectives**

The Visible the Invisible program aims to serve the need of the students to understand and apply the attributes of UTM graduate skills, guides students in developing basic skills through experiential learning based on social responsibility, consisting of communication, thinking, scholarship, teamwork & leadership, adaptability.

**Specific objectives:**

1. To increase awareness about homelessness to youths among UTM students.
2. To ameliorate UTM students’ negative perceptions of individuals experiencing homelessness
3. To provide opportunities for students to see themselves as a creative thinker, problem solver, able to collaborate, communicate effectively, with empathy and ethics.
4. To promote graduate attributes such as global citizenry, leadership, teamwork and thinking skills
5. The program is also part of the social responsibility of students and UTM lecturers collaborate and help in assisting in the decreasing number of homeless people in Malaysia.

**Innovative approach implemented**

Experiential learning was used in the run of the “Visible the Invisible” program. Students worked in groups, formed their committee and executed the program with the guidance from the lecturers of the program.

**Methodology**

The Visible the Invisible program consists of six activities which were conducted throughout the semester. These are, Charity on Wheel, March to End Homelessness, Video Competition, Homeless Matters Day, Cardboard Community and Feed Hunger Feeds Hope. The Charity On Wheel requires all the students to walk to all of the spots and places where homeless people sleep and give them the needed services such as medicine and daily basic needs. For March to End Homelessness the students organize a running event at UTM. Video Competing is a video competition about homelessness awareness, open to all universities in Malaysia. Whoever wants to join this competition needs to create a video about the homelessness that happens in Malaysia. The Homeless Matters Day is a one-day program about homelessness. NGOs, involved in charity work are invited to give a talk to UTM students. The Cardboard Community requires students to sleep on a cardboard for a night at KTMB JB stations to experience how to live as a homeless and also as a self-reflection of how lucky they are because they can sleep soundly during the night while the homeless people sleep by the roadside disturbed by vehicle noise. The Feed Hunger Feeds Hope program requires students to distribute food to the homeless people. About 60 students enrolled in one of the core courses dealing with the running of the projects and about 300 UTM students joined the program. Several NGOs also contributed. The findings of the impact of the program were based on the students reflection report.

**Finding and discussion of the project**

The following is the students’ reflections that participated in the program:

<table>
<thead>
<tr>
<th>Age Group</th>
<th>8-10 yrs</th>
<th>11-12 yrs</th>
<th>13-15 yrs</th>
<th>16 yrs and above</th>
</tr>
</thead>
<tbody>
<tr>
<td>40-49 yrs</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>50-59 yrs</td>
<td>6</td>
<td>3</td>
<td>8</td>
<td>1</td>
</tr>
<tr>
<td>60 yrs and above</td>
<td>8</td>
<td>1</td>
<td>8</td>
<td>1</td>
</tr>
</tbody>
</table>

Source: Department of Social Welfare, Malaysia (2013)
...We should pay more attention to our surroundings without having to care our status. Homeless people are human beings just like us, they deserve a fair and square treatment just like other netizens. Just because they seem lowly than you, that does not make them any less worthy. The government should have played an important role in dealing with such cases. The homeless does not want more, they just want to be cared of and treated fairly. We, a normal netizen should step up our game and help these poor people to strive for better. They need moral support from us so that they can move forward. If we want a better country, we should start with ourselves...

...We also learn that we must fix our perception about the homeless people in Malaysia. Many people have a negative perception of them. We must erase the negative perception from our mind because they also human. They also have worked out, but they failed. Life will always give you a second chance. So, we must support and encourage them to be a successful person in the future by making a program like ours. We should help each other and reduce the amount of homeless people in Malaysia...

...After this program, both participants and committees learnt how to stand up for the underprivileged. “Homeless people do not deserve our pity, they deserve our help.” Students should not only focus on their academic, they should also show concern to social issues. This program helped us to break the negative thinking of public especially teenagers towards homeless people. Participants got to understand that some homeless people did not choose to be homeless because of their laziness. Sometimes, they were forced to be. This program also created awareness and gave idea to those who always wanted to contribute to ease homelessness but had no idea what to do. Speakers from several organisations shared their experiences and introduced us some projects for us to join. Participants were more aware and concerned about activities and projects held to help homeless people around their areas. This program is worthwhile and meaningful as all participants are contributing to the problems faced by homeless people. Also, it was a rewarding experience in that we can learn how to socialise and strengthen the bonds between us. It helped us to create a better group dynamic where we learnt to work well together...

...After this program, students will learn not to set any perspective before they get to know the thing deeply. The homeless does not choose to be one, but there are forced to be one. Some homeless are labour working in Singapore, they finished their work late and when they got back to Malaysia its already 2am in the morning while at 4am morning they will have to get ready and go to work, they don’t even have time to go back to their home. Some are forced to be homeless because there are abandoned by their family, During the program our committee member has get to talked with a few of the homeless, the first one is named Ms. Akiki from Kelantan. She said that he become homeless because she came to Johor to find a job, but failed because of shortness of job opportunities. The second is Mr. Ading, he is forced to be homeless because his family member has cruelly abandoned him and now he is too old to find a suitable job. Through this program, students also get to learn a better group dynamic. This program strengthens communication and teamwork between students and also between students and NGOs...

In a nutshell the program was well organized and taught the students to be grateful of what they have right now and helped the person in need. It can be concluded that the program has achieved its objective in raising awareness towards homelessness within the students.

Award received

Silver Award for Visible the Invisible: A project to End Homelessness in the Grand Challenges Competition 2018 in conjunction with Innovate Johor 2018, organized by the Office of Undergraduate Studies, Universiti Teknologi Malaysia.

Acknowledgement

We would like to thank UGS UT M Grand Challenges 2018 grant for funding the project. We are grateful to our collaborators namely the Kechara Kitchen Soup, Johor Pihatin, Jalanin Sutera, Amilibha Malaysia, Pusat Kesihatan Universiti UT M (PKU UT M), Jabatan Kebojikan Masyarakat and Jabatan Agama Islam Negeri Johor as well as our sponsors that are Majlis Perbandaran Johor Bahr u (MPJB), Yayasan MPJB and individual sponsors and students of UHAK 1012 section 19 Session 2017/2018 and UHAK 1012 Session 28 Session 2018/2019 and Dr Rainer for the help in the article writing.

References


We Hope We Dream Camp 2019

Roziana Shaari, Azlineer Sarip, Siti Aisyah Panatik, Nor Akmar Nordin,
School of Human Resource Development and Psychology, Faculty of Social Sciences and Humanities,
Universiti Teknologi Malaysia, 81310 Johor Bahru, Johor
razianas@utm.my
azlineer@utm.my
sitiailashah@utm.my
akmar_nordin@utm.my

Nor Zafir Md Salleh
Azman Hasim International Business School
Universiti Teknologi Malaysia, 81310 Johor Bahru, Johor
zafr@utm.my

Nur Aiysah Md Nor
Jabatan Kemajuan Orang Asli Malaysia (JAKOA)
Level 3, West Block, Wisma Golden Eagle Realty
142-C Jalan Ampang
50450 Kuala Lumpur
nur.eisya@gmail.com

Highlights

This project is named as “We Hope We Dream Camp 2019” and is carried at the Convention Hall, TO8 Universiti Teknologi Malaysia on 9th April 2019. This project is part of the learning outcome from SHAR 1093 - Need Analysis in Human Resource Development (HRD) course. Instead of developing industrial or organizational context, HRD also relates to develop community or society. Based on the collaboration with Jabatan Kemajuan Orang Asli Malaysia (JAKOA), several issues were identified such as educational attainment among Orang Asli pupils, and lack of engagement in learning and education.

Key words: needs analysis; community skills enhancement; orang asli

Introduction (Project or Innovation)

This project is developed to solve community problems based on needs analysis process conducted by SHAR1093 students. The recommendations were delivered in the forms of talk, workshop and games. This project develops student’s skills in analytical thinking, professional and social as they need to involve in various process such as problem diagnosis, program design, contact arrangement and event management.

Content (Project or Innovation)

The population of Orang Asli or aboriginal community in Malaysia is 178,197, 13,000 in Johor state, and about 3,000 pupils for primary and secondary schools. The common major problem is educational attainment of the Orang Asli children particularly learning disengagement and low achievement. As an indigenous group, the achievement has not been at par with the national progress despite improvement initiatives carried out by the Government. Past research attributed the Orang Asli educational problems to the lack of interest in schooling, attitude, poverty, implementation failure, accessibility, parental involvement, curriculum, pedagogical skills, the quality of leadership of school administrators, the school climate, and social cultural milieu of the Orang Asli society. In this project, participants were from two schools namely Sekolah Kebangsaan Pontian Besar (SKPB) and Sekolah Tengku Mahmood Iskandar 2, Pontian (STMI 2). About 38 Orang Asli pupils were identified and invited to join the program.

The program impact was measured according to three main objectives:

1. Promote the importance of education
2. Increase self awareness & identity disclosure
3. Encourage critical and creative thinking
This project has a possibility to be commercialized based on its outcome – training game and workshop module that be used by teaching instructor or trainers. A sample of workshop and games was listed in Table 1.

<table>
<thead>
<tr>
<th>Games/Workshop</th>
<th>Objective</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Artsy Workshop</td>
<td>self awareness &amp; identity disclosure</td>
</tr>
<tr>
<td>2. I Love Me Workshop</td>
<td>self awareness &amp; identity disclosure</td>
</tr>
<tr>
<td>3. Coloring Your Muffin</td>
<td>self awareness &amp; identity disclosure</td>
</tr>
<tr>
<td>4. Fishing Game</td>
<td>critical and creative thinking</td>
</tr>
<tr>
<td>5. Mini Jumanji</td>
<td>critical and creative thinking</td>
</tr>
</tbody>
</table>

Acknowledgement

We would like to thank Mrs. Nur Aisyah Md Nor and JAKOA for the assistance in this project.

References


A Case Study Teaching on Needs Analysis in Human Resource Development

Roziana Shaari
School of Human Resource Development and Psychology, Faculty of Social Sciences and Humanities, Universiti Teknologi Malaysia, 81310 Johor Bahru, Johor
rozianas@utm.my

Azlineer Sarip
School of Human Resource Development and Psychology, Faculty of Social Sciences and Humanities, Universiti Teknologi Malaysia, 81310 Johor Bahru, Johor
azlineer@utm.my

Zul 'Idham Md Noh
IOI Loders Croaklaan Oils Sdn. Bhd., PLO 8&9, Jalan Timah, Pasir Gudang Industrial Estate, 81700 Pasir Gidang, Johor
zulidham.mdnoh@ioloders.com

Highlights

This case is in the field of human resource development and the context is in Johor Bahru, Johor Malaysia. This case on needs assessment presents an opportunity for first year undergraduate students to try their hands on assessing organization’s needs for training and non-training intervention. This case is also suitable for HR trainers to use in their training session. It provides critical information on the organization’s internal and external environment and highlights issues that require immediate attention.

Key words: Performance discrepancies; needs identification; needs analysis approach

Introduction (Project or Innovation)

This case is developed to emulate reality therefore a triggering event has been written into a case study, which would guide the students/learners in recommending suitable approach for needs assessment and identifying areas earmarked for training and non-training intervention. This case has a moderate level of difficulty.

Content (Project or Innovation)

This case study addresses the needs of a company to improve the roles that their managers and executives play in producing sustainable & reliable workforce for the company. The company’s focus over the next coming years is to refine its plan and implement initiatives already underway, along with others that will be identified and developed. In conjunction to this, the middle management levels are challenged to change their norms and the way things are done before, so that the company can move forward. The company expects their middle managers to demonstrate stronger sense of ownership, to be more energetic and dynamic presence, innovative and think creatively. Since there were performance discrepancies among middle managers, the HR assistant was assigned to investigate the issue and come out with training needs analysis report.

At the end of the case study session, the students are expected to:

1. Gain analytical and problem solving ability in assessing needs or gap.
2. Critically analyze the current issues from the perspective of HRD practitioner
3. To recommend suitable approach for needs assessment

This case study has a possibility to be commercialized based on its outcome – the case and the teaching guide that can be used as a reference by teaching instructor or trainers. A sample of suggested questions (Table 1) were formulated to assist instructor in class.
Table 1: Suggested Questions

<table>
<thead>
<tr>
<th>Suggested Questions</th>
<th>Referred Model/Theories</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Discuss the problem discrepancies in this company.</td>
<td>Performance discrepancies process</td>
</tr>
<tr>
<td>2. What is the suitable needs assessment approach that can be suggested to Mr. Zul?</td>
<td>TNA framework</td>
</tr>
<tr>
<td>3. Who should Mr. Zul interview to determine specific focus of managers and executives expected behaviors?</td>
<td>Competency-based needs assessment model</td>
</tr>
</tbody>
</table>

Acknowledgement

This project would not have been possible without the financial support by CWGS grant from MOHE, and we would also thank Mr. Zul Idham Md Nor for the assistance in this project.

References


Learning through Play: Urban Children’s Food Cycle (Farm to Food to Farm) Module

Nur Husna Abd Wahid, Nornazirah Suhairom, Zakiah Mohd Ashaari

School of Education, Faculty of Social Sciences & Humanities

Abstract

Education Psychologist refers the term learning through play to describe how a child can explore and learn to make sense of the world around them. While playing, children will develop social and cognitive skills, mature emotionally, and gain the self-confidence required to engage in new experiences and environment (Birleson, 1981). As children invest time and energy in play, and there are opportunities for learning when they do play (Smith & Pellegrini, 2008). Using the strategy of learning through play, this module was developed to introduce Urban Children to the concept of Food Cycle. This Food Cycle Module (Farm to Food to Farm) is a ‘blended’ approach between informal (Playing) with food cycle curricular (learning). This module is aimed to promote the National Agro-Food New Policy (NAFP) in the issue of food security issues in Malaysia. From the aspect of sustainability, this module is in line with 21st century education needs that emphasize an education system to provide feedback to current issues. In addition, the activities in this module encourage continued involvement of parents in guiding the development of children’s learning at home. Since Children’s access to outdoor playing opportunities in the urban area is very limited this day, the application of this module to Urban Children in the area of Johor Bahru showed a very significant impact to the participants. From observation, interview with parents and teachers and survey, participants’ social and cognitive skills were successfully developed through the series of Modules. Module developed had been reviewed by reviewer from several pre-school and primary school educator to access the appropriateness of the content.
Introducing an Online Based System to assess Students’ Progress for SKE Capstone Project

Lim Cheng Siong
Department of Control and Mechatronic Engineering, School of Electrical Engineering, UTM Johor Bahru
lcsiong@utm.my

Zulkarnain Ahmad Noorden
Institute of High Voltage and High Current, School of Electrical Engineering, UTM Johor Bahru
zulkarnain-an@utm.my

Rashidah@Siti Saedah Arsat
Department of Communication Engineering, School of Electrical Engineering, UTM Johor Bahru
rashidaharsat@utm.my

Suhana Binti Mohamed Sultan
Department of Electronic and Computer Engineering, School of Electrical Engineering, UTM Johor Bahru
suhanasultan@utm.my

Highlights

The motivating factors that promote Capstone Project in SKE is that it can be used to assess students’ proficiencies in knowledge and professional skills over the progression of the project. To make assessments of students’ progress an efficient task towards achieving sustainability, online based system was implemented. This results in significant reduction of hardcopy forms by 7 times. In addition, 66% of the facilitators responded found the current online based system is very convenient as it automatically stores and tracks students’ progress and competencies. Hours spent in assessing students were also reduced. Consequently, facilitators can channel their valuable times in assisting the students’ learning, providing the students’ with personalized feedback and carry-out improvements needed in the student’s progress.

Key words: capstone project; online based assessment; sustainability

Introduction (Project or Innovation)

Capstone Project was introduced since 2013 as the laboratory course for all 4thyear students, replacing the previously implemented laboratory course known as Problem-Based Laboratory. It is conducts for SKE students in a small team under the facilitation of an academic staff and an industry partner as advisor whenever possible. Preparations as well as the tools required, in terms of project management, facilitation, activities, and assessment criteria were developed to support the implementation of the Capstone Project-based learning.

In Capstone Project, the students are required to utilize design thinking and ideation approaches in solving an open-ended problem from either industry or community. The project provides opportunity for the students to systematically demonstrate their problem-solving skills - with all the knowledge obtained during the study - to solve a real industry or community problem. During this project implementation, the students are assessed in terms of their technical skills which includes modern tools usage and solution design/development and professional skills which include team working, lifelong learning and project management and finance.

Since there are 5 course learning outcomes to be addressed, there are several assessment items which are designed. In order to embrace a continuous assessment through the semester, our Capstone Project has gone a constant Continuous Quality Improvement in particular the assessment approach to ensure a well-aligned assessment with the course objectives. We have revolutionized the assessment techniques from traditional paper based since the course was started to partial online based assessment. This approach was proven to monetize the available times with the students, improved flexibility, avoid losing the students’ marks and allow the facilitators to advise on the students’ progress in real time.
Objectives

The main goal of the online based assessment is ultimately to save papers which address towards the sustainability goals. With more than 300 students progress to be recorded and to monitor, it is imperative to use online technologies for assessment. New approaches to record the assessment using technologies must ensure scalability, reusability, manageability, accessibility and durability (Al-Smadi, 09). Having these objectives in mind, an assessment system was designed and distributed among the facilitators and monitored by their respective departmental coordinators.

Research Methodology

Table 1 shows the assessment frequency of a Capstone Project group in one semester for 3 different academic sessions. Generally, each team of students will be given a Student File that contain the assigned Design Sheet, a Student Pack, Individual Report forms, Individual Minutes forms, Technical Report forms, sample of Gantt Chart and Bills of Materials to assist student in the financial and project management. The file is kept with students throughout the semester and returned to the lab at the end of the semester. In 2016/2017 and 2017/2018 sessions, the facilitators are supplemented with a Facilitator File that consist of a Facilitator Pack which provides additional information related to the design sheet. The file is also used to keep records on the weekly student assessment and kept in the designated laboratory. The activities and assessment forms, as well as the rubrics are included in the Facilitator files.

Starting from 2017/2018 academic session (based on Table 1), the frequency of assessment items was reduced by 58% in order to have a simple assessment approach. For example, each student only requires to prepare two minutes of meeting instead of three minutes. Similarly, each student only need to submit 3 individual reports for the whole Capstone Project instead of submitting it every week which counts to 12 individual reports. In addition, individual interviews are conducted only three times for 2017/2018 academic session onwards compared to 12 times previously. Based on the feedback received from the facilitators, they complained on the amount of time spent every week for assessments before 2017/2018 session. In 2018/2019 session, the assessment approach is improved further by abolishing Facilitator file system and replaced with online based system. This improvement is received positively by the facilitators.

Online based assessment involves the use of any web- based method that allows systematic inferences and judgments to be made about the student’s skills, knowledge and capabilities (Crisp, 07). In this research, all the forms are converted into a much more simpler system which is google sheets. Each Capstone group will have its own google sheet for recording the group students’ marks and monitor their progress. The sheet will be shared among the group facilitator and the coordinators. Assessment rubrics are included in one of the tab in the sheet for facilitator’s reference. There are also tabs for each member of the group so the facilitator can keep track of each member’s progress even outside the Capstone Project hours.

Findings

Based on Table 1, in 20182019 academic session, only 6 sheets of paper was used for assessment which was for the Conceptual prototype and final product evaluations. This pose a significant reduction on the number of sheets used which is 7~8 times of reduction. In addition, based on the feedback received shown in Figure 1, 66% of the facilitators responded found the current online based system is very convenient as it automatically stores and tracks students’ progress, competences and outcomes. They have also commented on the reduction of hours spent in assessing students progress after implementation of online based assessment. Consequently, they can channel their valuable times in assisting the students’ learning, providing the students’ with personalized feedback and carry-out improvements needed in the student’s progress.

Finally, an open-ended question was given to obtain facilitator’s comments and suggestions about the online assessment system. Overall, they liked the system and few have gone on to express their feedback as;

“*The present assessment is good*”

“*The system so far is excellent*”

Based on facilitator’s feedback, they were satisfied with the online based system, support and facilities provided by the system.

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<td>In Lab</td>
<td>13</td>
<td>13</td>
<td>13</td>
</tr>
</tbody>
</table>
As a conclusion, the implementation of online based assessment system in Capstone Project provides a new innovative assessment experience for the facilitators on how to keep track the progress of their respective group students anywhere and anytime. This results in significant reduction of hardcopy forms by 7 times. In addition, 66% of the facilitators responded found the current online based system is very convenient as it automatically stores and tracks students’ progress and competences. Assessment time was reduced which motivates the facilitators channel their valuable times in assisting the students’ learning, providing the students’ with personalized feedback and carry-out improvements needed in the student’s progress.

*shaded indicates online based assessment

Figure 1: Results of online survey to all facilitators who have experienced both online and offline based assessment.

Awards Received

SKE Capstone Project has received Gold award in NALI 2018 which highlights the project titled Design thinking and ideation approaches for innovative product development experience via Capstone Project. With the utilization of design thinking and IDEO’s idea generation approaches, Capstone Project provides opportunity for students to experience a comprehensive and systematic way of solving real engineering-related industry or community problem. Some of the projects produced from Capstone students were used for STEM exhibitions, regional competitions and in the process of publishing in the book chapters.

Acknowledgement

The authors would like to thank all the facilitators who have supervised Capstone Project students, the 4th year students from SKE and the School of Electrical Engineering, UTM Johor Bahru for the continuous support on the
Capstone Project implementation.

References


CDIO in Improving GIS Training Camp 1 Implementation

Noordyana Hassan
Faculty of Built Environment and Surveying, Universiti Teknologi Malaysia
noordyana@utm.my

Zakri Tarmidi
Faculty of Built Environment and Surveying, Universiti Teknologi Malaysia
zakritarmidi@utm.my

Highlights:

Adaptation of Conceive-Design-Implement-Operate (CDIO) model has improved the planning and implementation of GIS Training Camp 1 that was offered by Bachelor Program of Geoinformatics, under Department of Geoinformation. Implementation of CDIO in this course can reduce the gap between theories and practical in this program with implementation in industries. Six stages were listed and implemented in this course, from planning to produce the final thematic map. In 2018-2019 session, the theme for GIS training Camp 1 is Asset Inventory. Students need to produce final map of Asset Inventory for Tasik Ilmu, UTM. The final map combines several spatial data collection techniques with different types of spatial data processing, into one final map.

Key words: CDIO; capstone; GIS Training Camp 1

Introduction

GIS Training Camp 1 is one of the courses in Bachelor of Science (Geoinformatics) Program, which offered by Faculty of Built Environment and Surveying (previously known as Faculty of Geoinformation and Real Estate), Universiti Teknologi Malaysia. Geoinformatics is a discipline which need to solve geographic related problems (Goodchild, 2009). This course offered in second semester for second year students. The aim of this course is to recollect and revisit data collection methods from previous courses, design and develop spatial database, and produce the final results which consist of a thematic map for selected themes. To achieve this aim, seven learning outcomes have been designed: student should be able to (1) explain the geospatial data collection technologies and geospatial database development, (2) apply the geospatial data collection technologies and geospatial database development, (3) analyze and solve problems related geospatial data collection, (4) demonstrate geospatial project in writing and oral form, (5) conduct data collection method for Geospatial project, (6) demonstrate Geospatial project as a team and (7) organize a team as a leader in handling Geospatial project.

To improve the learning process in GIS Training Camp 1, Conceive-Design-Implement-Operate (CDIO) model was designed and implemented in this course. Implementation of CDIO in this course addresses the gap between the fundamental theories that taught to students with real environment implemented in industries, especially in planning and solving problems related to geospatial data collection, and producing a good thematic map (Melanie Yong Ze Sin et al, 2018). In this course, students practice a set of skills necessary, from planning, collecting, designing and developing spatial database, and to produce a final thematic map, which addressing Geospatial challenges in real context. Students participate in a team-based project whereby require conceive, design, implement and operate the solution to manage issues related to geospatial.

CDIO Framework in GIS Training Camp 1

One big project given to students, and they need to plan in into several tasks to achieve the output expected, which is the mapping of their working area. For 2018-2019 session, the theme for GIS training Camp 1 is Asset Inventory. The location is Tasik Ilmu, Universiti Teknologi Malaysia. Students were divided into small groups which responsible to collect data for small areas.

To achieve this aim, students need to combine field work, laboratory exercises and projects using real-world dataset. Students need to plan, implement and adjust their field work based on current situations, or any problems occur throughout their scheduling plan. Students are expected to gain an understanding of geospatial data collections and geospatial database development theory and methodology. Students are also expected to demonstrate their abilities of spatial thinking via solving any problems occur throughout this course. An independent project constitutes a substantial portion of the final assessment. To achieve learning objectives, six stages were designed and implemented in this course as shown in Table 1.
**Table 1**: Stages implemented in GIS Training Camp 1.

<table>
<thead>
<tr>
<th>Stages</th>
<th>Descriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project planning</td>
<td>Students discuss and plan their field work. Starting from data need to be collected, location of control point, site visit to the field work area and other issues that need to be solve.</td>
</tr>
<tr>
<td>Control Point</td>
<td>Students collect Ground Control Point that was planned and selected in Project Planning stage. This point will be collected using Global Navigation Satellite System (GNSS) methods, which combine Global Positioning System (GPS) and other satellite system. Besides that, student will also conduct traverse technique to ensure the control point that will be use in the phase is close, to make sure control point is reliable (precise).</td>
</tr>
<tr>
<td>Detail Survey</td>
<td>Students collect data for details that have in their working area. This include the roads, building, trees and other human build-up.</td>
</tr>
<tr>
<td>Unmanned Ariel Vehicle Data Collection</td>
<td>Students will collect Ariel data using drone, to support data collection that cannot be cover by Detail Survey technique, especially the water body data, which is quite dangerous for students to collect.</td>
</tr>
<tr>
<td>Geospatial Database Development</td>
<td>This include the conceptual, logical and physical design. From the design, then student will develop the spatial database which include spatial and non-spatial information.</td>
</tr>
<tr>
<td>Visualizations</td>
<td>From data that has been collected, and geospatial database developed, final results in report form, and thematic mapping in their working area will be assess and presented.</td>
</tr>
</tbody>
</table>

Student has conducted activities in GIS Training Camp 1 in two main group. The small group and large group. The small group consist of 5-6 person, and large group consist of all student in this course. The small group collect data for small area, and the large group need to include almost all other activities such as design database, traverse, UAV data collection, GPS data collection and designing final map.

Data collected in throughout this course is from different methods, including field survey, Unmanned Ariel Vehicle (UAV), Ariel Laser Scanning, and Ariel Laser Scanning. Each spatial data collection using different type of coordinate system. Student need to process the data to one final coordinate system. Student need to solve the differentiation of coordinate system before finalizing the thematic map.

After that, each small groups need to design and produce thematic map for their small area, and to make sure all data collected in this course is align with each other, the final thematic map which combine all information from all small group will be produced. Figure 1 shows the final thematic map produced by large group members.
Integration of CDIO in this course has enhanced the student’s lifelong learning in the theories and practical they’ve gained from previous courses, via implementing the real-world based problem, starting with planning, data collection, design and developing geospatial database, and produce thematic map. NALI approach used in this course give better impact and added value for student experience, especially in solving real-world based problem that they facing throughout the course.

Acknowledgement

We are grateful for all the academic staff and supporting staff from Department of Geoinformation, Faculty of Built Environment and Surveying (FABU) for their cooperation and facilitations throughout this course. We also grateful for Director of Geoinformation and Faculty for giving full support.

References


Three Minutes Proposal (3MP)

Che Rozid Mamat
Department of Chemistry, Faculty of Science, Universiti Teknologi Malaysia, 81310 UTM JB
cherozid@utm.my

Norazah Basar
Department of Chemistry, Faculty of Science, Universiti Teknologi Malaysia, 81310 UTM JB
norazahb@utm.my

Sheela Chandren
Department of Chemistry, Faculty of Science, Universiti Teknologi Malaysia, 81310 UTM JB
sheela@utm.my

Razali Ismail
Department of Chemistry, Faculty of Science, Universiti Teknologi Malaysia, 81310 UTM JB
irazali@utm.my

Shajarahntunnur Jamil
Department of Chemistry, Faculty of Science, Universiti Teknologi Malaysia, 81310 UTM JB
shajarah@utm.my

Doria Abdullah
School of Professional and Continuing Education, Universiti Teknologi Malaysia, 81310 UTM JB
doria.abdullah@utm.my

Highlights:
Terdapat keperluan untuk suatu perubahan drastik dilakukan kepada kursus umum SSCU 4902 Projek Sarjana Muda I (PSM 1) dan kurikulum di Jabatan Kimia memandangkan penilaian kursus ini dilakukan secara sumatif sahaja. Kursus ini menuntut pelajar menghantar cadangan penyelidikan pada akhir semester dan prestasi pelajar dinilai semata-mata berdasarkan cadangan penyelidikan tersebut. Maka program ‘Three Minutes Proposal” (3MP) diperkenalkan untuk memberikan nilai tambah kepada kaedah penilaian pelajar disamping mendedahkan pelajar kepada kaedah ‘pitching’ yang berkesan dengan berbantukan poster bersaiz A3. Selain mampu meningkatkan keyakinan pelajar kepada pengucapan awam, 3MP juga dipercayai mampu meningkatkan kebolehperkasaan dan memupuk budaya keusahawanan pelajar UTM.

Keywords: 3MP; public speaking; research proposal

Introduction
Nota: Program 3MP ialah sebahagian daripada MYROADMAP yang diperkenalkan di Fakulti Sains dan telah memenangi Anugerah Kualiti Akademik 2018 dalam Majlis Citra Karisma pada 17 Julai 2019 di Dewan Sultan Iskandar UTM.

Diinspirasi daripada pertandingan ‘Three Minutes Thesis’ (3MT) ialai menyampaikan maksud keseluruh tesis akademik dalam masa 3 minit sahaja, Jabatan Kimia, Fakulti Sains mengorak langkah ke hadapan dengan memperkenalkan program terbaharu, ‘Three Minutes Proposal’ (3MP) yang memberikan peluang kepada pelajar tahn akhir menyampaikan cadangan penyelidikan Projek Sarjana Muda dalam masa 3 minit dan berbantukan poster bersaiz A3. Idea awal program ini tercetus setelah didapati tiada pembaharuan atau CQI kepada kursus SSCU 4902 PSM 1 yang asalnya hanya mempunyai penilaian sumatif iaitu berdasarkan kepada laporan cadangan penyelidikan semata-mata.
Susulan hasrat Kementerian Pendidikan Malaysia untuk meningkatkan tahap kebolehpekerjaan pelajar, disamping keperluan CQI Jabatan untuk menghasilkan pelajar yang mahir komunikasi, 3MP diliham khas untuk memastikan keperluan kebolehpekerjaan dipenuhi dan menghasilkan pelajar yang celik kepada keperluan kerjaya selain latihan pengucapan awam yang baik. Peratusan kebolehpekerjaan pelajar dan alumni sentiasa menjadi topik perbincangan yang tidak berkesudahan. Apatah lagi, dalam era ekonomi berasaskan persaingan ini memerlukan tenaga pekerja mahir bukan sahaja daripada aspek teknikal, malah kemahiran insaniah calon pekerja turut dan sangat diberikan perhatian utama. Disinilah titik keperluan mendesak untuk memulakan inisiatif baharu untuk tidak lagi berada pada zon yang selesa. Perubahan ekosistem ekonomi dan tuntutan serta kehendak semasa memberikan peluang untuk Jabatan Kimia melaksanakan program 3MP ini, selaras untuk menghasilkan pelajar terbaik dan sesuai dengan keperluan pekerjaan semasa.

Content

Program 3MP diadakan untuk mencapai beberapa objektif seperti berikut:

1. Menyediakan platform penilaian pelajar yang kreatif dan inovatif, sejajar dengan keperluan seorang pelajar untuk mendapatkan ilmu yang bermanfaat daripada kursus.
2. Menilai kefahaman dan kredibiliti pelajar kepada cadangan penyelidikan yang dilakukan sepanjang semester melalui rubrik khas 3MP.
3. Menggunapakai teknik pitching – NABC dalam program 3MP yang turut memupuk budaya keusahawanan pelajar.

Program 3MP memperuntukkan sebanyak 15% daripada markah keseluruhan kursus umum SSCU 4902. Pada tahun 2018, pelajar memberikan kerjasama yang sangat baik dan prestasi mereka dalam program 3MP sangat menggalakkan dan membanggakan.

3MP turut menggunakan komponen NALI yang dijadikan panduan ketika perancangan awal program [1]. Komponen NALI yang digunakan dalam 3MP adalah pelbagai, antaranya Job Creation, Problem and Scenario Based Learning. Pelajar memperoleh pelbagai ilmu baharu dan beberapa testimoni pelajar turut dilampirkan dalam Jadual 1.

<table>
<thead>
<tr>
<th>No.</th>
<th>Testimoni berkaitan 3MP</th>
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<tbody>
<tr>
<td>1.</td>
<td>Melatih pelajar untuk bercakap dengan yakin</td>
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Jadual 1: Testimoni pelajar kepada program 3MP tahun 2018.
2. Memberi pendedahan dalam menyampaikan maklumat berkaitan projek
3. Melatih soft skills. Dapat melatih pelajar menyampaikan project dengan berkesan.
4. Increase your self-esteem.
5. Membantu pelajar lebih faham dengan projek masing2
6. Can know the mistakes that I made and get more ideas to improve the proposal
7. Penglibatan pelajar PG yang turut bersama memberi komen dan cadangan untuk pelajar tahun 4.
8. Melatih pelajar cara untuk menyampaikan idea dan maklumat dengan lebih baik dan efektif melalui poster dalam masa yang singkat
10. Train your communication skills, impromptu speech and answering
12. To ensure students really know what they are doing for their fyp.
13. Encourage student to speak up to the crowd, defend their projects and ideas, and to find ways to improve their projects and way of speech
14. Melatih pelajar untuk berkomunikasi dgn lebih berkesan agar maklumat dapat disampaikan dengan betul
15. Program ini dapat melatih para pelajar untuk enhance communication serta presentation skill.
16. Memastikan pelajar betul-betul memahami PSM yang dikendalikan
17. Menyediakan media untuk pelajar menjalankan pitching di depan orang lain
18. Mendedahkan pelajar kepada kemahiran menyampaikan idea dengan efektif dan kompak
19. Melatih skill pemahaman dini kemahiran dlm penyampaian dgn lebih efektif
20. Melatih pelajar untuk bercakap di hadapan orang ramai dan pensyarah memberi komen yg dapat membantu pelajar

Sebulan sebelum program 3MP berlangsung, satu bengkel diadakan dan dihadiri oleh semua pelajar tahun akhir untuk menyediakan pelajar kepada penilaian 3MP. Program ini dinamakan 'How to Pitch Your Research Proposal'. Bengkel ini dikendalikan oleh beberapa orang pensyarah Jabatan Kimia yang pernah mengikuti bengkel 'Elevator Pitch' bertemakan sama, dianjurkan oleh Stamford Research Institute, USA dan ditunjukkan contoh seperti berikut [2,3].
Rubrik penilaian 3MP didedahkan lebih awal kepada pelajar supaya mereka bersedia untuk dinilai. Pensyarah turut dimaklumkan untuk memberikan komen secara membina dan membantu pelajar ini berkeyakinan serta mampu menyampaikan maklumat cadangan penyelidikan secara berkesan. Selain pensyarah, pelajar lain yang tidak terlibat dengan 3MP (termasuk pelajar pasca ijazah) turut diminta hadir ke sesi 3MP dan memberikan komen secara telus kepada pelajar supaya mereka dapat memperbaiki prestasi ‘pitching’ mereka. Contoh rubrik yang digunakan untuk penilaian 3MP ditunjukkan seperti berikut.

Budaya keusahawanan dapat dipupuk kerana 3MP menggalakkan pelajar untuk seolah-olah ‘menjual’ cadangan penyelidikan mereka. Pelajar diminta untuk meyakinkan pelanggan dengan produk penyelidikan yang lebih inovasi dan bertunjang komersil. Unsur pujukan dan komunikasi berkesan memainkan peranan penting dalam meyakinkan pelanggan untuk membeli idea yang hanya sebatas cadangan penyelidikan.

Usaha 3MP ini tidak berakhir dan dipantau pada satu semester sahaja. Kesinambungan pemantauan diteruskan dan didapati corak pencapaian pelajar melalui SSCU 4902 – PSM 1 dan SSCU 4904 – PSM 2 berkadar terus, sekaligus membuktikan program 3MP ternyata berkesan dalam pembangunan kemahiran teknikal dan insaniah pelajar tahun akhir.

**Acknowledgement**

Terima kasih diucapkan kepada Jawatankuasa Pembangunan Pelajar Jabatan Kimia, Fakulti Sains, UTM.

**References**


Industry-Infused Curriculum in Computing Education for Future Ready Graduates

Abdul Samad Ismail, Aryati Bakri, Nor Hawaniah Zakaria, Dayang Norhayati Abang Jawawi

Abstract

In computing education, technical and generic skills are very crucial to graduates. In conventional curriculum, students are given theoretical and practical knowledge through lectures in classes and hands-on exercises in campus laboratory. These teaching methods do not give students learned through experience from real environment. In conventional methods, case studies are given from the textbooks or scenario simulation by lecturers. We have designed the first industry-infused curriculum in computing which incorporates experiential learning to students in real work environment. Industries’ practitioners from ICT-based companies and academicians from Universiti Teknologi Malaysia worked together to develop an industry-infused curriculum in Computing. The characteristics of the curriculum are; 1) it provides a systematic education in dual environment, the university campus and industry, 2) it gives a structured experiential learning to students; 3) it creates consistent engagement between university and industry. The advantages of this curriculum are; 1) students gained knowledge through direct experience obtained from their industry coach in real environment while solving real industry problem as course assignments, 2) the real practical experience obtained outside campus is the integration of practical and theoretical knowledge which the students had learned in university campus, 3) students’ technical and generic skills are developed in real work environment and 4) it gives opportunity for the students to learn and earn and future ready to be employed upon completion of their studies. This curriculum has become a model of reference by curriculum designers from other universities in Malaysia and the success story has been shared in seminars.
IMPLEMENTATION OF AN INTEGRATED WORK-BASED LEARNING COURSES IN INDUSTRY-INFUSED CURRICULUM

Nor Hawaniah Zakaria, Muhammad Iqbal Tariq Idris, Haza Nuzly Abdull Hamed

Abstract

Work-based learning (WBL) is defined as a class of university academic program that brings together universities and industries to create new learning opportunities in real environment. In our proposed industry-infused curriculum, we have conducted an integrated day release WBL to three different courses that were offered simultaneously in a semester. Each courses has its own course learning outcomes which mapped to the Programme Learning Outcome (PLO). The technical and generic skills obtained from these courses are required for the Computing students to develop a complete web-based information system. In the development of a Web-based System, students are assessed based on: 1) ability to gather real requirements and processes from the stakeholders; 2) ability to design a database for data storage, retrieval and manipulation; 3) ability to design user interface and use the current technology for systems development. The first assessment component is evaluated in the Systems Analysis & Design course, while the second component is in Database course and the final one is in Systems Development Technology. Each instructor of the course delivered the theoretical parts of the lesson individually but worked together in the process of monitoring the class group project together with the industry coach. Implementing a WBL approach in teaching and learning able to provide opportunities for the students to have real experiential learning at the early year of their academic programme. In addition, it gives exposure for the students to gain practical knowledge in real environment by applying the theoretical knowledge they obtained from the university.
Enrichment of Experiential Education through the Integration of Role-Playing and Synergized Service-Learning Methods

Ainur Zaireen Zainudin1
Norhidayah Binti Md.Yunus2

Department of Real Estate, Faculty of Built Environment and Surveying, Universiti Teknologi Malaysia, 81310 Johor Bahru, Johor
1ainurzaireen@utm.my, 2norhidayahmy@utm.my

Safwan Shaari
Planning Development Department Iskandar Puteri City Council, 81300 Skudai, Johor Bahru, Johor
SafwanShaari@mbip.gov.com

Muhammad Faiz Hakimi Bin Abd Latib
Department of Architecture, Faculty of Built Environment and Surveying, Universiti Teknologi Malaysia, 81310 Johor Bahru, Johor
faiz.abdlatib@gmail.com

Highlights

Role-playing and service learning are two approaches that widely use in teaching and learning to higher education institutions students. Whilst role-playing is easy to be executed as classroom activity, service learning on the other hand is always constrained by time, commitment and financial limitation. To overcome these challenges, synergy concept has been adopted in order to ensure the transformation of students learning experiences can be well executed according to the designed experiential education.

Key words: experiential education; role-playing; service learning; synergy

Introduction

‘Sustainability’ has become a global focus particularly after the reconciliation of the social, economic and ecological dimension of change in the Brundtland Report 1987. Since then, various initiatives have been put forward by local as well as international communities committing themselves to the movement for a better quality of life. To support sustainable development process, social actors are engaged in many programs associated with sustainability agenda and education is seen to be among important policy instruments that could build up better engagement or community action of the social actors. Consequently, sustainable development field of study has been included into the curriculum at schools and higher education institutions.

In Universiti Teknologi Malaysia (UTM), sustainable development is one of the elective courses offered to the undergraduate students of Land Administration and Development Program. This course is offered in the final semester of the undergraduate study, in which, besides knowledge it is focusing on developing students’ practical, critical thinking and problem solving as well as life-long learning skills. In the context of knowledge, students are not only provided with the principles of sustainable development, but most importantly they are taught to better understand the importance of this model to be adopted in developing every nation in this world. As previously mentioned, sustainability needs community action to be successfully achieved (Diesendorf, 2000). It is thus very important for this community action context to be included into the syllabus of Sustainable Development course. It is believed that community action is best to be delivered to students not only through conventional lectures but also by engaging students to experiential learning activities. Experiential learning is "the process whereby knowledge is created through the transformation of experience" (Kolb and kolb, 2005). For this Sustainable Development course, the transformation of experience has been executed through an innovated experiential learning methodology that integrating two teaching and learning methods namely the role-playing and the service learning methods. In addition, the service learning was set up through a synergy made with the campus community and industry in order to minimize financial implication to the students of this course. It is believed that, by executing these strategies, the experiential education could be enriched and can better achieve the targeted learning outcome of this course.

Transformation of Students’ Experience through Role-playing and Synergized Service Learning

The main objective of this experiential learning activities is to achieve the first learning outcome of this Sustainable Development course that is to enhance students’ understanding on the importance of sustainable development. Considering the broad area of sustainability literature, ‘community action’ was opted to be the focus area for
achieving this learning outcome, thus being the theme of the entire experiential learning process. This process has been designed to have two main phases in order to better execute the transformation of experience during the learning process. The first phase was conducted as classroom learning activity and the latter phase was then carried out by students outside the classroom by engaging them into an actual community service program. The framework of this experiential learning process is demonstrated in Figure 1.

Figure 1: Experiential Learning process Framework

As classroom learning activity, the community action is intended to be learned by students using Role-Playing method. Role-playing was utilized as to allow students to select, organize, and integrate information (Mayer, 1984) by themselves from acting activities. For diverse experience on the community action, students were divided into three groups of social actor namely the government, the service provider agency and the society. Before the acting begin, students were instructed to conduct a short brainstorming session to anticipate the (community) actions of the social actor that they represented towards the Solid Waste Separation Program as enforced by the government. For this purpose, students were guided with the given issues to keep students’ focus on the chosen theme of the learning content. Upon the brainstorming session, the role-playing activity was conducted in a sequence started by the society group, followed by the service provider agency and finally by the government group. Each group was required to act on community action based on the role of social actor they represented. They were also required to follow closely the community actions performed by other groups before them as they need to show their response to those actions through their acting later. The outcomes of the role-playing activity were then discussed by focusing on the different community actions showed by each social actor. In the discussion, the lecturer led the students to compare the anticipated actions students gathered in the brainstorming session with the actual outcomes of their acting when the students play the roles by themselves. Eventually, it can be seen that the activity allow students to relate the community actions with the importance of sustainable development initiative according to different social actors not only through critical thinking skills they acquired during the brainstorming session, but they were able to experience them through their own acting activities.

In the second phase of the experiential learning process, students were intended to further experience the community action context using service learning method. Serving learning is one of the many experiential education approaches that allow students to learn from the real experience (Sigmon, 1979; Furco, 1996). In UTM, service learning has been identified as one of the New Academia Learning Initiatives (NALI) that is highly recommended as part of student-centric learning modes. By using serving learning, students’ experience which was once simulated in the classroom was then transformed to a real project. Nevertheless, using service learning method is not without challenges. Common main barriers of service learning are time constraints, commitments, inadequate funding and lack of institutional support (Kolanko et al., 1996). To avoid service learning failure, thus synergy concept has been adopted. Literally, synergy is the combined power of a group of things when they are working together that is greater than the total power achieved by each working separately. The synergy can be done by determining activities with minimal fund and resources and explore existing resources that can be used effectively for greater project efficiency. In order to minimize financial implication to the students of this sustainable course, a synergized service learning has been designed in collaboration with the organizer of Riverdale Project.

Riverdale was a community service project organized by the Rahman Putra College Student Committee in collaboration with UTM Campus Sustainability (UTMCS), Center for Environmental Sustainability and Water Security [IPASA] and Iskandar Puteri City Council. It was aimed to raise the awareness and concern of UTM campus community to river’s cleanliness and water resources besides fostering volunteerism spirit among campus community. This project involved four phases of activities namely the Plastic Water Bottle Recycling Campaign, Floating Wetland Design Competition, Floating Wetland Production and Launching of Riverdale Project. The Plastic Water Bottle Recycling Campaign aimed to get 2000 plastic water bottles to be recycled as one of the materials for floating wetland production. This was where the synergy between Riverdale Project and sustainable development course was formed. The students of sustainable development course were engaged into Riverdale Project as volunteers to assist Riverdale’s organizer to collect the targeted number of plastic water bottle. In addition to that, each student was required to interview two participants of the Riverdale Project which had also contributed water bottles. The interview was aimed at gathering participants’ feedback on their participation in this community service project and the importance of Riverdale 4.0 program to the pursuit of sustainable development. The results of the interview were
then submitted as individual assignment report for assessment.

Figure 2: Strategies in Executing the Designed Teaching and Learning Modes

Figure 2 shows clearly the whole idea of innovation made throughout this experiential learning process. This innovation was designed to enrich the experiential education by combining classroom learning activity through role-playing and the learning process was then strengthened by a real service learning project on volunteerism basis. The novelty of this whole idea is on the use of synergy concept to overcome service learning barriers. This approach is important as to ensure the students’ experience in the simulated learning outcome could be well transformed into a real experience through a real community service project with minimal financial implication. Even though the contribution made by the students in the Riverdale Project seems small, the benefits of overall learning process are tremendous in the following ways:

i. Role-playing activity enables students to gain knowledge not through conventional lectures by through student-centric learning process which include critical thinking and response-based activities.

ii. The synergy concept adopted in this experiential education teaches students the importance of social network as one of the success factors of sustainable development initiatives.

iii. The transformation of experience occurs in the learning process from classroom environment to the real world environment has enriched students learning on civic responsibility that may foster their civic engagement to further contribute to the community in which the students would live.

iv. The instruction for the students to work together with Riverdale’s organizer has benefited all partners of the project and its targeted beneficiaries

v. The instruction for students to gather other participants views on Riverdale Project enables students to not only learn the importance of sustainable development initiative from their own experience after participating in the program but also from the experience of others.

Acknowledgement

We are grateful for the support and assistance given by Riverdale Project synergy team that includes KRP students’ committee, IPASA, UTMCS as well as Planning Development Department of Iskandar Puteri City Council (MBIP).

References


Innovative Product Development through Innovation-Based Learning Strategy

Sarimah Ismail  
School of Education, Faculty of Social Sciences and Humanities, UTM  
p-sarima@utm.my

Muhammad Khair Noordin  
mdkhair@utm.my  
School of Education, Faculty of Social Sciences and Humanities, UTM

Azra Syahirah A. Rahman @ Hud  
School of Education, Faculty of Social Sciences and Humanities, UTM  
azrai@gmail.com

Highlights:
This paper presents finding of a study on the implementation of Innovation-Based Learning (IBL) strategy that found challenging to produce innovative product replacing the monotonous of Project-Based Learning (PjBL) strategy with predicted product. The IBL strategy was created based on continuous quality improvement effort in learning and teaching (L&T) Food Processing Technology (FPT) course for 10 semesters to produce quality of innovative product that able to overcome problem of a society in a systematic way. Qualitative research design adopted in this study involved participant observation toward 14 weeks of L&T activities in the classroom and laboratory settings; interview with 15 students, lecturer and demonstrator of the course; and document analysis as data collecting techniques. Qualitative data were analysed thematically using Nvivo computer software. Finding of the study showed the IBL strategy that consisted of five phases: preparation, technical knowledge and skill development, innovation process, commercialization and reflection managed to develop innovative food products for patients of cancer, gout, autism, cyst and fibroid and eczema besides innovative food products for postpartum women and hair loss people. This study provided two major impacts for L&T: tangible impacts (innovative product development and intellectual property status) and intangible impacts (technical knowledge and skill development of the course as well as 21st century generic skills improvement). Both impacts are important and interrelated for the purpose of commercializing the innovative product been developed. This study suggests for the IBL strategy to be practiced in the courses that having interest in producing innovative product.

Key words: Innovation-based learning, Food Processing Technology, innovative food product, 21st century generic skills, qualitative research design

Introduction
Innovation is a continuous process of discovery and learning from various sources to produce new product: good, service, method, process, system, technologies and techniques (Sarimah et al., 2018). Modern growth theory identified three key determinants of productivity growth that interact and complementary in nature: physical capital, human capital, and rate of innovation and technological change (Gerguri and Ramdani, 2010).

Food industry is one of service sectors that having high demand and have contributed to economic growth of Malaysia. To stay relevant in the competitive market, the food industry has to produce product that satisfy consumers’ expectations. To achieve this, innovation is seen the best platform for the food industry to produce innovative product and stay out from competitors. Winger and Wall (2006) also claimed that food industry is an important economic sector in every country and product development is a key feature of companies’ strategies to remain competitive and to grow.

To produce creative and innovative generation, learning and teaching strategies that expose them to the innovation process should be introduced at the early stage. However, up to date, none of 21st century student centered teaching strategies (cooperative learning, problem-based learning, project-based learning, project oriented problem-based learning, problem oriented project-based learning, case teaching, blended learning, scenario-based learning, and experiential learning) that received high attention among academicians and documented in the literature has shown how to conduct innovation process in classroom setting to produce innovative product. Those teaching strategies were debated more on generic skills development and in-depth understanding of course content.

Thus, this paper presents finding of a study on how the innovative products is developed in the classroom and laboratory settings through the application Innovation-Based Learning (IBL) strategy.
Objectives of this study is to demonstrate how innovative food product is developed through the IBL strategy

**NALI approach implemented**

The implementation of new academia learning innovation (NALI) approach in this study is the application of IBL strategy in teaching Food Processing Technology course (SPPL4132) to develop innovative food product.

The IBL strategy has the characteristics of having R&D and dissemination of research-based knowledge as a key concept; innovation as a function of learning and knowledge creation to produce new or improvement in product; working area as both production and learning sites; involve active learning in constructing new knowledge (through fitting new information, knowledge and real-world experience) with what already know (prior knowledge) to hypothesize, test theories and draw conclusion from their findings; reflect experience of acquisition the new knowledge (what they are doing, how their understanding changed, what they get from the learning, changes to be made, irrelevant new information to be discarded, mistake should be avoided) with previous ideas and experience by asking question, exploring and assessing what already know.

The IBL strategy framework applied in this study of consists of five phases: preparation, development of technical knowledge and skill of the course, innovation process, commercialization and reflection. In the IBl strategy, students construct new knowledge based on instruction given and using their prior knowledge from multi-resources. In the process of acquisition the new knowledge, students involve actively in their learning through fitting new information, knowledge, real-world experience together with what they already know to hypothesize, test theories and draw conclusion from their findings. Then they reflect experience toward process of acquisition the new knowledge (what they are doing, how their understanding is changing, what they get from the learning, identify changes to be made, irrelevant new information to be discarded, mistake should be avoided) with previous ideas and experience. It is done by asking question, exploring and assessing what already know.

**Methodology**

This study applied qualitative research design. Data collecting techniques involved participant observation, interview and document analysis. Series of participant observations toward learning and teaching activities of lecturer and student were conducted in classroom and laboratory settings for 14 weeks of academic session. Saturation of data showed 15 students and a course lecturer were interviewed. Field note, interview protocol and relevant documents were used as research instrument. Two senior lecturers that specialized in Food Processing Technology and involved actively in innovation research adopting qualitative research method were verified the research instrument. Data were analyzed using Nvivo qualitative computer software. Finding of the study showed, through IBL strategy, the course managed to develop eight innovative food products for patients and in need people.

**Finding**

The Food Processing Technology is a 2 credit hour course and having pre-requisite of Basic Food Nutrition and Preparation course for prior knowledge and skills in food preparation. Aims of this course are to provide students with technical knowledge and skills in food processing technology; to produce innovative food, and to develop 21st century generic skills among students. The course has four learning outcomes (CLO) and four program outcomes (PLO) to be achieved. Constructive alignment of the course as stated in Table 1.

<table>
<thead>
<tr>
<th>No.</th>
<th>CLO</th>
<th>PLO (Co-de)</th>
<th>*Taxonomies and **generic skills</th>
<th>T&amp;L methods</th>
<th>Assessment methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>CLO 1</td>
<td>Possess knowledge in food processing technology at all levels of Bloom Taxonomy (from knowledge to synthesize)</td>
<td>P L O 1 (K W)</td>
<td>C4</td>
<td>Lecturer, active learning</td>
<td>Test</td>
</tr>
<tr>
<td>CLO</td>
<td>Demonstrate skills in food processing technology</td>
<td>PLO2 (A.P.)</td>
<td>P4</td>
<td>Demonstration, Hands on</td>
<td>Weekly Practice</td>
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<td>-------------------------------------------------</td>
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</tr>
<tr>
<td>CLO</td>
<td>Communicate effectively about food invention research proposal and final report</td>
<td>PLO4 (C5)</td>
<td>CS4</td>
<td>Innovation-based learning</td>
<td>Presentation</td>
</tr>
<tr>
<td></td>
<td>Applying technical knowledge and skill of the course to solve food problem in the society through innovative food development</td>
<td>PLO5 (C6)</td>
<td>CTPS3</td>
<td>Sensory evaluation, Labeling for packaging of the innovative food</td>
<td></td>
</tr>
</tbody>
</table>

This final year course consists of one hour theory and three hours practice. In the theory part, students are taught about food additives, food hygiene, Halal food, food labeling and packaging, innovation in food, and technologies in food processing. The practice part offers experience and skills in innovation process to produce innovative food. The students are guided to identify real food problems faced by the society and solution to overcome the problems; presenting proposal for potential innovative food development; conducting research and development (R & D) for innovative food; applying for Intellectual Property status; evaluating the innovative food and reflecting learning and teaching process of the course for future improvement.

The engagement of student in group with small numbers of heterogeneous students (gender, academic achievement, state of origin) has produced eight innovative food products (healthy snack for patients of cancer, anemia, gout, cyst and fibroid, eczema and autism besides snack for Postpartum confinement women and hair loss people). Teaching and learning activities of the course and their outcomes are portrayed and summarized in Table 2.

The innovative food was evaluated from two perspectives: sensory and innovation. The sensory evaluation measures feature/look, taste, color, smell, texture, nutrition, well-cooked and garnishing of the innovative food. The innovation aspect measures novelty, creativity, innovative, applicability and impact toward process, technology and ingredients used. The development of 21st century generic skills among students was identified on week 15 of the academic session through survey research.

The IBL strategy can be applied in any course that involves innovation outcomes regardless product, service, process, method etc. It has been adopted in the Fashion Design course of the SPPH program curriculum.

The implementation of IBL strategy provides two major outcomes: tangible and intangible. The tangible outcomes in a form of innovative food product development [innovative foods for patients of cancer, anemia, gout, cyst and fibroid, eczema and autism besides innovative foods for postpartum confinement women and hair loss people], IP status for innovative food and labeling of the innovative food packaging, certificate of participation in the R&D of food innovation, profit (for students who commercialized their innovative food). The intangible outcomes were in the forms of in-depth understanding toward technical knowledge and skill of the course and 21st century generic skills development.
Table 2: Learning and Teaching Activities through IBL Strategy

<table>
<thead>
<tr>
<th>Phases</th>
<th>Learning &amp; Teaching Activities</th>
<th>Learning &amp; Teaching Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Preparation</td>
<td>a) Preparing technical knowledge and skill of the course and IBL strategy</td>
<td>• Content expert</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• IBL expert</td>
</tr>
<tr>
<td></td>
<td>b) Preparing teaching materials (lecture notes, assessment rubrics, interview protocol, list of SME food industries, letters for field trip application and budget for the course)</td>
<td>Teaching materials</td>
</tr>
<tr>
<td>2. Technical knowledge and skills of the course development</td>
<td>a) Delivering theory of the course</td>
<td>Technical knowledge development of the course</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Technical skills development of the course</td>
</tr>
<tr>
<td></td>
<td>b) Delivering practice of the course</td>
<td></td>
</tr>
<tr>
<td>3. Innovation process (innovative food development)</td>
<td>a) Identifying food problem in the society</td>
<td>• Creative Thinking and Problem solving skill</td>
</tr>
<tr>
<td></td>
<td>• group discussion,</td>
<td>• Team working skill</td>
</tr>
<tr>
<td></td>
<td>• literature search,</td>
<td>• Life-long learning skill</td>
</tr>
<tr>
<td></td>
<td>• field trip,</td>
<td>• Entrepreneurial Skill</td>
</tr>
<tr>
<td></td>
<td>• interview with experts (nutritionist, dietitian, food industries, food research officers)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• interview with parties facing the problem</td>
<td></td>
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<tr>
<td></td>
<td>b) Identifying solution for the food problem</td>
<td>• Creative Thinking and Problem solving skill</td>
</tr>
<tr>
<td></td>
<td>• group discussion,</td>
<td>• Team working skill</td>
</tr>
<tr>
<td></td>
<td>• literature search,</td>
<td>• Life-long learning skill</td>
</tr>
<tr>
<td></td>
<td>• field trip,</td>
<td>• Entrepreneurial Skill</td>
</tr>
<tr>
<td></td>
<td>• interview of experts (nutritionist, dietitian, food industries, food research officers)</td>
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<td></td>
<td>• interview of parties facing the problem</td>
<td></td>
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<td></td>
<td>• conducting Need Analysis</td>
<td></td>
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<td></td>
<td>c) Approving suggestion for innovative food title and problem background</td>
<td>Creative Thinking and Problem solving skill</td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>d) Writing and defending research proposal for innovative foods</td>
<td>Communicating Skills</td>
</tr>
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<td></td>
<td></td>
<td>• Entrepreneurial Skill</td>
</tr>
<tr>
<td></td>
<td>e) Conducting series of R &amp; D for innovative food development and reflection</td>
<td>Technical knowledge and skills of the course</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Creative Thinking and Problem solving skill</td>
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<tr>
<td></td>
<td></td>
<td>• Innovative food product</td>
</tr>
<tr>
<td></td>
<td>f) Developing labeling for the packaging of innovative food</td>
<td>• Technical knowledge and skills of the course</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Creative Thinking and Problem solving skill</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Innovative labeling</td>
</tr>
<tr>
<td></td>
<td>g) Applying IP status for</td>
<td>• Ethic and Professionalism Skill</td>
</tr>
<tr>
<td></td>
<td>• Innovative food</td>
<td>• IP status for</td>
</tr>
<tr>
<td></td>
<td>• Labeling for packaging of the innovative food</td>
<td>a) Trade Secret</td>
</tr>
<tr>
<td></td>
<td></td>
<td>b) Copyright</td>
</tr>
<tr>
<td></td>
<td>h) Evaluating the innovative food</td>
<td>Certificate of participation in the R &amp; D of food innovation</td>
</tr>
</tbody>
</table>

- IP: Intellectual Property
4. Commercialization

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>a)</td>
<td>Determining expenditure of the innovative food development</td>
</tr>
<tr>
<td>b)</td>
<td>Determining price of the innovative food development</td>
</tr>
<tr>
<td>c)</td>
<td>Determining market size</td>
</tr>
<tr>
<td>d)</td>
<td>Commercializing the innovative food</td>
</tr>
</tbody>
</table>

Entrepreneurial Skill

- Communication Skills
- Report
- Course assessment report

5. Reflection

Presenting final report of experience in food innovation development through IBL strategy for continuous quality improvement

Commercialization potential

To identify possibility of the innovative food to be commercialized, it was retrieved from need analysis result which indicated the innovative food having potential buyers and market. Prior R&D, planning of the innovative food development has received professional advised from nutritionist, dietitian, entrepreneur of food industry and officers of food research centers besides thorough literature search in terms of technology adopted, process involved and food ingredients used. This signed that the food are safe, healthy and having innovative values to solve food problem of the society. Serial of R&Ds were conducted to enhance quality of the food. Heterogeneous of consumers (students, house wife, patients and professionals) involved in blind sensory evaluation to determine the food quality. The foods evaluated were rated with high mark. These gave impression that the innovative foods developed having high potential to be commercialized.

Awards received (title of project, exhibition and year)

The IBL Strategy Conceptual Framework received Bronze Award in NALI Exhibition and Competition 2018.

Conclusion

Sawyer (2004) claimed most learning institutions failed to show students on how to create knowledge. As a result, the students view knowledge as static and complete, and they expert in consuming the knowledge rather than producing knowledge. However, the constructive learning process of IBL strategy (as explained in four phases of the IBL strategy) completely challenged this claim.

This study recommended for the students to participate in the knowledge of society, learning institutions particularly course lecturer should prepare the students to get involve in complex and creative system through working collaboratively with multiple organizations to build knowledge together through constructive and innovative L&T weekly schedule as well as learning strategy. To increase creative performance, those students are strongly encouraged to work in group.

The IBL strategy can be applied in any course that involves innovative product as an outcome regardless good, service, process, method and etc. as it has been adopted in the Fashion Design course offered to the SPPH program at the same university.

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Penggunaan Rubrik Penyelesaian Masalah Pengiraan Nilai Tenaga Makanan dalam Pengajaran Mata Pelajaran Sains Rumah Tangga

Zaharah Ja’afar
Sekolah Pendidikan, Fakulti Sains Sosial dan Kemanusiaan, Universiti Teknologi Malaysia Johor Bahru, 81310 Skudai, Johor, MALAYSIA
zarajc190@gmail.com

Sarimah Ismail
Sekolah Pendidikan, Fakulti Sains Sosial dan Kemanusiaan, Universiti Teknologi Malaysia Johor Bahru, 81310 Skudai, Johor, MALAYSIA
p-sarima@utm.my

Ahmad Fauzi Mohd Ayub
Fakulti Pengajian Pendidikan, Universiti Putra Malaysia, 43400 UPM Serdang, Selangor, MALAYSIA
afauzi@educ.upm.edu.my

Highlights
Artikel ini melaporkan dapatan kajian penggunaan Rubrik Penyelesaian Masalah Pengiraan Nilai Tenaga Makanan yang telah dibangunkan bagi menentukan tahap penyelesaian masalah, kesilapan fakta dan kriteria pengiraan nilai tenaga makanan dalam mata pelajaran SRT. Aspek lain yang dilaporkan adalah hubungan antara tahap penyelesaian masalah pengiraan nilai tenaga makanan dengan pencapaian pengiraan nilai tenaga makanan. Data dianalisis menggunakan statistik deskriptif dan korelasi. Dapatan kajian menunjukkan terdapat hubungan yang signifikan antara empat prosedur penyelesaian masalah pengiraan nilai tenaga makanan dengan pencapaian pengiraan nilai tenaga makanan murid SRT. Kajian ini mencadangkan agar Rubrik Penyelesaian Masalah Pengiraan Nilai Tenaga Makanan yang dibangunkan digunakan sebagai alat dalam pengajaran menyelesaikan masalah pengiraan nilai tenaga makanan mata pelajaran SRT di sekolah-sekolah menengah harian seluruh Malaysia bagi membantu menambah baik strategi pengajaran guru SRT dan meningkatkan keupayaan menyelesaikan masalah pengiraan murid SRT.

Kata kunci: Pembelajaran Berasaskan Masalah; Sains Rumah Tangga; Penyelesaian Masalah

Pengenalan
Mata pelajaran Sains Rumah Tangga (SRT) ditawarkan kepada murid tingkatan 4 dan 5 di sekolah menengah harian. Terdapat sembilan strategi pengajaran dan pembelajaran yang telah disarankan oleh Kementerian Pendidikan Malaysia (KPM) sebagaimana tercatat dalam Dokumen Standard Kurikulum dan Pentaksiran (DSKP) mata pelajaran ini. Satu di antaranya ialah Pembelajaran Berasaskan Masalah (PBM).


Malangnya, majoriti murid SRT mempunyai latar belakang matematik yang lemah di peringkat PT3. Kajian Zaharah (2013) yang dijalankan ke atas 170 murid tingkatan 5 yang mengambil mata pelajaran SRT mendapati 55 orang responden (32.4%) gagal memperoleh sebarang skor dalam ujian pencapaian pengiraan nilai tenaga makanan yang melibatkan pengiraan matematik. 21 responden (12.4%) memperoleh skor 4 dan bagi skor yang lain pula dicapai kurang dari 10%. Hanya 5 responden (2.9%) memperoleh skor penuh iaitu 16 markah.

Kandungan Proyek Inovasi

1. Proyek Inovasi (Rubrik Penyelesaian Masalah Pengiraan Nilai Tenaga Makanan)

Rubrik ini mengandungi empat prosedur (P) penyelesaian masalah dengan setiap satu prosedur mengandungi lima tahap penyelesaian masalah yang diberi skor 0 hingga 4 (rujuk Jadual 1).

P1: mengenal pasti masalah  
P2: merancang strategi penyelesaian masalah  
P3: melaksanakan jawapan penyelesaian masalah  
P4: menyemak serta menulis jawapan penyelesaian masalah


Jadual 1: Rubrik Penyelesaian Masalah Pengiraan Nilai Tenaga Makanan

<table>
<thead>
<tr>
<th>Prosedur (P)</th>
<th>Penyelesaian Masalah</th>
<th>Skor</th>
</tr>
</thead>
</table>
| Mengenal pasti masalah (P1) | Mengenal pasti masalah secara menyeluruh dengan betul dan tepat berdasarkan gambar rajah atau jadual dan maklumat soalan bagi empat fakta (elemen) pengiraan yang diberi:  
  i) Menu / makanan  
  ii) Porsi (g)  
  iii) % E.P  
  iv) Nutrien dan nilai dalam gram | 4 |
| Merancang strategi penyelesaian masalah (P2) | Pemilihan strategi penyelesaian masalah yang betul dan tepat dengan membina jadual atau membuat senarai tersusun / menyusun atur maklumat berdasarkan gambar rajah atau jadual dan maklumat soalan bagi empat fakta (elemen) pengiraan:  
  i) Menu / makanan  
  ii) Porsi (g)  
  iii) % E.P  
  iv) Nutrien dan nilai dalam gram | 4 |
| Melaksanakan jawapan penyelesaian masalah (P3) | Melaksanakan jawapan penyelesaian masalah dengan betul dan tepat bagi empat kriteria:  
  i) Kaedah pengiraan  
  ii) Nilai tenaga makanan (17kJ, 38kJ, 17kJ)  
  iii) Unit pengiraan (g & kJ)  
  iv) Jawapan pengiraan | 4 |
| Menyemak dan menulis jawapan penyelesaian (P4) | Penyelesaian masalah pengiraan yang betul dan tepat dengan skor maksimum | 4 |

Objektif Proyek Inovasi

Objektif proyek inovasi ini adalah untuk:

a) Mengenal pasti dengan terperinci kesilapan fakta (elemen) dan kriteria pengiraan bagi pengiraan nilai tenaga makanan murid SRT ketika mengira nilai tenaga makanan.
b) Menentukan skor pencapaian penyelesaian masalah pengiraan nilai tenaga makanan yang diperolehi oleh murid SRT.
c) Meningkatkan kemahiran menyelesaikan masalah pengiraan nilai tenaga makanan murid SRT.

2. Aplikasi NALI dalam Proyek Inovasi

Rubrik Penyelesaian Masalah Pengiraan Nilai Tenaga Makanan yang dibangunkan ini mengaplikasikan NALI mengikut aspek berikut:

a) Ketulian

Rubrik ini telah dibangunkan sendiri oleh penyelesaikan berdasarkan Rubrik Prosedur Penyelesaian Masalah Polya oleh Szetela dan Cynthia (1992), Carta Aliran Penyelesaian Masalah Krulik dan Rudnick (1984), Skala Analitikal Penyelesaian Masalah...

b) Kreativiti
Masalah penguasaan matematik dalam kalangan pelajar-pelajar SRT sehingga menjelaskan proses pembelajaran topik pengiraan nilai tenaga makanan yang memberi kesan negatif kepada pencapaian dalam SPM telah memberi idea kepada pembangunan rubrik ini. Penggunaan rubrik ini membuktikan murid SRT dapat mengenal pasti secara terperinci kesilapan pengiraan nilai tenaga makanan yang telah dilakukan dan dapat memperbaiki kesilapan tersebut secara kendiri. Guru SRT pula dapat memembimbing murid secara individu berdasarkan kesilapan-kesilapan pengiraan yang dilakukan oleh setiap murid SRT.

c) Inovasi

d) Aplikasi
Rubrik yang dibangunkan ini dapat dilapiskan secara praktikal dalam kalangan murid SRT ketika mempelajari standard pembelajaran mengira nilai tenaga makanan. Menerusi penggunaan rubrik ini guru SRT dapat memembimbing murid secara individu untuk memperbaiki kesilapan pengiraan nilai tenaga makanan dengan lebih spesifik. Murid SRT pula akan dapat memperbaiki kesilapan pengiraan yang dilakukan secara kendiri.

e) Impak
Projek inovasi ini membantu murid SRT berdikari dalam mengenal pasti kesilapan fakta (elemen) dan kriteria pengiraan yang dilakukan ketika mengira nilai tenaga makanan serta memperbaiki kesilapan pengiraan yang dilakukan secara kendiri. Bagi guru SRT pula rubrik ini dapat dijadikan panduan dalam menyampaikan standard pembelajaran mengira nilai tenaga makanan, menentukan skor pencapaian pengiraan nilai tenaga makanan, mengenal pasti tahap penyelesaian masalah pengiraan nilai tenaga makanan dan memembimbing murid SRT memperbaiki kesilapan pengiraan secara individu.

3. Metodologi Kajian

4. Dapatan dan Perbincangan Projek Inovasi
Dapatan dan perbincangan projek inovasi ini terdiri daripada aspek tahap penyelesaian masalah pengiraan, kesilapan fakta (elemen) dan kriteria pengiraan nilai tenaga makanan, serta hubungan tahap penyelesaian masalah pengiraan nilai tenaga makanan dengan pencapaian pengiraan nilai tenaga makanan.

a) Tahap penyelesaian masalah pengiraan
Dapatan kajian menunjukkan majoriti responden gagal memperoleh skor penuh (4) bagi semua prosedur terutamanya prosedur P3: melaksanakan jawapan penyelesaian masalah pengiraan nilai tenaga makanan dan prosedur P4: melaksanakan jawapan penyelesaian masalah penyelidikan masalah penyelidikan nilai tenaga makanan.

b) Kesilapan fakta (elemen) dan kriteria pengiraan nilai tenaga makanan
Bagi P1: mengenal pasti masalah, dapatan kajian menunjukkan seramai 46 (27.1%) responden memperoleh skor 1. Skor ini bermaksud sebilangan besar responden menyalah faham maksud soalan dengan hanya satu daripada empat fakta (elemen) pengiraan sahaja yang dikenal pasti betul.

Bagi P2: merancang strategi penyelesaian masalah, bilangan tertinggi dicatatkan adalah 54 (31.8%) orang mendapat skor 1. Skor ini menunjukkan hanya satu daripada empat fakta (elemen) sahaja yang disenaraian strategi penyelesaian masalah disusun dengan betul.

Bagi P3: melaksanakan jawapan penyelesaian masalah pengiraan nilai tenaga makanan, hasil analisis deskriptif menunjukkan sebahagian daripada responden salah dalam melaksanakan jawapan menyelesaikan masalah sementara 92 orang (54.1%) iaitu memperoleh skor 0.

Bagi P4: menyemak dan menulis jawapan penyelesaian masalah, seramai 55 orang (32.4%) melakukan pengiraan nilai tenaga makanan yang salah keseluruhannya atau tidak ada jawapan langsung serta tidak memperoleh skor.
c) Hubungan tahap penyelesaian masalah pengiraan nilai tenaga makanan dengan pencapaian pengiraan nilai tenaga makanan.

Jadual 2: Hubungan antara tahap penyelesaian pengiraan nilai tenaga makanan dengan pencapaian pengiraan nilai tenaga makanan

<table>
<thead>
<tr>
<th>Tahap Penyelesaian Masalah Pengiraan Nilai Tenaga Makanan</th>
<th>Pencapaian Pengiraan Nilai Tenaga Makanan</th>
<th>Coefficient of Determination (r²)</th>
<th>Peratusan (P)</th>
<th>Tafsiran</th>
</tr>
</thead>
<tbody>
<tr>
<td>Procedur Mengenal pasti Masalah</td>
<td>0.249**</td>
<td>0.062</td>
<td>6.2%</td>
<td>Kecil</td>
</tr>
<tr>
<td>Procedur Merancang Strategi Penyelesaian Masalah</td>
<td>0.285**</td>
<td>0.081</td>
<td>8.1%</td>
<td>Kecil</td>
</tr>
<tr>
<td>Procedur Melaksanakan Jawapan Penyelesaian Masalah</td>
<td>0.701**</td>
<td>0.491</td>
<td>49.1%</td>
<td>Kuat</td>
</tr>
<tr>
<td>Procedur Menyemak dan Menulis Jawapan Penyelesaian Masalah</td>
<td>0.903**</td>
<td>0.815</td>
<td>81.5%</td>
<td>Kuat</td>
</tr>
</tbody>
</table>

**Signifikan pada aras 0.01 (2-tailed)

Hasil kajian mendapati prosedur menyemak dan menulis jawapan penyelesaian masalah merupakan tahap penyelesaian masalah yang mempunyai hubungan yang kuat dengan pencapaian pengiraan nilai tenaga makanan (r = 0.903**, p < 0.01). Ini diikuti dengan prosedur melaksanakan jawapan penyelesaian masalah (r = 0.701**, p < 0.01). Dapat dikesan hubungan antara prosedur menyemak dan menulis jawapan penyelesaian masalah menyumbang sebanyak 81.5% dan sangat berperanan dalam menentukan pencapaian pengiraan nilai tenaga makanan murid SRT.

Justeru, bagi memastikan murid SRT memperolehi pencapaian yang cemerlang dalam topik pengiraan nilai tenaga makanan ini, mereka perlu belajar untuk merancang dan menulis jawapan penyelesaian masalah yang benar dan tepat serta dapat memenuhi dan memperbolehkan pencapaian nilai penyelesaian dalam kalangan murid SRT.

5. Maklumat Tambahan
a) Potensi pengkomesiaan

b) Anugerah diterima
Rubrik Penyelesaian Masalah Pengiraan Nilai Tenaga Makanan telah berjaya memperoleh Akuan Berkanun (Statutory Declaration) daripada Bahagian Perlindungan Harta Intelek, Universiti Putra Malaysia pada 20 May 2011.

Penghargaan

Ekonomi Rumah Tangga”

Rujukan


Teaching Graduate Success Attribute (UHAK 1012) By Using Service Learning Approach

Marlina Ali
School of Education, Faculty of Social Science and Humanities, Universiti Teknologi Malaysia
p-marlina@utm.my

Corrienna Abdul Talib
School of Education, Faculty of Social Science and Humanities, Universiti Teknologi Malaysia
corrienna@utm.my

Norulhuda Ismail
School of Education, Faculty of Social Science and Humanities, Universiti Teknologi Malaysia
p-norulhuda@utm.my

Sharifah Osman
School of Education, Faculty of Social Science and Humanities, Universiti Teknologi Malaysia
sharifah.o@utm.my

Normazira Suhairom
School of Education, Faculty of Social Science and Humanities, Universiti Teknologi Malaysia
p-nazira@utm.my

Yuliana Sirkam
Sultan Ismail Library
yuliesz@yahoo.com.my

Highlights
It is compulsory for undergraduate students in UTM, especially in Year one, to take a 2 credit course named as Graduate Success Attribute or in short called UHAK 1012. This course aims to serve the need of the students to understand and apply the attribute of UTM graduate skills. The course guides students in developing basic skills which consist of communication, thinking, scholarship, teamwork & leadership, adaptability, global citizenship and enterprising skills. This course also prepares them to face the real challenging world. In this course, students will be assessed through various class activities such as individual case study and group project. For group project, they collaborated with Majlis Bandaraya Johor Bahru to organize a program for B40 group called “Prihatin Bandaraya”. The program aims to develop their basic skills such as communication skills, thinking skills, teamworking, leadership skills as well as global citizenship. By involving in the project helps students polish their soft skills as well as giving them experience to serve the communities. The module of running Prihatin Bandaraya project has opportunities to be commercialised in future.

Key words: service learning; Prihatin Bandaraya; graduate success attribute

Introduction
Unemployment refers to a phenomenon where people who are willing and capable of working are unable to find suitable paid work (Emeh, Nwanguma, & Abaroh, 2012). In 2016, 54103 out of 238187 graduates were unemployed which is 22.7% of the total number of graduates, while in 2017, 53373 out of 255099 graduates were unemployed which is 20.9% of the total number of graduates (Ministry of Higher Education Malaysia, 2018). In other words, on average of 1 out of 5 graduates remain unemployed. JobStreet Corporation Berhad (2018) released a report based on a survey of employer’s perception towards the standards of fresh graduates in today’s job marketplace. Apart from asking unrealistic salary, the other reasons includes graduates having poor character, attitude or personality, graduates with poor command of the English language and lack in communication skills.

University qualifications will not be the only factor taken into consideration when it comes to employment and it may no longer suffice in the world today. Ismail (2011) has found that the chance of being employed rose with an
increase in English proficiency as well as significant personality variables such as leadership and technical skills such as analytical thinking, intelligence, independent, communication skills, computer skills and possessing work experience. Graduates should be urged to not only focus on academics but also acknowledge that both hard skills and soft skills are crucial and they should not be afraid to expand their horizons.

Methodology

Teaching Graduate Success Attribute (UHAK 1012) uses New Academia Learning Innovation (NALI) approach which is service learning. Service learning is a teaching and learning methodology which nurtures civic responsibility and applies classroom learning through meaningful service to the community. It also integrates community service projects with academic studies to enrich learning, teach civic responsibility, and strengthens the communities in which we live and work. Service learning integrates academic theory with practical real-life experience, provides students with a broader and deeper understanding of the course content, fosters their sense of civic engagement, and enhances their insights about themselves and their place in the community. Prihatin Bandaraya provides a platform to work with B40 group at Flat Pinang 3 Taman Daya and Flat Akasia, Zon Desa Cemerlang.

Findings and discussions

The program was held in February and March 2019. In order to organise and manage the program, students carried out several meeting in their class. The purpose of the meeting were to discuss and plan the activities. In their meeting, students discussed and appointed task for every students. This was handled by the director of the program. The lecturer was also present in the meeting but acted as advisor and to monitor the discussion. The lecturer observed students’ leadership skills from the start of the meeting until the program ended by using a rubric. There were seven criteria in observing the students which carry 20% from overall of their score. The following is the Quality Leadership rubric.

<table>
<thead>
<tr>
<th>Level / Criteri a</th>
<th>Unacceptable performance</th>
<th>Acceptable performance</th>
<th>Successful performance</th>
<th>Distinguished performance</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responsibility</td>
<td>Has poor attendance, consistently tardy, and rarely participate.</td>
<td>Demonstrates average attendance, occasionally arrives late, and minimally participates.</td>
<td>Demonstrates adequate attendance, arrives on time and adequate participation.</td>
<td>Demonstrates perfect attendance, always on time or early and exceptional participation.</td>
<td></td>
</tr>
<tr>
<td>Respect</td>
<td>Is not respectful of others or differences.</td>
<td>Demonstrates developing understanding of respect in an educational environment.</td>
<td>Demonstrates ability to respectfully interact with all team members. Accepts feedback and follow directions.</td>
<td>Demonstrates sensitivity, honesty, ethical consideration, and respect for the culture/language/gender.</td>
<td></td>
</tr>
<tr>
<td>Reliability</td>
<td>Frequently skip tasks / misses the deadlines.</td>
<td>Occasionally skip tasks or misses the deadlines.</td>
<td>Work is submitted on time. Student can be relied on to follow through with tasks.</td>
<td>Quality work is submitted and/or provided on time. Keeps accurate records of field experience requirements.</td>
<td></td>
</tr>
<tr>
<td>Professionalism</td>
<td>Does not wear proper attire</td>
<td>Seldom wears proper attire/seldom</td>
<td>Wears proper attire and displays</td>
<td>Always wears proper attire and displays</td>
<td></td>
</tr>
</tbody>
</table>
This “Pihatin Bandaraya” program has benefited students in many ways. Apart from achieving the primary objectives, it has also encouraged volunteerism, leadership growth among the undergraduate students. Students contributed their time, energy and resources in this program. Students were also required to support each other in ensuring that unresolved problems were looked into as a group. The students were 100% committed and many went out of their way to ensure the program run smoothly.

Acknowledgments (if any)

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References


STEM interest-infusion program to promote graduate success attributes

Marlina Ali
School of Education, Faculty of Social Science and Humanities, Universiti Teknologi Malaysia
p-marlina@utm.my

Corrienna Abdul Talib
School of Education, Faculty of Social Science and Humanities, Universiti Teknologi Malaysia
corienna@utm.my

Norulhuda Ismail
School of Education, Faculty of Social Science and Humanities, Universiti Teknologi Malaysia
p-norulhuda@utm.my

Hanifah Jambari
School of Education, Faculty of Social Science and Humanities, Universiti Teknologi Malaysia
Hanifah-j@utm.my

Nornazira Suhairom
School of Education, Faculty of Social Science and Humanities, Universiti Teknologi Malaysia
p-nazira@utm.my

Nurbiha A. Shukor
School of Education, Faculty of Social Science and Humanities, Universiti Teknologi Malaysia
nurbiha@utm.my

Highlights:

Unemployment currently being a serious global issue among all group of individuals from senior citizens to fresh graduates and it goes to both male and female as well. Malaysia is one of the country which has faced high rate of unemployment issues for several times in last couple of years. Graduates should be urged to not only focus on academics but also acknowledging that both hard skills and soft skills are crucial and they should not be afraid to expand their horizons. Service learning is a teaching and learning methodology which nurtures civic responsibility and applies classroom learning through meaningful service to the community. It also integrates community service projects with academic studies to enrich learning, teach civic responsibility, and strengthens the communities in which we live and work. Service learning integrates academic theory with practical real-life experience, provides students with a broader and deeper understanding of the course content, fosters their sense of civic engagement, and enhances their insights about themselves and their place in the community. STEAM ignition-interest program organised by Faculty of Social Science and Humanities provide a platform for undergraduate as well as postgraduate all over the faculties in UTM to develop their basic skills such as communication skills, thinking skills, teamworking, leadership skills as well as global citizenship. By involving in the project helps students polish their soft skills as well as giving them experience to serve the communities. As a conclusion, STEAM ignition-interest has benefited in many ways. Apart from achieving the primary objectives, it has also encouraged volunteerism, teamworking, thinking skills and leadership growth among the students. Students contributed their time, energy and resources in this program. The students were 100% committed and many went out of their way to ensure the program run smoothly.

Key words: service learning; Prihatin Bandaraya; graduate success attribute
Harnessing Cooperative Learning Environment in Digital Electronic Course

Nurul Mu’azzah Abdul Latiff
School of Electrical Engineering, Faculty of Engineering, Universiti Teknologi Malaysia
nurulmuazzah@utm.my

Rashidah Arsat
School of Electrical Engineering, Faculty of Engineering, Universiti Teknologi Malaysia
rashidaharsat@utm.my

Leow Pei Ling
School of Electrical Engineering, Faculty of Engineering, Universiti Teknologi Malaysia
leowpl@utm.my

Nurzal Effiyana Ghazali
School of Electrical Engineering, Faculty of Engineering, Universiti Teknologi Malaysia
nurzal@utm.my

Highlights:
Recent advances in educational research and studies have shown that the traditional passive learning environment is no longer suitable to prepare students for 21st century skills. Due to the rapid development in technology, the engineering classroom is experiencing a pedagogical shift towards a more active and cooperative learning to stimulate a deeper learning experience. In this study, we present an implementation of cooperative learning in Digital Electronics course for certain topics. In particular, we highlight the findings from this implementation in two sub-topics based on certain course learning outcomes. Based on the survey conducted and reflective reports from students, the activities conducted are able to create a more meaningful learning experience and enhance their engagement during the class. In addition, students also appreciate the hands-on activity and found the group project is beneficial to increase their knowledge on this course.

Key words: cooperative learning; digital electronics;

Introduction
Digital Electronics is one of the fundamental courses offered to all first-year undergraduate students undertaking engineering programs in the School of Electrical Engineering, Universiti Teknologi Malaysia (UTM). This course serves as a pre-requisite subject for other advanced courses that will be taught in second and third year of the Electronic Engineering program. The teaching of this course is quite challenging due to its fundamental to practical translational nature, hence it is vital to engage students in the learning process to ensure effective course content delivery. In addition, new academia learning innovative (NALI) approach needs to be incorporated into the classroom instruction in the 21st century in order to prepare the University for Future Ready Curriculum. Leveraging an open and online platform provided by UTM can also create a more meaningful and immersive experiential learning for students in which it can accelerate the university’s effort to achieve ‘envision UTM2025’ that projects UTM as the University of The Future (Mohammad, S., Hamzah, M. and A. Samah, 2018).

In cooperative learning, people work together in a team to accomplish a common goal where all members must have positive interdependence and each member is accountable for the complete final outcome (Johnson, Johnson and Smith, 2006). This paper highlights the implementation of cooperative learning strategy in the Digital Electronics course based on the outlined course learning outcomes. Table I lists the course learning outcomes in this course. Since the knowledge of logic gates is essential in all learning outcomes listed, the cooperative learning activities implemented during the lecture were centered on this topic.
Table 1: Course learning outcomes (CLO) in Digital Electronics course

<table>
<thead>
<tr>
<th>Course Learning Outcomes (CLO)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CLO1</td>
<td>Apply the basic digital signal concept, various number systems, codes, logic gates and basic digital circuit’s concepts.</td>
</tr>
<tr>
<td>CLO2</td>
<td>Demonstrate number systems conversion, formulate logic circuit simplification and identify or construct logic digital circuit using gates and MSI circuits (both sequential and combinational).</td>
</tr>
<tr>
<td>CLO3</td>
<td>Combinational and sequential MSI (medium scaled integrated) circuits design solutions for complex digital systems.</td>
</tr>
</tbody>
</table>

Methodology

The specific approaches that we used are formal cooperative learning such as jigsaw method and group project. There were 32 students in the class and these students were grouped together based on the results of their personality test. Prior to forming the group, students were asked to answer an online survey to determine their personality type. Students were also requested to report their personality test results via E-learning platform provided by UTM. There are 4 types of personality which are analysts, diplomats, sentinels and explorers, and the description of each type can be found via the link given (NERIS Analytics Limited, 2019). Several groups of students were then formed based on their personality type, in addition to the factors such as gender and ethnicity which were also considered during the grouping process.

A. Jigsaw and Gallery Walk

Prior to formal cooperative learning activities, several informal cooperative learning activities were conducted in the class to develop a sense of team cohesion among the students. The first formal cooperative learning activity held in the class is jigsaw method and gallery walk (Aronson, 1978). There are 3 important parts in this approach which are home team discussion, expert team discussion and gallery walk. The following explains the steps involve in all these parts:

Step 1: Students are instructed to sit together in their home team which consisted of 6 students in 4 different groups.

Step 2: Each member in this home team is given different topic to study. The topics are based on different type of logic gates which are OR gate, NOR gate, XOR gate, NAND gate, AND gate, and XNOR gate.

Step 3: Students from different home team sat together in the expert team according to the topic given. They are required to discuss and study the topic together, and come up with prepared notes on a mahjong paper for the presentation. These mahjong papers are put on the wall around the class for gallery walk activity.

Step 4: All students are asked to sit back in their home team. Then each home team took turn to walk around the class to listen to the presentation given by their members. Every student in the home team is responsible to teach others in his/her team the topic that he/she has been assigned to.

At the end of this activity, students were asked to fill a short online survey form and give their feedback about this activity.

B. Group Project

Group project is assigned to all students in this class in order to assess CLO3 which is related to program learning outcomes 5 (PLO5). It requires students to design combinational and sequential MSI circuits for complex digital systems. In this project, each group were required to identify a problem and design a solution using digital electronics circuits based on the theme ‘Smart City’. To guide the students to complete their project, students were assigned several tasks according to the milestones as shown in Table 2. The online platform E-Portfolio provided by UTM is exploited for the students to upload their reflection and report on the project management. In addition to that, students must also prepare a video of full working project, and demonstrate their circuits in the class.
Table 2: Activities and E-Portfolio Instruction

<table>
<thead>
<tr>
<th>Activities/Milestones</th>
<th>E-Portfolio Instruction</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brainstorm – Project’s idea and task distribution</td>
<td>All members must setup their E-Portfolio Page and join E-Portfolio Group: PROJECT SKEE1223 (DrNMAL) 18192</td>
<td>1 week</td>
</tr>
<tr>
<td>Circuit design, Quartus simulation and hardware development</td>
<td>Reflection 1 on E-Portfolio by using PAGES (individual) and Group Leader needs to make Collection for Reflection 1 by Group.</td>
<td>3 weeks</td>
</tr>
</tbody>
</table>
| Video of full working project (1-minute or less) | • Reflection 2: Reflection on overall project working experience and Project Management.  
• Report: One A4 page Project Report/Profile/Infographic | 1 week   |

Results and Discussion

Figure 1 depicts the in-class situation during the jigsaw gallery walk activities. Students were encouraged to jot down important points and ask questions during the presentation. Based on the survey conducted, most of the students showed positive attitudes toward this learning method and able to grasp the fundamental concept in the discussed topics. Some of their comments are:

“This activity is fun and all the parts are understandable.”

“It is quite interesting and creative. I do understand a bit about the XOR gate and XNOR gate but it’s just a bit confusing than the other gates. Overall the activity is good.”

“A very good experience to me because if i want to the “expert” i have to make sure i really understand the topic first.”

“It was a great activity what I liked about the most is how students interacted with each other. ”

“In my opinion for gallery walk activities, make students socialize with friends and share knowledge to friends. The material in the form of posters is very good so it looks interesting and exciting to study together.”

“It was a fun and quick way to learn the subject matter. Looking forward to more of similar activities.”

Only one student commented that he/she needs lecturer to explain again the concept in the class to further understand the topics.

Figure 1. The in-class situation during jigsaw and gallery walk activities.

Figure 2 shows an example of E-Portfolio reflection report from one of the students. As it is shown in the figure, this student reported the process of accomplishing the project and his engagement from his personal point of view. Most of the students also gave good reflection report which includes the step by step process to complete the project, time management, as well as cost incurs in the project. Nevertheless, there were also few students who wrote very simple reflection in which it reflects their engagement in the group project. Overall, this activity allows students to gain experience in project management which would be useful for them in their final year project.
Reflective Report - NG JIA SHENG

In summary, the cooperative learning platform harnessed in the Digital Electronics course have created a more fun and enjoyment in students' learning process. Although there are some challenges faced by the lecturer during the implementation such as students' attendance and passive students, positive feedbacks received from the students have demonstrated that these activities are able to boost their motivation and enhance their attention in the class. Final outcomes from the assessment have also shown positive effect from the cooperative learning environment where the key performance indicator for all course learning outcomes are achieved. Ultimately, this study shows that an innovative classroom pedagogy, facilitated by online platform technology can make a difference in the students’ learning experience.

References


Empowering Students through High Impact Educational Practice: Impact and Future Prospect

Muhammad Abd Hadi Bunyamin
Universiti Teknologi Malaysia
mabhadi@utm.my

Nina Diana Nawi
Universiti Teknologi Malaysia
ninadiana@utm.my

Highlights:
Research skills are crucial for graduate students because they will need to carry out master's projects at the end of their master's studies. Yet, they often get insufficient opportunity to gain empirical research skills in graduate courses. This study aims to determine the impact of providing students with an opportunity to design innovative physics curricula using research skills learned in the graduate course of Design and Implementation of Physics Curriculum. All students mentioned that they have gained the fundamental skills in conducting an empirical research in order to produce an innovative curriculum of physics. Implications to future courses are discussed.

Key words: Empirical research; research skills; innovative physics curriculum

Introduction (Project or Innovation)
Research skills are critical for graduate students because they will need to conduct a master's project at the end of their studies. Yet, they often get insufficient opportunity to gain empirical research skills in graduate courses.

In the course of Design and Implementation of Physics Curriculum, students were required to design an innovative curriculum of physics as the major product of the course. However, the ways they came up with the curriculum must be research-based. The lecturers have taught students how to carry out empirical research by teaching them content analysis, making observations, and interviewing.

From week to week, students had to report their current progress to the whole class. They must share their current work such as collecting data and analysis of the data. Any problems and challenges were solved during the class to provide students with immediate solutions by discussion between students and the lecturers.

This empirical research project had never been implemented in the previous academic year in the course. In the past years, students were just asked to conduct reviews of foreign curricula of physics such as in the Hong Kong and Singapore. The lecturers decided to change the review-type of research to empirical-type to provide students with opportunities to learn how to conduct actual research.

This empirical research project might be beneficial to students because they could gain the necessary skills in conducting research in real settings. This would help them to carry out studies for their master's projects.

To verify either students really gained the research skills or not, a survey was conducted. All four students in the course participated in the survey. Written feedback was provided to the lecturers to determine the impact of the research projects to the students.

Content (Project or Innovation)
The innovative physics curriculum project aims to provide students with research skills needed to develop a new physics curriculum that has innovation values such as the inclusion of the culture of a society into a physics curriculum. The implemented New Academia Learning Innovation (NALI) approach was the High Impact Educational Practices (HIEPs), particularly Empirical Research (ER). Students were paired with peers and did the research project as a team. Then, the lecturers taught them research skills such as making content analysis, making observations, and conducting interviews. They were provided with in-class activities such as interviewing their friends about an academic topic during the class. After that, from a week to another, all teams were required to present their current progress to the class. They also needed to address any challenges in doing the research project. For example, one group mentioned that they had a problem with getting a sufficient number of research participants. They discussed with the lecturers and friends to solve the problem. The practical solution was for them to ask their contact who are teachers to suggest other teachers who wanted to participate in the research project. The solution was practical and students managed to secure a suitable number of
participants.

At the end of the semester, all teams presented their research work with the whole class. They shared their work by talking about their steps in solving challenges such as getting not in-depth answers and how they re-interviewed the same research participant to gain more data. The innovative physics curricula were produced based on the research work. They presented the innovative curriculum that had the features of daily applications such as cooking that applies that concept of heat.

The following paragraph states the written feedback of the students regarding the empirical research project.

Aisha: This project helped me to improve how to analyse the data, especially in doing thematic analysis. You (the lecturers) guided us (me and my friend) on how to do it – to generate codes, themes, and so on. It’s really helpful for me to use this skill in my research study (master’s research project). I thought that I also improved my skill in collecting the data. I need to plan properly before collecting the data. This is because without planning, I might need to re-collect the data to get the meaningful data. This project was also useful especially in understanding the process of developing a curriculum. It made me more understood the steps to develop the curriculum using the Taba’s model. If this project can be implemented to the target learners, it would be great, but I knew that it needed a longer time and extra work for it.

Sasha: Through the project, it helped me to improve a little bit my critical thinking in solving the problem that I faced during completing the project. For example, writing the report and finding the idea of the project starting from the beginning of the semester. In terms of collecting data, I am not exposing to the real setting of interview. This is maybe due to my weakness in obtaining the subject for the project. However, in doing content analysis, I learn a lot doing the correct way. I believe the project is useful for me because the skills such as doing content analysis and collecting data by interview can be used for my research study and other research in the future.

Asmida: First, I have my first interviewing experience. It gave me a good experience which might help me in interviewing people in my next research. It might not be perfect yet and might be lacking in some areas but, for a novice researcher, I believe this was a good experience in giving a good skill. Next, I also have to work in team for this research project. The differences in opinion and working styles also making it hard at first, but it also gave me a good opportunity to work better with others and accepting the differences, difficulties and hardship in doing a research. It might help me in gaining the data through interviews and survey while interacting with the people later on. I believe this research project was beneficial and useful for me as I was lacking in research skills. So, through this research project, I learnt on how to be a better researcher. I also have made some mistakes while doing the research project, such as we should not rely on just one source of data. So, I learnt better that way, and will do better in my next research. It gave me a good practice for my next research study that I will be taking in the next semester.

Khadija: The research project helped me to know same basic points about research like how to select the topic and how to analyse the answers. The other point was the interview with people. I learned doing the interview with people and got information from their answers. It was very useful when I worked on that project because now I can make curriculum by models.

Based on the feedback given to the lecturers, it is clear that students have learned doing the empirical research by designing an innovative physics curriculum. They have gained the fundamental research skills such as knowing how to conduct interviews and to analyse the data using thematic analysis method. Many of them believe that the research skills gained from this project are useful for their master’s project, the research project that is required for them to conduct in two semesters.

For one of them, like Sasha, she believed that her critical thinking skill was improved when conducting the research project. Others such as Asmida admitted that she lacked in research skills, so that this project helped her to gain the necessary skills for doing research.

On the other hand, some of the students also stated that they had no opportunity to implement the curriculum that they developed because it was not the learning objective of the courses for students to execute the curriculum in the real setting, such as using the curriculum that they developed for teaching at schools.

Empirical research (ER) is one of high impact educational practices (HIEPs) in higher education (Kuh, 2008; Mohd Ismail et al., 2016). Students in this course have gained valuable research experience in developing an innovative physics curriculum and have become more engaged in their learning (Association of America Colleges & Universities, 2014).

The future course needs to look into the possibility of extending the time specially for executing the developed curriculum in the actual place, such as in schools. Even though the current learning objective does not mention about the implementation of the curriculum developed, the lecturers could assist students to get users of the curriculum. This may broaden the prospect of commercialising the research product among stakeholders, such as to school teachers. Protection of research products is needed to ensure they are not used by others without permissions.
Another suggestion is for students to be involved in any suitable exhibition or competition so that they can promote the product of their project to the public and stakeholders. Benefiting the product for the society is critical for students to feel honoured with the efforts given to complete the project. This measure may alter their mindset from merely completing the project for their master’s study to benefiting the society from the research product. In conclusion, this ER project has provided meaningful experience to students to prepare them to become competent researchers.

Acknowledgement

We are grateful for the assistance provided by the students who provide written feedback for the research project. Without the information, we are unable to determine the impact of the project.

References


Ideation of Capstone Project using Coggle Mind Map Application to Enhance School’s Library Service

Rashidah Arsat
Communication Engineering Division
School of Electrical Engineering, UTM Johor Bahru
rashidaharsat@utm.my

Ahmad Firdauz Abdullah Tahrin
Sekolah Kebangsaan Pekan Nanas,
Pekan Nanas, Pontian, Johor
firdauz_abdullah@yahoo.com

Suraiti Md. Yusop
Sekolah Kebangsaan Pekan Nanas,
Pekan Nanas, Pontian, Johor

Nurzal Effiyana Ghazali
Communication Engineering Division
School of Electrical Engineering, UTM Johor Bahru
nurzal@utm.my

Nurul Mu’azzah Abdul Latiff
Communication Engineering Division
School of Electrical Engineering, UTM Johor Bahru
nurulmuazzah@utm.my

Mahyuddin Arsat
School of Education, Faculty of Social Science and Humanities, UTM Johor Bahru
mahyuddin@utm.my

Capstone Project was introduced as the laboratory course for all 4th year students of School of Electrical Engineering. For Communication Engineering Division, School of Electrical Engineering, Capstone Project was conducted by integrating service learning for local community: Mukim Jeram Batu/Pengkalan Raja.

In this lab, students were divided into five themes and one of the themes was Smart Education. Students under Smart Education theme will conduct their interview in Sekolah Kebangsaan Pekan Nanas (SKPN). The students’ of Communication Engineering Division are also required to utilize design thinking and ideation approaches in solving an open-ended problem from SKPN. The project provides opportunity for the students to systematically demonstrate their problem-solving skills - with all the knowledge obtained during the study - to solve a real community problem.

Capstone Project was divided into two phases (refer to Figure 1). In phase 1, after conducting survey in SKPN, the data were clustered and brainstormed together using Coggle mind map application.
Coggle mind map which serves to record the result of the ideas generated during the brainstorming process in conceiving, replacing the use of sticky notes. Its purpose is to save cost, therefore the needs of using the cost for sticky notes can be used for other purposes. At the same time, it eases everybody to refer to the clustered data anywhere, anytime. Figure 2 shows the mind map from one of the smart education theme group. The group decided to improve the school’s library system.

A library is a place to cultivate a culture that promotes wider reading, motivated reader and learners for life. In the era of digital technology, the development of a library should align with current technology, especially if it is serves young generation of Gen Z. Primary school such as SKPN still using traditional method where librarian is required to catalogues every new book manually. Therefore the aim of this project is to improve library system of the school by using barcode technology. Barcode technology is viewed as a system that able to improve in management control and information updating. Although this technology is commonly used in library’s circulation counter, the system is quite expensive for a small scale user. In this project, the developed system includes school’s library database, returning and borrowing system. Figure 3 shows the general architecture of the developed SKPN’s library system. Database is important element in a library system. For this system, four elements of database are created using the combination of Microsoft Access and Visual Basic. The four elements are identified as Book, Member, Borrow and Return. Then to fulfill additional needs of the primary school for their library system, the system includes NILAM and cataloguing report. NILAM Program is a program that to inculcate reading habit in young generation. In current practices, marks are given manually based on the type of book and number of pages. This developed system is set to calculate the system automatically based on the borrowing record. Final feature that is also added in the system is able to generate statistical data for each class. This data will definitely help the teachers to identify reading behaviour of their students.
Effectiveness of Problem-based learning on the Principles of Structure Course for Quantity Surveying and Construction Students

Nurshikin Mohamad Shukery
Universiti Teknologi Malaysia
b-nurshikin@utm.my

Fuziah Ismail
Universiti Teknologi Malaysia
b-fuziah@utm.my

Highlights:

Students are divided into groups and required to propose the best popsicle bridge model to solve the problem given by the lecturer. The PBL approach was analysed to determine: (a) students’ ability to identify the problem (b) design a simple structural element that solving the problems, and (c) the capability of students to apply the concepts of structural mechanics to solve structural problems. Through group discussion, PBL provides additional opportunities for students to work collaboratively and practice communication and social skills. Student discuss their ideas and challenge each other in a constructive manner, giving participatory learners an avenue to excel.

Key words: Problem based learning; principles of structure; structural design

Introduction (Project or Innovation)

The problem-based learning (PBL) have stated that its approach helps students develop effective and efficient problem-solving skills. Very little is known about the use of PBL during the first years of the undergraduate Quantity Surveying and Construction course and how it influences further acquisition of basic principles of structure knowledge. For Quantity Surveyor and Construction student it is very important for them to understand the principles of structure and to be able to design a simple structure such as beam, column and slab. The basic understanding of the principles of structure is for students to appreciate the building structure in order to help them in measurement and construction process. The capability to understand the principles of structure of Quantity Surveying and Construction students whom are not from the engineering background are very low. Therefore, a new innovative approach has been adapted to promote the development of critical thinking skills, problem-solving abilities, and communication skills. It can also provide opportunities for working in groups, finding and evaluating research materials, and life-long learning (Duch et al, 2001). The PBL approach was analysed to determine: (a) students’ ability to identify the problem (b) design a simple structural element that solving the problems, and (c) the capability of students to apply the concepts of structural mechanics to solve structural problems.

Content (Project or Innovation)

The objective of this project is to encourage an appreciation of the structure of buildings and develop concepts of structural action, leading to an ability to model, analyse and design common elements and structural frames. The focus of this course is on understanding the forces in structures and the behaviour of some structural materials. Class are divided into group of 4-5 members and each of the group are given a problem related to bridge structure. The problem required students to design a bridge by using popsicles and to address several conditions such type of bridge model, bridge span, weight of the bridge and finally load test. This class has 2 credit which is 2 hours class. During the first hour, the students will learn all the theories and calculations of basic principles structure according to syllabus. The second hour, the students will sit with their own group as the group discussion will begin. During this session, they will discuss on the design concept until how to solve the problem. This session supervised by the lecturer. When students are involved in creative processes aiming at implementable outcomes, they act as dynamic and active agents with their individual experiences and competences (Eteläpelto et al., 2013).

Students is given 10 weeks to complete the bridge design. Students need to present their idea and giving justification on their bridge design and concept. Very often, the presenting teams delivered their presentations in an earnest yet humorous manner, which the other students responded with critical and challenging questions. The lecturer would, at appropriate times, draw the students’ attention to key issues which were brought up in the midst of discussions, or encouraged further elaboration of ideas that were explored. This interactive process of engagement allowed the students to better appreciate the key learning objectives of the lesson; at times, it led to unexpected but desirable learning outcomes (San Tan and Ng, 2006). Then, the experiment will be carried out by implied a certain amount of load on the popsicles bridge. Structural analysis needs to be done after the experiment prior before handling the full report. This approach creates creativity, innovation and new product development processes are intimately correlated. An “innovation journey” is undertaken when inventing, developing, and implementing new products, programs, services or other new concrete solutions (Cheng and Van de Ven, 1996). It is an exploration into
the unknown by which novelty emerges.

Due to the emphasis on the learning experience, this project took a thematic coding to analyse open-ended question on students’ experience and opinion on the PBL for principles of structures. The data has been collected from 37 students who participated in the survey, which is 55% from the total number of students. This project has identified 3 codes; 1) enjoy/fun/happy; 2) great/good/interesting; and 3) new knowledge/learn new thing. The finding shows that 45% of the students feel that this learning method has developed their new knowledge on principles of structure, and 32.5% of students feel happy and enjoy this learning method, while 22.5% of the students feel that this method of learning is great, good and interesting. The overall feedback from the students show the positive views toward the implementation of PBL in learning principles of structures. Figure 1 shows the feedback from Quantity Surveying and Construction students.

![Figure 1: Feedback on PBL method in learning Principles of Structure](image)

This PBL method of learning principles of structure by designing a bridge may have a good commercialization potential. The PBL method of learning principles of structure by designing a bridge has a potential to be extended to a competition level apart from just an in-class project. People could take an advantage to participate in the popsicles bridge competition. Furthermore, every design developed by the students can be registered as design patent for a project. Which, it adopted a real problem-solving technique and method that may have some value for certain people in the industries.

**Acknowledgement (if any)**

We are grateful for the opportunity to adopt the PBL method for Principles of Structures course. We thank our Quantity Surveying and Construction students who provided insight/feedbacks and greatly participated in the project.

**References**


Be Right Kit (B √ Kit): An Interactive Learning Aid in Teaching and Learning of Magnetism

Syazana Binti Abd Khalik
Kolej Matrikulasi Kejuruteraan Johor
syazana@kmkj.matrik.edu.my

Siti Noorehan Binti Mon
Kolej Matrikulasi Kejuruteraan Johor
noorehan@kmkj.matrik.edu.my

Eady Eswaddy Bin Che Yahya
Kolej Matrikulasi Kejuruteraan Johor
eady@kmkj.matrik.edu.my

Mohd Rizal Bin Mohamed @ Mohd Badri
Kolej Matrikulasi Kejuruteraan Johor
rizal@kmkj.matrik.edu.my

The Be Right Kit (B √ Kit) is invented to improve students’ skills in solving problems related to magnetism specifically in the subtopics magnetic field produced by current-carrying conductor and magnetic forces between two parallel wires. This kit consists of three main features which are two simulators, models and learning cards. Initially, the B √ Kit uses a two-cylinder model and two circular disks to teach magnetic field and magnetic force in current-carrying wires. An improvement has been made to ensure this kit is a complete kit for teaching and learning of the topic magnetism. The first simulator in this kit is for the study of magnetic field pattern produced by a long straight wire and the second simulator is for magnetic field produced by a circular coil. The models consist of a magnetic rewriteable board, two cylindrical rods and an arrow. To strengthen students understanding, learning cards are provided. Teachers can creatively combine the simulators, models and learning cards according to the student’s need. The traditional method to teach Magnetic Field and Force is by drawing the diagrams on the whiteboard and using the Right Hand Grip Rule or Flemming’s Left Hand Rule. With the B √ Kit, teachers can easily engage students to learn this topic and cater for students who are visual and kinaesthetic learners. This kit is portable and also provides an interactive learning experience.

Key words: Be Right Kit; Magnetism; Simulators, Model, Learning Cards

Introduction (Project or Innovation)

Magnetism is the 4th topic in the Matriculation Curriculum Specification for the Physics subject (EP025). In this chapter, students will learn the subtopics related to the magnetic field caused by the current carrying conductor and magnetic force between two parallel wires. Basically, the concept of this magnetic field has been learned by students in their physics lesson during high school. However, there are many students who are unable to master this topic in the second semester because of difficulties in understanding its abstract concepts.

The study conducted by Guisasola, Almudi, & Ceberio (1999) found that most students failed to identify the source of the magnetic field and there was confusion between the magnetic field and the magnetic force. This statement is also supported by Saarelainen M et. al. (2007) and Mauk HV et. al. (2005). They have revealed that students often face difficulties in Magnetism, especially in explaining the concept of magnetic fields and magnetic force. Therefore, a “Be Right Kit (B √ Kit)” which is a set of learning kit has been created to give students knowledge as well as enhancing their understanding in magnetism especially in magnetic field caused by current-carrying conductor and magnetic force between two parallel wires.

Product Features

The “Be Right Kit (B √ Kit)” consist of three main features: simulators, models and learning cards. Each feature tackles different components of Teaching and Learning of Magnetic Field. These features can be combined to provide better teaching and learning experiences of Magnetic Field.

The original idea of the B √ Kit was to use a model of two cylinders and two circular disks to teach magnetic field and magnetic force in current carrying wires. We find that there are still students struggling with the concept and thus, decided to create a simulator.
Figure 1: Students use the B√ Kit in their group with the lecturer as facilitator.

Instead of making one simulator, we came up with two simulators to be used diligently by both teachers and students. The first simulator is for magnetic field arising from a long straight wire and another for circular coil. The key to understanding Magnetic Field is to help students imagine the magnetic field. When students fail to imagine the magnetic field, the topic becomes difficult. This is frustrating for both student and teacher.

In order to assist students to imagine the magnetic field, a practical or hands on experience is necessary. The simulator that we have developed can be turned on and students can see the magnetic field pattern. Once these students are able to understand the magnetic field due to the current-carrying wire, teachers can move to the next simulator (depending on syllabus) which is the magnetic field for a circular coil. When students understand the magnetic field arising from these two simulators, teachers can move to the model feature of this Kit.

The model consists of a magnetic rewriteable board, two cylindrical rods and an arrow. Teachers and students can explore the concept of magnetic field and magnetic force from two current-carrying wires. To strengthen students understanding, learning cards can be combined with both simulators and models. Conceptual questions are included in the learning cards and teachers can creatively combine the simulators, models and learning cards according to their students need.

Objectives

By using the B√ Kit, students should be able to:

i. identify the direction of magnetic field produced by the straight wire
ii. identify the direction of magnetic field produced by circular coil
iii. draw magnetic field direction correctly
iv. determine the direction of magnetic field for straight wire
v. determine the direction of resultant magnetic field between 2 parallel wires
vi. determine the direction of forces between 2 parallel wires
vii. answer reinforcement questions given in the learning card

Methodology

The flow chart below shows the procedure for using B√ Kit on the targeted students.

Figure 2: Flowchart of Study Procedures The students of tutor groups are divided into four small groups.

Four sets of B√ Kits are given to each group. This kit is provided along with a usage guide sheet containing steps to set up and use it correctly. After that, lecturers give a little explanation of how to use the kit and students are given
time to use the B √ Kit so that they can determine the direction of the magnetic field from various direction. The lecturers act as facilitators and at the same time, they also observed changes in students’ attitudes when the intervention method is applied.

**FINDING**

Based on these observations, it was found that students were more interactive and confident in determining the direction of the magnetic field. In addition, students can determine the direction of the magnetic field from various directions. The kit also promotes creativity among students. There are also students who have successfully used deduction techniques from using this Kit. The B √ Kit can potentially help conceptual student learning and deductive learning experience.

After students are given the opportunity to discuss and use the B √ Kit to determine the direction of the magnetic field, students are given a Post Test to determine the effectiveness of the Kit in helping students determine the direction of the magnetic field. Students respond positively by 100% agreeing that this Kit will help them better visualize the direction of the magnetic field.

**DISCUSSION**

The collected data were analysed using Statistical Package for Social Sciences (SPSS) Version 16.0. The t-test was used to determine the existence of a significant difference value of 95% confidence level or p value <0.05. Table 1 and Table 2 respectively show the comparative analysis of performance improvement based on the mean score and percentage of pre and post-test groups of the study group. The mean of pre and post-test mean respectively were 6.3333 and 10.0513 respectively, while mean of pre and post-test respectively were 16.3077% and 25.7436% respectively. Min difference scores were 3.718 and 9.4359% respectively. The value of these differences indicates that there was an improvement in performance as a result of the intervention conducted using the Be Right Kit.

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>N</th>
<th>Standard Deviation</th>
<th>Standard Error Mean</th>
<th>Mean Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre Test</td>
<td>6.3333</td>
<td>39</td>
<td>2.87762</td>
<td>.46079</td>
<td>3.718</td>
</tr>
<tr>
<td>Post Test</td>
<td>10.0513</td>
<td>39</td>
<td>3.21140</td>
<td>.51424</td>
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</tbody>
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Table 1: Mean Scores for Pre-Test and Post-Test

<table>
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<th>Standard Deviation</th>
<th>Standard Error Mean</th>
<th>Mean Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre Test</td>
<td>16.3077</td>
<td>39</td>
<td>7.44861</td>
<td>1.19273</td>
<td>9.4359</td>
</tr>
<tr>
<td>Post Test</td>
<td>25.7436</td>
<td>39</td>
<td>8.05481</td>
<td>1.28980</td>
<td></td>
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</tbody>
</table>

Table 2: Mean for Percentage Scores for Pre-Test and Post Test

A t-test analysis of the study group was performed to assess whether there was a significant increase in pre and post-test as shown in Table 3 below. T-test results revealed significant differences between pre and post test scores (M = 3.71795, SD = 3.54630, t (18) = -6.547 and p = 0.000 (p < 0.05)

<table>
<thead>
<tr>
<th>Paired Differences</th>
<th>Mean</th>
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<th>Standard Error Mean</th>
<th>95% Confidence Interval of the Difference</th>
<th>t</th>
<th>Diff</th>
<th>Sign. (2-tailed)</th>
</tr>
</thead>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Lower</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre Test - Post</td>
<td>3.717</td>
<td>--</td>
<td></td>
<td>-</td>
<td>-</td>
<td>38</td>
<td>.000</td>
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<tr>
<td>Test</td>
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<td>-</td>
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<td>2.56837</td>
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</tr>
<tr>
<td></td>
<td>463</td>
<td>6</td>
<td></td>
<td></td>
<td>3</td>
<td>6.547</td>
<td></td>
</tr>
</tbody>
</table>

Table 3: Paired T-test for Pre Test and Post Test Scores
IMPACT TO TEACHING AND LEARNING

The findings of previous studies show that students can understand better in abstract concepts if these concepts can be translated into visual form and this is supported by Lee Chiong Wee (2012) who recommended that teachers apply visual teaching and learning styles to engage students and enhance their level of understanding.

The traditional method to teach Magnetic Field and Force is by drawing the diagrams on the whiteboard and using the Right Hand Grip Rule. With the B√ Kit, teachers can creatively engage students to learn this topic. The Kit caters for students who are visual and kinaesthetic learners.

The B√ Kit is portable and can be used to demonstrate in class. It provides an interactive learning experience and is best done in small groups.

COMMERCIALISATION PROSPECT

The price for the full set of B√ Kit is still under consideration. The expected retail price will be below RM500 for the whole kit which can be used multiple times where the study of magnetic field is involved.

The potential customers are:
- Matriculation College
- Foundation Studies
- Secondary School
- Primary School

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Mapathon: Pembelajaran Berasaskan Servis kepada Komuniti

Nurul Hawani Idris, Noordyana Hassan, Noordini Che’ Man, Alvin Lau Meng Shing, Nurul Syakima Mohd Yusoff, Noorhakim Yusoff

Abstrak

Bengkel Mapathon, suatu program pembelajaran berasaskan projek komuniti telah dianjurkan hasil kerjasama strategik antara Grab Malaysia dengan program Geoinformatik, Fakulti Alam Bina dan Ukur (FABU), Universiti Teknologi Malaysia (UTM) melalui kursus Web GIS SGHG 4583. Tujuan program Mapathon adalah untuk memperkenalkan kepada pelajar satu platform berasaskan GIS, iaitu OpenStreetMap yang giat dibangunkan oleh aktiviti pemetaan komuniti di seluruh dunia. Oleh itu, program mapathon ini dijalankan sebagai salah satu aktiviti pembelajaran dan pengajaran non-konvensional untuk menguasai kemahiran psikomotor dan memupuk semangat sukarelawan di kalangan pelajar untuk bersama-sama menyumbang data setempat untuk kegunaan bersama.

Sepanjang program, peserta bertanding mendigit jaringan jalan raya dan tempat menarik atau lokasi yang menjadi kebiasaan peserta yang masih tidak direkod didalam peta OpenStreetMap. Program mapathon turut melibatkan pihak industri dalam menaja dan memberikan latihan untuk memantapkan lagi pengalaman dan kemahiran pelajar dalam prospek kerjaya program Geoinformatik.

Program pembelajaran melalui servis ini merupakan satu kategori pengajaran dan pembelajaran secara non-konvensional yang dapat memberi impak kepada pelajar melalui:

1) Sesi pembelajaran menggunakan pendekatan berasaskan permainan (gamification) dimana momentum motivasi pelajar dapat dibentuk dalam tempoh yang singkat kerana pelajar perlu menguasai kemahiran yang diperkenalkan kerana mata matlamat yang jelas iaitu ‘reward’ dipenghujung program

2) Sesi pengajaran untuk memperkenalkan pelajar kepada teknologi terkini Web GIS dapat disampaikan dengan lebih menarik dan praktikal, iaitu tidak terhad kepada nota kuliah dalam suasana dewan kuliah yang biasa.

Modul aktiviti program boleh dikomersil dalam bentuk buku versi Bahasa Melayu untuk dijadikan panduan kepada bengkel pemetaan komuniti oleh NGOs, pihak sekolah dan juga program kelab.
Teaching and Learning in Fluid Mechanics: Gamification as a Supportive Tool

Azmahani Abdul Aziz, Zainab Mohamed Yusof, Erwan Hafizzi Kasiman, Mohd Ridza Mohd Haniffah, Jamaludin Mohamad Yatim, Nur Izziati Fadzil, Nur Farahin Yanto,

School of Civil Engineering, Faculty of Engineering, Universiti Teknologi Malaysia
azmahani@utm.my, zainabyusof@utm.my, erwanhafizzi@utm.my, mridza@utm.my, jamaludin@utm.my

Mohamad Termizi Nurdin
Kolej Matrikulasi Kejuruteraan Kedah
mizikmtk@gmail.com

Highlights:
This paper describes the gamification and how it can be applied to the design of innovative tasks related to assessment in teaching Fluid Mechanics. Gamification of learning is an educational approach to motivate students to learn. The purpose of this study is to investigate the implementation of gamification tool using Snake and Ladders in learning about pressure in Fluid Mechanic course. A mixed method research methodology was carried out and involved a sample of 67 first year Civil Engineering students at School of Civil Engineering, Faculty of Engineering. The results showed the positive impact on student’s content of knowledge, skills development and motivation to learn. This study concludes that, Snake and Ladders game as learning approach creates an enjoyment and interactive atmosphere that gives positive impact on student’s understanding of the educational content and create conditions for an effective learning process.

Key words: Gamification; Pressure measurement; Skills development; Motivation

Introduction (Project or Innovation)
Gamification in education is the process of transforming typical academic components into gaming themes. Bohyun Kim (2015) defined that gamification is a powerful tool due to its ability to capture people’s attention, to engage them in a target activity, and even to influence their behavior. In the same view, Kapp (2012) also stated that gamification is “using game-based mechanics, aesthetics and game thinking to engage people, motivate action, promote learning, and solve problems”. The goal of using gamification is to maximize enjoyment and enhance learning by increasing student engagement. Studies on gamification show that the use of gamification in the classroom also increases student engagement. The more students engaged in the process of learning, the more they will internalize the learned skills.

Why educator need to be innovative and creative in conveying knowledge? According to Field et.al 2015, many students nowadays does not interested with what they have to learn. This shows that educators are facing new challenges and need to solve important issues related to the adaptation of the learning process towards students’ needs, preferences and requirements. They have to use different teaching methods and approaches that allow students to be active participants with strong motivation and engagement to their own learning. Modern pedagogical paradigms and trends in education, reinforced by the use of new approaches and techniques in order to implement active learning. The main problems in modern education are related to the lack of engagement and motivation of students to participate actively in the learning process. One possible solution is the use of game elements in the learning process.

In this study, Snake and ladder game is used as a gamification tool to evaluate students’ understanding about pressure in Fluid Mechanics course. Fluid Mechanics is one of the civil engineering courses to introduce the concept of fluid statics and kinematics, forces and flow in closed conduits, pipe network and centrifugal pumps. However, throughout the years, feedbacks from students who took this course have been complex in the sense that fluid mechanics is a very tough course [Azmahani & Ridza, 2018]. Hence, this study was conducted to investigate the implementation of gamification as an educational tool to enhance student’s understanding in Fluid Mechanics.

Project Objectives
The objective of this research is to investigate the implementation of Snake and Ladder as gamification tool in learning about Pressure in Fluid Mechanics course among first year students at School of Civil Engineering, Universiti Teknologi Malaysia. The research question for this study is, does gamification tool impact on students’ content of knowledge, motivation to learn and skills development?
Gamification as Teaching and Learning Tool

In teaching and learning, gamification can also be seen as a teaching materials that can be used to increase student’s academic. Studies had showed that gamification also increase student knowledge of the subject matter (Buckley et al., 2017). In addition, students actively engage in the learning process and have a positive attitude towards learning and thus increased student learning productivity (Shin et al., 2012). Rewarding players for their accomplishment will help push and motivated players to complete all tasks in the best possible manner. Furthermore, gamification also can be seen as one of the teaching and learning tools that can enhance and improve skills. Skills they can develop included team working skills, problem solving skills, communication skills and others. Students also build their knowledge through discussion and decision-making that occurs with their peers (Russell, 2011). When a group is engaged in an investigation, all of the members will be motivated and well-articulated, hence they get meaningful gains for the learning (Leach, 2010). According to Hsin-Yuan & Soman (2013), there are 4 steps that should be considered in the designing of the game strategies, as shown in Table 1.

<table>
<thead>
<tr>
<th>Design Strategy</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Determination of learners’ characteristics</td>
<td>Define students’ characteristic such as educational background, gender, races, etc.</td>
</tr>
<tr>
<td>2. Definition of Learning objectives</td>
<td>Learning objectives should be specific and clear; Determine educational content; Select appropriate game mechanics and techniques</td>
</tr>
<tr>
<td>3. Creation of educational content and activities</td>
<td>Educational content should be interactive and engaging; Activities should be tailored to the learning objectives; Multi performance, feasibility, increase difficult level and multi paths</td>
</tr>
<tr>
<td>4. Adding games elements and mechanisms</td>
<td>Social interaction; student as a part of learning community; Accumulation of points, transition to higher levels, and winning awards</td>
</tr>
</tbody>
</table>

Design of Snake and Ladder Game

In this study, the Snake and Ladder game is chosen and played traditionally to enhance engagement between players and also as an assessment tool to evaluate students’ understanding. The learning activities should be developed tailored to the learning objectives and allow multiple performance, feasibility and increasing difficulty level. Interacting face to face rather to create more interaction and could provide competition among players. All of this characteristics are satisfied in Snake and Ladder game. Snake and Ladders game also contained the quiz time at each level to assess student’s understanding. If students able to solve the quiz questions, they will move up or skip several steps. However, if students unable to solve the question given, then they will stuck at the same level and need to proceed with different questions with the same level of questions. The total of 50 questions are provided in this game. In order to encourage active and cooperative learning environment, this game is play in team.

Set-up Instrument, Design Storyline and Procedure

The snake and ladders board (Figure 1) consists of 3 different colours which are green, yellow and red. These colours show the different levels of knowledge (Table 2); green (low - fundamental knowledge), yellow (intermediate – simple related problem) and red (high – complex problem). The flow of the questions is referred to Bloom’s Taxonomy Level as show in Table 2. Snake and Ladders game also contained the quiz time at each level to assess student’s understanding. If students able to solve the quiz questions, they will move up or skip several steps. However, if students unable to solve the question given, then they will stuck at the same level and need to proceed with different questions with the same level of questions. The total of 50 questions are provided in this game. In order to encourage active and cooperative learning environment, this game is play in team.
Expert Review and Pilot Study

To test the reliability and validity of the instrument, comments from experts in the subject matter are very crucial. A pilot study was conducted to test the capability and effectiveness of the instrument before implemented among the real respondents. In this study, it was conducted among 8 students to play the game.

Research Methodology

The study was carried out among a group of 67 first year Civil Engineering students (49.3% male and 50.7% female) took Fluid Mechanic course in the academic year of 2018/2019. This research methodology consists of three phases; (i) literature review, (ii) development of instrument and (iii) data collection and analysis. A mixed method research methodology was carried out to achieve the research objective. Classroom observation, student’s reflection and pre and post-test are collected as data sampling. In quantitative study, descriptive analysis were carried out using percentage based on student’s agreement. Meanwhile, in qualitative study, the data are obtained through direct observation and reflection gather from the students after played the game. Thematic analysis is used to analyze the data.

Results and Analysis

1) Students’ Perception on Content of Knowledge

Results from students’ reflection and pre and post-test, students able to increase their content of knowledge after played the game. Most of the students are able to increase their content of knowledge after played the game. It was observed that most of the students classified their level of understanding are at low level (0, 1 and 2) with total percentage are 89.6%. However, after undergone the Snake and Ladders game, it showed that majority of the students have improved up to level 4 and 5 with total percentage are 94.1%.

2) Students’ Perception on Skills

Respondents obtained several type of skills while playing Snake and Ladders board game such as team working skills, problem solving skills, time management skills and communication skills. Students mostly acquired problem solving skills since it recorded the highest percentage of agreement from students with 100%. Followed by communication of 92.5% and team working of 86.6%. While the lowest are time management skills which is 52.2%. As excerpt from the reflection of one respondent, “this game help to improve my problem solving skills as it exposed us with different kind of questions. It also allow team working among students.”

3) Students’ Perception on Motivation

Analysis from students’ reflection, there are two types of motivation that the students gained which are extrinsic and intrinsic motivation. Extrinsic motivation are the individual’s motivational that are coming from outside. Examples of extrinsic motivation are they feel competitive and struggle to get the correct answer to move to the next level. While intrinsic motivation are the individual’s motivational that are coming from inside, such as they work hard to win the game.
Conclusion

The study shows the implementation of gamification as an assessment tool that could enhance students' understanding about the topics. Results shows that:

1. Knowledge and understanding of students have increased after playing the Snake and Ladders game.
2. Games strongly increase motivation among the students intrinsically and extrinsically.
3. Students’ acquire several skills such as team working, problem solving, time management and communication skills.

Gamification is a powerful tool for catalyzing attention, focus and engagement. It creates engagement which is a necessity for learning experiences. The development of an effective strategy for the implementation of gamification in learning Fluid Mechanics implies a positive impact on students’ understanding about the topic. This study concludes that, Snake and Ladders game as learning approach creates an enjoyment and interactive that gives positive impact on student’s understanding of the educational content and create conditions for an effective learning process.

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Students’ Reflective Journal as a Tool for Teaching Plan

Sitti Asmah Hassan
School of Civil Engineering, Faculty of Engineering, Universiti Teknologi Malaysia, 81310 Skudai, Johor. 
sasmah@utm.my

Azmahani Abdul Aziz, Siti Norafida Jusoh, Norelyza Hussein, Nordiana Mashros, Che Ros Ismail
School of Civil Engineering, Faculty of Engineering, Universiti Teknologi Malaysia, 81310 Skudai, Johor. 
azmahani@utm.my, snorafida@utm.my, norelyza@utm.my, mnordiana@utm.my, cheros@utm.my

Highlights:
Reflective journal is a strategy to identify students’ personal, learning approach and educational background. This study clarifies reflective journal method in Traffic Engineering course. Students were requested to write a reflective journal consists of personal and academic background. Four construct elements were analysed: course content, teaching and learning approach, students’ current skill and teaching facilities. It was found that the reflective journal helps lecturer in aligning the teaching plan to students’ learning need. Positive impacts of this strategy can be observed on the teaching and learning experience.

Key words: reflection writing; student-centred; teaching strategies; teaching activities; assessment

Introduction
Reflective journals are personal records of students’ background and learning experiences. Using reflective journal, students are encouraged to write down their personal and academic background and learning experiences. Using reflective journal, students can reflect issues and concerns about teaching and learning practices and as a result of reflection, both students and lecturers able to enhance teaching and learning approach (Sellars, 2012; Leijen, et al., 2014; Toom et al., 2015). Furthermore, lecturer’s capacity in understanding students’ learning approach would be a great aspect in delivering the knowledge. According to Biggs (1999), students’ learning approach can be categorised into deep approach learning (academic orientation) and surface approach learning (non-academic orientation). In the same view, Wright (2011) states that student-centred learning is found to provide greater success for students and classroom effectiveness. The concept of reflective journal used in Traffic Engineering course supports student-centred learning environment and it is used to obtain students’ personal characteristics and academic background. Through the implementation of reflective journal, bonding and chemistry between lecturer and students are improved and it helps lecturer to provide flexibility in course contents’ delivery (Spalding, E. and Wilson, A., 2002).

Innovative Design of Teaching and Learning in Traffic Engineering Course
Traffic engineering course is a compulsory course offered for third year students in School of Civil Engineering. Teaching strategies in Traffic Engineering course is divided into two parts: Part A (reflective journal) and Part B (design of teaching plan) as shown in Figure 1.

Figure 1: Design of Traffic Engineering Course
In Part A (reflective journal), students are required to write personal experiences related to family background, educational achievement, strength and weaknesses, and preferred approach of teaching and learning. Reflective journal used in the Traffic Engineering course is based on the concept of turning students’ experience to effective learning strategies. This reflective journal helps the construction of teaching plan. While in Part B, based on outcome-based education (OBE), the design of teaching plan should consists of course learning outcomes, teaching and learning activities and assessment as shown in Figure 1. Alignment between reflective journal and teaching plan can be used as an effective strategy to achieve the outcome intended for the course of Traffic Engineering.

**Project Objectives**

This project aims to help lecturer in designing and aligning teaching approach to suit students’ need in teaching and learning activities.

**Project Methodology**

The sample of this study consisted of 47 students who enrolled in Traffic Engineering course for semester 2 2018 2019. Students were required to write reflective journal in the first week of the academic semester before lecture begins. The reflective journal consists of students’ personal and academic background. Students were also required to reflect about their preferred teaching and learning in the class. The students’ reflection was then analysed into four construct elements: content, teaching and learning approach, skill development, and teaching facilities.

**Findings**

Analysis was conducted to investigate students’ perception and needs in teaching and learning experience in Traffic Engineering course. Figure 2 shows students’ perception on the content, teaching and learning approach, their current skill and teaching facilities for Traffic Engineering course.

![Figure 2: Elements in Reflective Journal](image)

Results from Figure 2 shows that 22% of students preferred to have real exposure to site or application of the knowledge to the real site. For teaching and learning approach, it was found that almost half of students (48.9%) preferred active learning in the teaching and learning approach such as brainstorming, two-way communication/discussion and fun groupwork. About 37.8% of students preferred traditional method such as lecturer delivered the lecture, discussion related to past year exam questions. A total of 26.6% students suggested to use graphical aid and mind mapping because it is easier for them to understand. The class of Traffic Engineering course consists of 8.9% fast learner, 4.4% slow learner, another 4.4% have leadership trait and a total of 6.6% students are quite and nervous. For teaching facilities, a total of 15.6% of students suggested to have a comfortable chair and table in the learning space, air-conditioning in good operating performance and clean space. Table 1 shows examples of statement from students’ reflective journals.

<table>
<thead>
<tr>
<th>Construct Elements</th>
<th>Respondents</th>
<th>Example of Students’ Reflection Statement</th>
<th>Teaching Strategies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Content</td>
<td>R2</td>
<td>I’m not a fan of people who just focus on the examination and test like they learn for the examination not for the knowledge</td>
<td>• Relate theory and practice</td>
</tr>
<tr>
<td></td>
<td>R9</td>
<td>I believe students learn better when they are physically exposed to the environment where the knowledge will be applied</td>
<td>• Project/case study</td>
</tr>
</tbody>
</table>
Teaching & Learning Approach

R34 Learning environment that suits to me is where the lecturer makes the student understand in class and give example based on real situation.

R4 I prefer to learn in writing method. I like when the lecturer teaches by writing the important words on the whiteboard. It can make me more understand and not sleepy in the class. The mind map method also can make me understand the topic in general and easily to remember it.

R5 When in class, I love to have some brainstorm time which we need to be in group of several people where we need to discuss on certain subtopic and present it to class or maybe have a two way interaction between the lecturer and the student rather than listen to the lecture for two hours solid which will be quite boring.

Current Skills

R12 I prefer to study by traditional method which is lecturer teach and explain in class and we take notes of important points. I do not prefer many activities to be done in the class such as dividing into groups and have some small quiz etc. I think it is quite troublesome.

R20 I tend to be scared easily to talk in front of an audience like a presentation or hosting.

R27 I am a nervous person. Merely standing on stage makes me nervous and uncomfortable. Also, it makes me uneasy to stay in public.

Teaching Facilities

R12 I feel that I really need to have a table and chair. The environment in most of the classroom in UTM is just not comfortable. I really don’t like the table-chair in UTM because I feel uncomfortable to study and this reduce the efficiency of study.

R19 Environment that suit me best I think is when the table is big and spacious so it can provide us comfortable environment of study.

R26 I prefer learning environment with a cool and airy spaces.

Discussions and Conclusion

Based on the findings from students’ reflective journal, teaching plan for Traffic Engineering course was aligned to students’ need. Reflection of topic was considered in each session of lecture to make sure everyone can understand and see the connection between the knowledge. Various teaching strategies have been implemented such as group project, progress discussion related to project, real site video or image in teaching contents as shown in Table 1. In Course Assessment Report (CAR), about 97.9% of students had excellent performance in PLO4 (ability to resolve complex problems based on investigation or research using integration of knowledge and the consequent responsibilities relevant to professional practice).

The reflective journal was found to be very helpful in designing teaching plan to make sure that it is aligned to students’ need. Teaching strategies was planned to make sure that no one left behind in understanding and applying the knowledge especially those students’ in need for emotional support (either having personal issues such as family, illness and loss of loved ones). Bonding between lecturer and students were found to be improved, hence creating an enjoyable teaching and learning experience. We believe that the soul of educator is to teach students theoretical knowledge, and at the same time, we care on building their soul and personality in knowledge seeking. This reflective journal has been used for Traffic Engineering course since the past seven years and it provides positive impact in aligning the teaching strategies to students’ need. Consequently, it has benefited in minimising gap of students’ learning approach and maximising students’ engagement in knowledge seeking.

Acknowledgement

We are grateful for the Ministry of Education Malaysia and Universiti Teknologi Malaysia for providing financial assistance to support this research work (R.J130000.7851.5F024).
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Fun and Fit’ Exercise with baby: Suitability of the theme-based exercise program for postpartum mother

Halijah Ibrahim
School of Education, Faculty of Social Science and Humanities, UTM
p-halija@utm.my

Asha Hasnimy Mohd Hashim
School of Education, Faculty of Social Science and Humanities, UTM
asha@utm.my

Diyana Zulaika Abdul Ghani
School of Education, Faculty of Social Science and Humanities, UTM
diyana@utm.my

Zainal Abidin Zainuddin
School of Education, Faculty of Social Science and Humanities, UTM
p-zainal@utm.my

Highlights:
Information related to exercise for postpartum mother not yet well established. The traditional postpartum belief and practices had restrained Malaysian mothers to physically active. A theme-based exercise program to allow afterbirth mother exercise together with the baby (by carrying baby using baby carrier) had been conducted by a group of sports science students. Conducted program benefited the students and postpartum mother. Generally, the program able to increase their personal skills as well as knowledge related to exercise after postpartum. Established theme-based exercise program conducted continuously become needed demand in the healthy-life style market.

Key words: Exercise with baby; postpartum mother; theme-based exercise

Introduction
A guideline for women who wish to exercise during pregnancy can easily access but little information regarding exercise for postpartum mother (Mottola, 2002). Review on the traditional postpartum belief and practices among Malaysian mothers shown that this postpartum recovery phase should focus on dietary intake and passive physical rehabilitation (massage and immobilization technique) (Fadzil, Shamsuddin, & Wan Puteh, (2016). This traditional practice rendering postpartum mothers to physically active and involve in mild to strenuous exercise. In addition, several studies from other countries showed that unmet social support (Boothe, Brouwer, Carter-Edwards, & Ostbye, 2011), lack of time, energy and interest (Haakstad, Vistad, Sagedal, Lohne-Seiler, & Torstveit, 2018)) were the most frequently perceived barriers to involve in physical exercise, and consistent over time. It is believe that these perceived barriers to leisure-time physical activity are also the main barriers among Malaysian postpartum mother.

Various physical activities program is needed to encourage afterbirth mother to keep fit. With the increasing popularity of traditional babywearing (baby carrier) to modern society (Russell, 2015) through various social media platform, exercise instructor should grab and expend this phenomenon. The acceptance of using baby wearing that allows mothers to have two free hands to accomplish tasks while babysitting (Russell, 2015) commence opportunity for mother to physically active by doing mild to vigorous exercise.

A project-based learning strategy has been implemented to a group of sports science students to conduct a series of exercise program to this postpartum mother. General observation has shown that Malaysian urban women preferred to joint aerobics class as their physical activity. However, normal aerobics class that have high impact of movement might not suitable to mother who are just deliver the baby due to individual physical fitness. Therefore, a theme-based exercise program has been proposed to the Selat Tebrau Babywerer (a non-government organisation) to collaborate in the exercise program.

The purpose of this teaching-research activity is to explore the impact of project-based learning strategy among students and participants involved in the ‘Fun and Fit theme-based exercise with baby’ program. Twenty nine Sports Science students serve as facilitator (exercise instructor) conducting six sessions of them-based exercise program. A total of 69 attendances collected from these six sessions of exercise. Observation, students’ reflection, interviews and written respond documents have been used in interpreting the impact of the exercise program. Table 1 show detail
of group participants, six types of theme-based exercise program and findings for both groups investigated in this learning-research activity.

Table 1: Participants, list of theme-based exercise program and findings of learning-research activity.

<table>
<thead>
<tr>
<th>Groups</th>
<th>Total of Subjects and Theme-based Exercise Programs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sport Science Students</td>
<td>Weight &amp; Strength</td>
</tr>
<tr>
<td></td>
<td>Posture &amp; Balance</td>
</tr>
<tr>
<td></td>
<td>Fat loss</td>
</tr>
<tr>
<td></td>
<td>Muscle Toning</td>
</tr>
<tr>
<td></td>
<td>Aerobics</td>
</tr>
<tr>
<td>Postpartum Mothers</td>
<td>5 facilitators</td>
</tr>
<tr>
<td></td>
<td>4 facilitators</td>
</tr>
<tr>
<td></td>
<td>5 facilitators</td>
</tr>
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<td></td>
<td>5 facilitators</td>
</tr>
<tr>
<td></td>
<td>5 facilitators</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Groups</th>
<th>Findings</th>
<th>Theme-based Exercise Programs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sport Science Students as Facilitator</td>
<td>- Enhance knowledge &amp; experience</td>
<td>1. Weight &amp; Strength</td>
</tr>
<tr>
<td></td>
<td>- Suitability of communication skills in context</td>
<td>2. Posture &amp; Balance</td>
</tr>
<tr>
<td></td>
<td>- Theme-based exercise module for specific population</td>
<td>3. Core &amp; Pelvic</td>
</tr>
<tr>
<td>Postpartum Mothers as Participants</td>
<td>- Low to moderate intensity exercise</td>
<td>4. Fat loss</td>
</tr>
<tr>
<td></td>
<td>- Differentiate purpose of theme-based exercise</td>
<td>5. Muscle Toning</td>
</tr>
<tr>
<td></td>
<td>- ‘we want more’ – continuous in group exercise program</td>
<td>6. Aerobics</td>
</tr>
</tbody>
</table>

Besides of successfully conducting all six sessions of theme-based exercise, facilitator able to interact and communicate with postpartum mother informally with appropriate manner. Previously, facilitators keep repeating inappropriate words choices while giving instructions during exercise rehearsal. Facilitators agree that inappropriate word choices usage during exercise rehearsal mostly were influenced by previous experience of being teacher-trainee at school. During theme-based exercise sessions, the appropriateness word usage of facilitators within the context has shown a transferable learning and adaptability skills among them. Generally, the postpartum mothers embrace the knowledge related to suitable exercise after postpartum, and able to relate the theme-based exercise program to the functionality of their part of the body. Responds form the participants indicated the opportunity to establish theme-based exercise program conducted continuously as a one of the demand in the healthy-life style market.

Several articles related to this project based learning activity have been published. A copyright of the theme-based exercise program is also registered at Innovation and commercialization Centre (ICC), UTM. This theme-based exercise program is also registered as one of community research grant at the Centre of Community Industry and Network, (CCIN) UTM.

Acknowledgement

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Structured Framework to Facilitate Research Methodology Skills in Final Year Project for Bachelor of Engineering (Electrical-Electronics) Program

Nurul Ezaila Alias
School of Electrical Engineering, Universiti Teknologi Malaysia, 81310 UTM Johor Bahru, Johor, Malaysia.
ezaila@utm.my

Yusmeeraz Yusof
School of Electrical Engineering, Universiti Teknologi Malaysia, 81310 UTM Johor Bahru, Johor, Malaysia.
yusmeeraz@utm.my

Highlights:

Final Year Project (FYP) is the finale of the undergraduate program. The course is dissimilar from other courses. Although students are supervised by the supervisor, however, the accountability is on the student who independently has to do on their own from literature review and determine the problem statement to present the results in writing, verbally and in action. In an effort to improve the CQI of FYP course, this paper presents an implementation of structured framework to facilitate Research Methodology (RM) skills in FYP (RMFYP) for Bachelor of Engineering (Electrical-Electronics) Program at School of Electrical Engineering, Universiti Teknologi Malaysia (UTM). The focus is on developing student’s ability to identify, conduct research literature and analyse complex engineering problems as well as to take responsibility in conducting their FYP. The effectiveness of this implementation was evaluated based on students’ program learning outcome (PLO) achievement on their individual key performance indicator (KPI) and feedbacks in the end of the course (EOC) survey. Based on the findings, the implementation of structured framework of RMFYP gives impact on students’ skills development on writing and better reflect their capability in working independently.

Key words: Research Methodology; Framework; Final year project; Undergraduate research

Introduction

21st Century skills are required to prepare students to face the changing environment with complex challenges and to enable them to apply core skills to ordinary tasks. The Accreditation Board for Engineering and Technology (ABET) emphasizes six (6) ‘professional skills’ to be integrated in the undergraduate curriculum. These ‘professional skills’ include communication, teamwork, understanding ethics and professionalism, engineering within global and societal context, lifelong learning, and knowledge of contemporary issues, project management and critical thinking [1]. The implementation of final year project in undergraduate program is to provide students the opportunity to explore those ‘professional skills’, be creative and innovative to solve practical science, mathematical and engineering societal problems. Students are exposed to project management planning and execution [1]. Undergraduate final year project (FYP) is considered as an ‘high impact’ educational practice, which means it increases rates of student retention and engagement, leading to the achievement of benefits in educational learning outcomes, skills and attitudes. These learning gains, which are defined as the improvement in students’ knowledge, skills and personal development over time [2].

In undergraduate program, the FYP is the finale of the degree. The module is dissimilar from other modules. Although students are supervised by the supervisor, however, the responsibility is on the student who independently has to do the literature review, to determine the problem boundaries, to investigate possible solutions, and to present the results in writing, verbally and in action. Normally, there are no formal lectures to attend except an initial briefing session. Also, it consists of regular meetings with the supervisor to discuss progress. For the formative assessment includes progress evaluation, while for the summative assessment includes students submit logbook and reports, and give in-person seminar and demonstrations of their work. Since there is no other formal lecture provided to the students, a very conducive initial briefing session would greatly help the students to start their project. Generally, research methodology (RM) course is designed for research student to guide them on how to start their research. Also, it helps students to plan and manage their project from beginning to end as well as indirectly improve their writing skills [3]. Therefore, the implementation of RM course is not only relevant to the research student but also to the undergraduate student for their FYP.

In this paper, the quality of 2 program learning outcomes (PLOs) which are PLO2 and PLO6 of FYP course for Bachelor of Engineering (Electrical-Electronics) Program (SKE Program) at School of Electrical Engineering (SKE) are studied. The comparisons were made for cohorts of 20172018 and 20182019 with the previous cohort of 20162017 academics sessions. PLO2 is the KPI that measures the ability of students to identify, formulate, conduct research literature, and analyze complex engineering problems using first principles of mathematics and engineering sciences, and PLO6 is
the KPI that measures students’ ability to responsibly act as well as respond to the societal health, safety, environment, legal and cultural issues that are relevant to the professional engineering practice. In 2016-2017 academic session, the implementation of FYP at School of Electrical Engineering was already at the point of satisfied state where students are guided by a logbook which includes all the procedures on what students need to do for the entire FYP I in semester 1 and FYP II in semester 2. Although, both targeted KPIs are slightly achieved just above 0.65, however, for the CQI, an appropriate action has to be taken to improve the KPIs to an outstanding level. Consequently, in 2017-2018, the implementation of structure framework to facilitate RM skills in FYP (named as RMFYP) is introduced. RMFYP module is a well-structured procedure for students to follow comprises: 1. Introductory to RM, 2. Guided logbook and 3. Report writing workshop. Thus, comparisons were made between these two groups of students corresponds to their KPIs achievement for FYP according to before and after the implementation of structured framework of RMFYP module.

Implementation

The implementation of the RMFYP includes three components: research methodology introductory class, guided logbook and report writing workshop. Table 1 shows the framework timeline for each component. The first module, Introductory Class to Research Methodology is held at the beginning of the Final Year Project (FYP). The class takes place at week 2 of semester 1 with the aim that students can grasp at the earliest possible the concept of research to start their FYP. The content describes the general research methodology approach in conducting engineering-based research project. After this introduction, students are guided by a logbook prepared by the FYP committee of the School of Electrical Engineering for their entire FYP duration. The logbook provides step-by-step guides on the weekly basis following the Need, Approach, Benefit, Competition (NABC) method created by the Stanford Research Institute [4]. The report writing workshop is organized at week 2 of semester 2 to improve students’ comprehension in writing a good technical report. During the workshop, students are required to bring their FYP I report and get hands-on advice on how to complete their final FYP II report. This facilitation includes the content-wise delivery, professional writing skill, and plagiarism aspect.

| Table 1: Framework Timeline of Research Methodology for Final Year Project (RMFYP). |
|---------------------------------|-----------------|-----------------|
| RMFYP Module                  | Academic Session |
|                                | Semester 1 | Semester 2 |
| Introductory to Research      | ✔            | ✔            |
| Methodology                   | Week 2      |              |
| Guided Logbook                | ✔            | ✔            |
| Report Writing Workshop       | ✔            |              |
|                               | Week 1 - 14 | Week 1 - 14  |

With the targeted learning outcome to demonstrate the students’ research methodology skill, the evaluation rubrics are designed with the assessment tools that consist of progress work, seminar and report. The mapping between course learning outcome (CLO), assessments and program learning outcome (PLO) are based on the constructive alignment theory [5]. In this study, the effectiveness of the RMFYP implementation were measured from the second program learning outcome (PLO2) and the sixth program learning outcome (PLO6) achievement in Final Year Project II of Bachelor of Engineering (Electrical-Electronics) program (SKEL). Measurement of the PLO2 achievement directly reflects the achievement of the first course learning outcome (CLO1), which indicates the ability of student in executing an electrical and electronics engineering project. Meanwhile, measurement of the PLO6 achievement links to the achievement of the third course learning outcome (CLO3) that represents the ability of student to effectively communicate on their project via oral and written forms. The summary of the assessment mapping to the targeted PLOs in this study is shown in Table 2.

| Table 2: Assessment Mapping of PLO2 and PLO6 in Final Year Project II. |
|-----------------|-----------------|-----------------|
| Assessment Item | Program Learning Outcome |
| Logbook         | PLO2            | PLO6            |
|                 | Progress work 6 % - CLO1 rubrics |              |
| Seminar         | ✔              | ✔              |              |
| Report          | 10 % - CLO1 rubrics | 10 % - CLO3 rubrics |              |
|                 | 10 % - CLO1 rubrics | 12 % - CLO3 rubrics |              |

Impact to Students’ Learning

The data after the implementation were collected for two student-cohorts; academic session 2017-2018 and 2018-2019 with the total of 114 and 111 students, respectively. The achievement of PLO2 and PLO6 were compared with the data taken from the previous cohort of academic session 2016-2017, which has 121 students. As shown in Figure 2, both PLOs before the implementation of structure framework of RMFYP in 2016-2017 were just slightly above
the key performance index (KPI) target of 0.65. After the implementation of RMFYP, significant improvement can be observed in both PLOs. The KPI level for PLO2 in 2017/2018 is 12.9% higher than the previous cohort. This KPI level is maintained at outstanding KPI of 0.79 in 2018/2019, which demonstrates the impact of the RMFYP to the student’s ability in executing an electrical-electronics engineering project with systematic and practical research approach. For PLO6, the improvement of 14.7% in 2017/2018 was achieved compared to the previous 2016/2017 cohort. This KPI level of 0.78 also remained for the following cohort in 2018/2019, showing the consistency of student performance in effective communication skill. In terms of the individual PLO achievement, 100% of students in 2017/2018 and 2018/2019 were successfully passed the 0.4 KPI target for both PLO2 and PLO6. All these findings confirm that the implementation of newly structured RMFYP has contributed to the student learning by providing a proper and effective guidance to develop their research methodology skills that indirectly enables students to nurture their independent critical thinking skill along with oral and written communication skills. This will have lasting impact as undergraduates prepare for professional service or postgraduate studies upon graduation.

**Figure 2:** PLO2 and PLO6 achievement level in Final Year Project II for SKEL program in three consecutive years.

Based on the end of course survey, students give their feedback on accomplishment level in FYP implementation at School of Electrical Engineering in rating scale 1 to 4, where 4 = well accomplished, 3 = Accomplished, 2 = Acceptably accomplished, 1 = Poorly accomplished and 0 = Not accomplished. The pie chart in Figure 3 summarized the feedback given by 2018/2019 students towards the implementation of RMFYP in FYP. As displayed in Figure 3, it shows that about 93 % of the students rated level 4 and 5 for both PLO2 and PLO6 achievements, which confirms that they have accomplished well in their FYP with the structured framework of RMFYP implementation. On the other hand, only 7 % of the students who rated level 1 and 2 for both PLO2 and PLO6 achievements. It reflects that they did not accomplished quite well their FYP, this perhaps they felt burdened with the provided RM class and report writing workshop as well as filled-up the logbook.

**Figure 3:** Students’ feedback on PLO2 and PLO6 in Final Year Project II for SKEL program in 2018/2019.

**Conclusion**

The analysis on the performance of students who undergone the structured framework of RMFYP showed that the FYP has improved students’ interpersonal skill development in conducting research skills and report writing (PLO2 – ability of students to identify, formulate, conduct research literature, and analyze complex engineering problems using first principles of mathematics and engineering sciences) and higher responsibility to work independently (PLO6 - ability to responsibly act as well as respond to the societal health, safety, environment, legal and cultural issues that are relevant to the professional engineering practice). The implementation of structured framework of RMFYP had managed to consistently guide students in starting and managing their FYP throughout semester 1 and 2. The implementation of structured framework of RMFYP is highly recommended to other schools in UTM as the students will be in a state of readiness and will be very clear in conducting their FYP.
References


INTEGRATION OF E-SERVICE LEARNING PLATFORM IN AUTHENTIC LEARNING ENVIRONMENT FOR COMPUTER NETWORK CABLING & SETUP

Azizah Yusof1, Noor Azean Atan2, Mohd Shafry Mohd Rahim3 Jamalludin Harun4 and Nor Fadila Mohd Amin5

1, 2 Department of Science & Mathematics Education, and Creative Multimedia, UTM JB
(E-mail: azizah38@graduate.utm.my, azean@utm.my)

3 Centre for Co-Curriculum Courses and Service Learning (CCSL), UTM JB
(E-mail: shafry@utm.my)

4 Department of Science & Mathematics Education, and Creative Multimedia
(E-mail: p-jamali@utm.my)

5 Department of Technical and Engineering Education
(E-mail: p-fadila@utm.my)

ABSTRACT

Online service learning is also known as e-Service Learning holds great potential to transform both service learning and online learning from geographical constraint provided that online platform was equipped as a tool to promote engagement. As e-service learning program involved students from across disciplines, the integration of online platform making the process of collaboration easier. Therefore, the purpose of this study is to design the suitable learning activities in e-Service Learning through MOOCs platform (Massive Open Online Courses) and examine the effect of online platform use in the service learning program based on authentic learning environment for computer network cabling and setup. Result of this study indicated that there is an improvement on students’ academic performance before and after the integration of e-Service Learning platform. Meanwhile, an analysis on students graduate attributes competency through a series of service learning activities in online platform based on authentic learning showed an increment in students’ scores. In addition, these findings were also supported by their positive reactions of e-Service Learning in helping them to enhance their understanding about the course and their graduates’ attributes (mastered skills). Thus, this study concluded that by integrating e-Service Learning in an authentic environment can ensure students have the potential to articulate students service experience, academic concepts, and reflection in an organize manner while enhance students’ graduates attribute.

Key words: service learning, online platform, network cabling and setup

INTRODUCTION

The past three decades have witnessed dramatic changes in the types of skills that employees require to succeed in the workplace. New technologies have provided individuals with the means to access and distribute specialised information quickly and easily, reducing demand for skills associated with the storage and retrieval of detailed technical information (e.g., memorisation and classification for archival purposes). In contrast, the ability to source, process, manage, communicate and apply knowledge across diverse contexts has come to be seen as critical for workplace success. Service learning projects allow students to develop the generic skills that employers highly valued such as communication skills, teamwork skills, problem solving skills, enterprise skills, planning and organising skills, self-management skills, learning skills and technology skills (Hatcher and Bringle, 1997; Astin et al., 2000; Ropers-Huilman et al., 2005; Bringle and Hatcher, 2009). Modern industries require graduate students with enhanced employability skills should provide generic skills as industry needs multi-skilled employees in different engineering disciplines (Markes, 2006). Joseph et al., (2007) stressed that the integration of service learning approach would result in future employees that would have skills and knowledge to perform well in the workplace. Employers today are looking for employees with 21st century skills and teamwork is the number one global workforce in the industry (Bates et al., 2004; Casner-Lotto, 2006). Most industry namely management, healthcare, education, science, engineering and technology operate in a form of teams (Scamati, 2001). Teamwork require a mix of interpersonal, collaboration, problem solving, and communication skills needed for a group to work together towards a common goal (Pollard et al., 2004). Teamwork is essential since students will always be exposed to a variety of experiences in which they will have to cooperate and collaborate with others. Here we present the pedagogical rational for developing students graduate attributes competency and including teamwork experience in service learning project.

PEDAGOGICAL CONTEXT

A combination of service learning and online learning are proven to enhance student civic engagement as it can foster student reflection. A case study done by Waldner et al., (2012) in the comparison of traditional service learning and blended service learning; service learners been aided by online learning shows significant performance to
compare with traditional service learning. The forms of online learning whether partially or fully online have been offered by most universities and have been actively produced since the rise of open online course (O’Donnell et al., 2015; Phan et al., 2016; Yusof et al., 2017).

The lack of interaction and discussion between students has cause low completion rate continue to impede in online platform (Alraimi et al., 2014; Hew and Cheung, 2014). Therefore educators have been applying the modality of flipped classroom, hybrid and blended learning in online platform on smaller groups to engage students learning (Embi, 2014). The successful of the modality have enlightened educators to innovate the pedagogical approach in enhancing the learning by immersing student in experiential learning. Service learning a form of experiential learning requires a hands-on approach that fully immerses students in the learning process.

RESEARCH METHODOLOGY

Table 1. Service Learning Project through Online Platform

<table>
<thead>
<tr>
<th>Week / Phase</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Before Service Learning Project</strong></td>
<td></td>
</tr>
<tr>
<td>Face-to-face and Online Instruction</td>
<td></td>
</tr>
</tbody>
</table>
| Week 1 – 4, Phase 1: Investigation | - Introduce syllabus
- Introduce navigation system
- Introduce course goals, skills and abilities
- Introduce to expert in the field
- Student reflection on expectation of joining the course
- Form committee member
- Form virtual meetings
- Identify student committee member leader
- Site visit to community partner to identify community needs |
| Face-to-face and Online Instruction | - Hands-on practice and knowledge on network cabling infrastructure skills
- Individual and group assignments posted in OpenLearning
- Class discussion in OpenLearning
- Successfully completed assignments posted in OpenLearning for peer review and comments
- Virtual meetings discussion
- Student collaborate and write proposal
- Conduct project planning, coordinate tasks with team members, coordinate schedules and estimate price materials with vendors |
| **During Service Learning Project** | |
| Onsite Instruction and Service Learning | - Student discuss in virtual meetings
- Perform physical labour,
- Prepare a detailed proposal and track project progress. |
| **After Service Learning Project** | |
| Face-to-face and Online Instruction | - Group discussion of individual work
- Student collaborate and draft final report
- Course and student peer evaluations
- Prepare for final report writing and oral presentation |
| Online Instruction and Service Learning | - Presentation of final innovations that were introduced to community partner
- Celebrate success |

CONCLUSION

E-service learning in the inclusion of online discussion forums and virtual meetings are an effective method of service learning when executed successfully can provide students with a valuable and enjoyable learning experience that develops students graduate attributes competency. Through this study and previous research it has been demonstrated that the incorporation of e-service learning have the potential to have a positive effect on the level of student learning engagement affecting both the students’ understanding and knowledge through teamwork.
REFERENCE


ENHANCING ICT COMPETENCY AND PROJECT MANAGERIAL SKILLS FOR UNDERGRADUATE STUDENTS IN SERVICE LEARNING PROGRAM

Azizah Yusof¹, Mohd Rustam Mohd Rameli² and Juhazren Junaidi³

¹Department of Science & Mathematics Education, and Creative Multimedia, UTM JB
(E-mail: azizah38@graduate.utm.my)

²Department of Educational Foundation and Social Science, UTM JB
(E-mail: mrustam2@utm.my)

³Department of Science & Mathematics Education, and Creative Multimedia, UTM JB
(E-mail: juhazren@utm.my)

ABSTRACT
ICT service learning program titled “The Computer Network and Multimedia Design for Knowledge Workers” requires undergraduate students to involve a service learning experience regarding ICT related services for the underprivileged poor community in the school of urban area. The undergraduate students followed the five phase of service learning to conduct the program with the community. The service learning program had an impact on undergraduate students development in ICT skills and project managerial skills. Students who provide community service as part of two credits course “ICT for Community Services” showed a significant increase in their skills on network cabling installation and graphic design. The undergraduate students involvement with the community also showed a significant difference in their communication, leadership and team working skills.

Key words: service learning, computer network setup and multimedia design

INTRODUCTION
Service learning a form of experiential learning practices is very important in Higher Education Institution (HEI). According to Malaysia Education Blueprint (2015-2025), Malaysia Ministry of Higher Education (MoHE) has included service learning in one of the 10th shift statement to create graduates who are holistic, entrepreneurial and balanced. The pedagogy teaching tool is well underway in Malaysia HEI since MoHE encourage HEI to take advantage of service opportunities in order to apply or observe principles learned in the classroom outside in the community. The Centre for Co-curriculum Courses and Service Learning (CCSL, 2017), Universiti Teknologi Malaysia has come out with the initiative to implement the National Higher Education Strategic Plan beyond 2025. The overall planning of CCSL (2017) is to provide an experiential learning that provides students the opportunity to apply experiences gained in serving people in the local community to their understanding of material learned in the classroom.

PEDAGOGICAL CONTEXT
Service learning in higher education is often defined as an academic course based on credit hours that involves participating in service and reflecting on that service in order to gain a better understanding of the curriculum and a deeper appreciation of the field (Bringle & Hatcher, 2000). Service learning has been a recognized pedagogical method for more than twenty years as John Dewey (1938) suggested the importance of linking learning and knowledge to activity and social inquiry. Since that time, educators have been aware that students learn better when their learning is not bound by classroom, textbooks and memorization. Service learning as a pedagogy is different from more traditional types of pedagogy because of its emphasis on the group rather than individual. Service learning indicate that properly implemented service learning projects not only enrich the learning experience of the students, but promote reflection on the long term benefits of community service.
In addition to providing students with opportunities to apply the knowledge they learn in the classroom to a real world environment, Hatcher and Erasmus (2008) argue that service learning teaches civic responsibility and at the same time it is helping to strengthen communities. The benefits of service learning not only providing students with real-world experience in technical and social skills but also developing in students a sense of responsibility and ownership (Webster & Mirielli, 2007). Kaye (2004) provide an example of a student development model that identifies the following five phases of involvement in service learning: (a) Investigation (Phase 1), (b) Planning & Preparation (Phase 2), (c) Action (Phase 3), (d) Reflection (Phase 4) and finally (e) Demonstration of Results and Celebration (Phase 5) as shown in Figure 1. A mature service learning curriculum will promote this type of student development through coordinated course sequences and assessment of student outcomes (Mentkowsk & Rogers, 1993).

**CONCLUSION**

With renewed attention on community service, university administration is interested in committing their resources to develop effective project managerial skills and academic skills among the students, to address complex needs in their communities through the application of knowledge, and to form creative partnerships between the university and the community. Service learning provides one means through which students, faculty, and administrators can strive toward these aspiration.

**REFERENCE**


Scenario Based-learning in High Voltage Technology for 3rd Year Students of SKE

Noor Azlinda Ahmad, Kwan Yiew Lau, Zolkafle Buntat Buntat, Kamarudin Abdul Hamid

Abstract

In order to prepare our engineering graduates with challenges of rapid technological development and advancement of ideas and innovation, the objective of High Voltage Technology course was designed to inculcate Problem-Based Learning (PBL) to stimulate critical thinking, problem solving abilities and communication skills among students. For this PBL project, students in a group of 4 were given a problem that required the knowledge of high voltage to solve either through experimental investigation or software simulation. By working cooperatively as a group, students would be able to learn effectively on how to design selected high voltage components and subsystems as part of the solutions. This PBL project successfully encompassed the capability of the students to manage projects and produce effective work within teams, to deal with conflicts, to adapt to different working environments as well as to assess the students’ own learning outcomes. It also promoted the attitude of respect to the works of others.
KEBERKESANAN APLIKASI X-BAR DALAM PENYELESAIAN MASALAH MATEMATIK BERAYAT MURID TAHUN LIMA

Hartini binti Ismail
Universiti Teknologi Malaysia (UTM)
hartini.ismail88@gmail.com

Najua Syuhada binti Ahmad Alhassora
Universiti Teknologi Malaysia (UTM)
najuasyuhada@utm.my

Siti Mistima binti Maat
Universiti Kebangsaan Malaysia (UKM)
sitimitsima@ukm.edu.my

Abstrak

Kata kunci : Penyelesaian Masalah, Aplikasi X-Bar, Peratus

Pengenalan

Aplikasi X-Bar digunakan untuk meningkatkan penguasaan murid Tahun Lima dalam penyelesaian masalah peratus. Pendekatan pengajaran menggunakan aplikasi X-Bar adalah berdasarkan fakta bahawa kebanyakan murid di peringkat sekolah rendah tidak dapat menyelesaikan masalah abstrak. Penggunaan aplikasi X-Bar ini dapat membantu murid untuk menggambarkan dan melihat hubungan antara fakta matematik dengan maklumat yang terdapat di dalam soalan penyelesaian matematik dengan lebih jelas. Keupayaan untuk melihat perkaitan tersebut akan membantu murid menyelesaikan masalah yang sukar dan rumit. Aplikasi X-Bar dapat memudahkan murid memahami sesuatu situasi penyelesaian matematik dan menterjemahkannya kepada bentuk yang lebih mudah. Tambahan lagi, aplikasi X-Bar ini juga dapat mendorong pelajar utuk terlibat secara aktif dalam aktiviti pembelajaran di mana lanya selari dengan matlamat model pengajaran NALI.

Isi Kandungan (Inovasi : Aplikasi X-Bar)
1. Objektif Inovasi
Objektif-objektif bagi kajian ini adalah :
(i) Mengenalpasti punca kesilapan murid dalam menyelesaikan masalah matematik berayat topik peratus. 
2. Metodologi Kajian

Kaedah pemerhatian dan temu bual digunakan untuk mengenal pasti masalah kajian. Tindakan susulan yang lebih berfokus pula dijalankan kepada peserta kajian melalui ujian diagnostik dan ujian pra. Ujian-ujian ini adalah untuk mengenal pasti tahap kefahaman murid terhadap penyelesaian masalah peratus sebelum sesi intervensi menggunakan aplikasi X-Bar dijalankan.

Sesi intervensi dijalankan terhadap peserta kajian sebanyak 8 sesi selama 1 jam bagi setiap sesi. Semasa sesi intervensi, peserta kajian didedahkan dengan menggunakan aplikasi X-Bar dan menjalani latihan secara berperingkat dan sistematis. Ujian pasca dijalankan untuk menilai prestasi peserta kajian dari segi pengetahuan setelah terhadap soalan berbentuk penyelesaian masalah adalah meningkat atau sebaliknya setelah mempelajari kaedah aplikasi X-Bar. Analisis data dibuat dengan membandingkan markah ujian pra dan ujian pasca untuk membandingkan keberkesanan kaedah X-Bar dalam meningkatkan keterampilan penyelesaian masalah bagi topik peratus dalam kajian peserta kajian.

Aplikasi X-Bar

Aplikasi X-Bar merupakan kaedah penyelesaian masalah matematik yang diimplementasikan oleh kurikulum di Singapura. Ianya merupakan kaedah yang berkesanan dan digunakan dalam buku teks sekolah rendah di Singapura dinamakan gambar rajah jalur (Beckmann, 2004). Model Bar menggunakan bentuk segi empat tepat sebagai asas.

Contoh:

Terdapat 50 buah buku di dalam sebuah rak. 30 buah adalah buku cerita dalam Bahasa Inggeris. Berapakah peratus buku cerita Bahasa Inggeris di dalam rak tersebut?

Langkah 1 : Murid diperkenalkan dengan Model Bar dan perlu melukis bentuk segi empat tepat sebagai asas.

Langkah 2 : Segi empat tepat itu dibahagikan kepada 10 bahagian (bar) yang mewakili 10% bagi setiap bahagian tersebut.

| 10% | 10% | 10% | 10% | 10% | 10% | 10% | 10% | 10% | 10% |

Langkah 3 : Jumlah keseluruhan dibahagikan kepada 10 bar

50 buku

| 10% | 10% | 10% | 10% | 10% | 10% | 10% | 10% | 10% | 10% |
| 5 buku | 5 buku | 5 buku | 5 buku | 5 buku | 5 buku | 5 buku | 5 buku | 5 buku | 5 buku |

Langkah 4 : Lorek jumlah buku yang dinyatakan dan tentukan nilai peratus

50 buku

| 10% | 10% | 10% | 10% | 10% | 10% | 10% | 10% | 10% | 10% |
| 5 buku | 5 buku | 5 buku | 5 buku | 5 buku | 5 buku | 5 buku | 5 buku | 5 buku | 5 buku |

Jawapan: 60 %

Dapatan Kajian

Soalan Kajian 1: Adakah penggunaan Model Bar dapat membantu murid menggambarkan situasi masalah matematik yang abstrak kepada gambar rajah yang lebih konkret?

Soalan Kajian 2: Adakah penggunaan Model Bar berkesanan dalam penyelesaian masalah matematik bagi topik peratus Tahun Lima?
Berdasarkan Rajah 1 dapat diihat bahawa terdapat peningkatan yang ketara pada peratus markah setiap peserta kajian bagi ujian pra dan ujian pasca. Hampir semua peserta kajian menunjukkan peningkatan peratusan lebih daripada 50% daripada ujian pra ke ujian pasca.

Jadual 1 Analisis min peratusan ujian pra dan ujian pasca

<table>
<thead>
<tr>
<th>Ujian</th>
<th>Bilangan</th>
<th>Min</th>
<th>Sishan piawai</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ujian pra</td>
<td>9</td>
<td>31.48%</td>
<td>5.55</td>
</tr>
<tr>
<td>Ujian pasca</td>
<td>9</td>
<td>94.44%</td>
<td>8.34</td>
</tr>
</tbody>
</table>

Jadual 1 pula menunjukkan min peratusan markah peserta kajian antara ujian pra dan ujian pasca. Terdapat peningkatan min peratusan yang ketara iaitu sebanyak 62.96% dari 31.48% dalam ujian pra kepada 94.44% dalam ujian pasca. Dapatan menunjukkan min peratusan dalam ujian pasca adalah lebih tinggi daripada ujian pra.

4. Perbincangan

Hasil analisis data yang didapati dalam kajian ini berjaya menjawab kesemua persoalan kajian. Dapatan yang diperoleh menunjukkan bahawa aplikasi X-Bar dapat meningkatkan min peratusan markah murid secara drastik daripada ujian pra ke ujian pasca. Ini menunjukkan bahawa aplikasi X-Bar dapat membantu murid menggambarkan situasi matematik yang abstrak kepada gambar rajah yang lebih konkrit dan berkesan dalam penyelesaian masalah matematik bagi topik peratus Tahun Lima

Aplikasi X-Bar


Selain itu, penggunaan aplikasi teknologi sebagai bahan bantu mengajar dapat membantu pelajar untuk melibatkan diri secara aktif di dalam kehas. Penggunaan teknologi seperti aplikasi X-Bar ini juga dapat meningkatkan kecepatan dan keberkesanan hasil pembelajaran secara tidak langsung. Tambahan lagi, pelajar akan lebih tertarik dan tidak mudah berasa bosan dalam proses pembelajaran terutama apabila belajar Matematik. Selari dengan matlamat model NALI, proses pengajaran yang melibatkan yang melibatkan bahan bantu belajar yang interaktif, bukan sahaja dapat
memastikan penglibatan aktif pelajar di dalam kelas malah suasan pembelajaran yang menyeronokkan dan lebih bermakna dapat diwujudkan.


Terdapat satu peringkat semi konkritis di antara peringkat konkritis dengan peringkat abstrak iaitu peringkat piktorial. Pada peringkat ini, model piktoral amat penting bagi membantu murid menterjemahkan bahan konkrit yang telah dipelajari ke dalam bentuk gambar rajah atau visual sebelum diterjemahkan lagi ke dalam bentuk simbol Matematik. Ini disokong oleh Bruner (1966) yang mencadangkan penyampaian pelajaran bermula daripada pengalaman enaktif (pengalaman secara langsung atau sebenar) ke pengalaman ikonik (melalui visual) dan seterusnya kepada pengalaman simbolik atau digital (melalui perkataan).


Berdasarkan Kon Pengalaman Dale, murid hanya akan mengingat 10% daripada apa yang mereka baca, 20% daripada apa yang mereka dengar, 30% daripada apa yang mereka lihat, 50% daripada apa yang mereka dengar dan lihat, 70% dari apa yang mereka sebut dan tulis, dan 90% dari apa yang mereka katakan seperti yang mereka lakukan. Klasifikasi pengalaman juga dibuat mengikut peringkat peringkat iaitu dari yang paling konkritis iaitu asas kepada aras yang paling tinggi iaitu abstrak. Ini membuktikan bahawa pengalaman belajar yang konkrit akan memberi manfaat yang paling besar kepada murid.

5. Kesimpulan

Secara keseluruhannya, dapatan kajian ini membuktikan bahawa penggunaan Aplikasi X-Bar ini merupakan peringkat pertengahan yang penting dalam menentukan simbol Matematik dan seterusnya meneruskan langkah penyelesaian masalah Matematik. Melalui penggunaan aplikasi X-Bar, murid akan dapat menyuaskan masalah Matematik berbanding kepada bentuk visual yang sesuai dengan mina kanak-kanak iaitu dalam bentuk bar. Maka, kanak-kanak dapat menyelesaikan masalah Matematik berdasarkan kefahaman konsep Matematik berbanding dengan proses hafalan semata-mata melalui penghasilan gambar rajah konkrit daripada situasi ayat Matematik yang bersifat abstrak. Tuntasnya,
pembelajaran bermakna telah berlaku melalui proses konstruktivisme dan ini seiring dengan konsep NALI yang memfokuskan strategi pembelajaran yang sistematik untuk menghasilkan PdPc yang berkesan.

Rujukan


Psychological Review.


Modul Q-PjBLSTEM Berpotensi dalam Menghasilkan Pelajar Berpemikiran Kritis

Aini Aziziah Ramli
Universiti Teknologi Malaysia
ainiaziziahramli@gmail.com

Nor Hasniza Ibrahim
Universiti Teknologi Malaysia
p-norhaniza@utm.com

Johari Surif
Universiti Teknologi Malaysia
johari_surif@utm.com

Abstrak

Modul Q-PjBLSTEM yang dihasilkan merupakan modul pembelajaran STEM yang dilintasikan bersama ayat Al-Quran yang menggunakan pendekatan pembelajaran berasaskan projek dengan tujuan meningkatkan kemahiran pemikiran kritis pelajar. Antara kelebihan modul Q-PjBLSTEM yang dibangunkan adalah masalah yang diutarakan adalah masalah yang memerlukan penyelesaian menggunakan konsep sains, teknologi, kejuruteraan dan matematik. Selain itu, potongan ayat Al-Quran turut disertakan pada setiap tema dan pelajar didorong untuk menghubungkait potongan ayat Al-Quran yang terpilih dengan konsep sains yang digunakan dalam penyelesaian bagi meningkatkan kemahiran pemikiran kritis mereka.

Kata kunci: Pendidikan STEM; Al-Quran; pembelajaran berasaskan projek; modul pembelajaran

Pengenalan

Objektf Projek

Objektf pembangunan projek ini adalah untuk menghasilkan modul pendidikan STEM yang diintegraskan bersama petikan ayat-ayat dari Al-Quran dengan menggunakan pendekatan pembelajaran berasaskan projek yang diberi nama Modul Q-PjBL STEM. Modul Q-PjBL STEM yang ini dibangunkan bertujuan untuk memenuhi keperluan meningkatkan kemahiran abad ke 21 pelajar yang memerlukan mereka mempunyai kemahiran pemikiran kritis yang tinggi sebagai persediaan menempatkan diri di alam pekerjaan kelak. Seiring dengan tujuan penghasilan modul ini, pendekatan pembelajaran berasaskan projek telah digunakan sebagai medium pendekatan pembelajaran di dalam modul ini bagi menarik minat dan memudahkan penyampaian kandungan modul oleh guru kepada pelajar. Ini kerana antara kelebihan pendekatan berasaskan projek adalah kemampuan pendekatan ini untuk memberi peluang dan ruang kepada pelajar untuk melakukan aktiviti hand-ons yang terbukti dapat merangsang membangunkan psikomotor pelajar selain fungsi kognitif pelajar apabila pelajar berpeluang untuk menentukan proses pencairan maklumat mereka sendiri bagi menyelesaikan masalah yang diberikan (Nitce Isa Medina & Mai Shihah, 2018). Selain itu, objektif pengintegrasan potongan ayat Al-Quran di dalam pembelajaran STEM adalah untuk menarik minat pelajar selain mendorong pelajar untuk membuat hubungan potongan ayat Al-Quran yang terpilih dengan konsep sains yang digunakan dalam menyelesaikan masalah mereka. Aktiviti ini turut dapat meningkatkan kemahiran pemikiran kritis mereka selain bertujuan untuk menambahkan keimanan mereka terhadap keEsaan Allah apabila mereka menyedari ilmu sains yang mereka pelajari telah lama dinyatakan oleh Allah menerusi ayat-ayat yang terkandung dalam Al-Quran.

Implementasi pendekatan NALI di dalam kajian


Metodologi Kajian


Dapatan dan Perbincangan Projek

Keberkesanan modul Q-PjBL STEM telah diuji dengan mengimplimentasikan modul Q-PjBL STEM ini kepada pelajar kimia tingkatan 4 dari dua buah sekolah menengah aliran agama secara berturutan. Dapatan keberkesanan modul ini telah dianalisis secara kuantitatif dan kualitatif. Bagi dapatan yang dianalisis secara kuantitatif, instrument yang digunakan adalah set soalan pra dan pasca intensiv yang dijalankan terhadap kedua kumpulan pelajar ini. Perbandingan min dan sishan piawai dilakukan terhadap dapatan dari set ujian pra dan pasca ini. Selain itu, ujian t-test turut dijalankan bagi mengenalpasti kewujudan perbezaan yang signifikan bagi pelajar yang menerima aktiviti pembelajaran pemikiran kritis melalui modul Q-PjBL STEM. Bagi dapatan secara kualitatif pula, instrument yang digunakan adalah dapatan temubual dan refleksi pelajar.
Bagi melihat keberkesanan penggunaan modul Q-PjBL STEM terhadap kemahiran pemikiran kritis kumpulan pelajar ini, ujian t telah dilaksanakan. Ujian-t sampel bersandar dijalankan bertujuan untuk menilai kesan penggunaan modul Q-STEM terhadap pemikiran kritis pelajar. Keputusan ujian-t sampel bersandar menunjukkan hipotesis nul perlu ditolak. Terdapat perbezaan yang signifikan dalam skor pemikiran kritis daripada ujian pra (μ = 41.22, σ = 5.36) kepada ujian pasca (μ = 71.42, σ = 9.12), t (31) = -18.15, p < 0.05, dengan kesan saiz yang besar (d = 0.95) seperti yang dinyatakan oleh Cohen (1992) bahawa nilai kesan saiz yang melebihi 0.80 adalah besar. Ini membuktikan bahawa intervensi Q-PjBL STEM memberikan perbezaan yang besar dalam pemikiran pelajar apabila nilai kesan saiz yang ditunjukkan ialah = 0.95 (> 0.80). Seterusnya transkrip temubual dan refleksi pelajar digunakan bagi melihat perkembangan proses pemikiran kritis pelajar setelah menjalani intervensi. Hasil daripada temubual dan refleksi pelajar, enam orang pelajar yang terpilih untuk ditemubual telah menonjolkan beberapa elemen kritis mengikut fasa pembelajaran berasaskan projek. Selain itu elemen pemikiran kritis yang ditonjolkan juga turut bertambah seiring dengan tema pembelajaran yang mereka laksanakan mengikut modul. Diakhir analisis ini, satu kerangka proses pemikiran kritis berdasarkan modul Q-PjBL STEM telah dihasilkan seperti dalam rajah dibawah.

Rajah 1.0 Kerangka pemikiran proses pemikiran kritis berdasarkan modul Q-PjBL STEM

Maklumat berkaitan

Walaupun modul Q-PjBL STEM ini mengandungkan kandungan yang menggabungkan potongan ayat Al-Quran dan pendidikan STEM, modul ini boleh digunakan oleh pelbagai latar belakang pelajar kerana potongan ayat Al-Quran digunakan bertujuan untuk membantu pelajar menjana pemikiran kritis mereka dengan membuat hubungkan potongan ayat Al-Quran dengan konsep sains yang dipelajari. Selain itu, walaupun modul ini menggunakan pendekatan pembelajaran berasaskan projek, pelajar hanya menggunakan bahan-bahan terpakai yang diperolehi dari persekitaran rumah mereka sahaja untuk membina prototype selain bahan dan alatan radas makmal yang biasa. Oleh itu, semua mini projek yang dijalankan tidak akan melibatkan kos yang tinggi kerana fokus utama modul ini adalah untuk meningkatkan kemahiran kritis pelajar dalam menyelesaikan masalah yang diberikan sebagai penyediaan untuk mereka menghadapi alam pekerjaan yang memerlukan daya pemikiran kritis yang tinggi.

Penghargaan

Kami mengucapkan terima kasih kepada Universiti Teknologi Malaysia (UTM) dan Kementerian Pendidikan Malaysia (MoE) atas sokongan dan penganugerah Geran Penyelidikan Universiti (Q.J130000.2531.13H69).

Rujukan


Snazzy Sets Game Cards

Nurul Huda Abdul Wahab¹, Kalaiaarasi A/P Nadarajan², Norhasniza Ibrahim³ & Nur Husna Abd. Wahid⁴

¹Sekolah Pendidikan, Universiti Teknologi Malaysia, n.huda1985@graduate.utm.my
²Sekolah Pendidikan, Universiti Teknologi Malaysia, kalaiarasi.n@graduate.utm.my
³Sekolah Pendidikan, Universiti Teknologi Malaysia, p-norhaniza@utm.my,
⁴Sekolah Pendidikan, Universiti Teknologi Malaysia, husna@utm.my

Abstract
Mathematics is often considered difficult by students. Introduction to Sets is quite tough to be mastered by some students. The problems are caused by lack of understanding the symbolization and conceptual aspects of Sets, errors made by students and associated misconception in Sets. Hence, this study was conducted to introduce a product named Snazzy Sets Game Cards as a teaching aid in order to help students to build a strong understanding about Sets topics through game based learning approach. Respondents involved in this study consisted of 19 students of Form 2A5 in SMK Sultan Abdul Jalil, Kluang. Research design was carried out based on ADDIE Model. A pre-test was administering to record students’ achievement in Introduction to Sets. Based on pre-test analysis, all respondents cannot achieve a minimum score of 40%. This indicated that their achievement level was low and weak. All respondents were then introduced to Snazzy Sets Game Cards in teaching and learning session. After that, a post-test was administered to all respondents. There was a significant difference in performance score between pre-test and post-test; in which all respondents’ score are above 60% in the post-test. Through questionnaire conducted to students and teachers about the suitability of the product, they found that the product was interesting and can be used at any time in any where without relying on technology. The findings of this study provide an alternative method for teachers to improve the understanding and achievement of students in Introduction to Sets.

Keyword: Mathematics, Introduction to Sets, Venn Diagram
eStatsTh!nk: Enhancing Statistical Thinking (ST) through Blended Learning (BL) among Postgraduates in Education

Rosmawati Ismail
Department of Educational Sciences, Mathematics and Creative Multimedia, Universiti Teknologi Malaysia, 81310 Skudai, Johor, Malaysia.
rosmawati.ismail911@gmail.com

Zaleha Ismail, Yudariah Mohammad Yusof
Department of Educational Sciences, Mathematics and Creative Multimedia, Department of Mathematical Sciences, Universiti Teknologi Malaysia, 81310 Skudai, Johor, Malaysia.
p-zaleha@utm.my, yudariah@utm.my

Highlights:
Towards empowering 21st century learning and 4.0 industrial revolution, a new blended learning environment namely eStatsTh!nk that blends collaborative learning, scenario based learning, flipped classroom, face-to-face instructions and computer based learning approach with aims at enhancing statistical thinking skills has been introduced. eStatsTh!nk integrates open source statistical software, video, online game-based learning and MOODLE as the means to support learning through various approaches in postgraduate course known as Statistics for educational research. The environment provides various tools and pedagogical approaches to meet needs of diversified learners with different backgrounds. From the implementation for several semesters, analysis indicate satisfactory improvement in ST such that the postgraduates have become successful novice researchers.

Key words: Statistical Thinking Skills, Collaborative Learning, Online Game-based learning, Video, PSPP

Introduction
Statistical thinking is one of the essential sub-skills in the 21st century learning. For postgraduates whose work heavily focus on research, ST is required to understand previous researches as well as in preparing research report in particular on the data analysis, interpretation and generating results ST. Errors in analyzing and reporting statistical data were frequently found in many research report prepared by postgraduates who are considered as novice researchers. Based on these concerns, measures should be taken to improve statistical thinking among novice researchers who are expected to share their findings in conferences and publications. Chance et al (2000) urged that statistical thinking should be improved by incorporating technology in instructions.

Content
Objectives eStatsTh!nk:
The objectives of eStatsTh!nk as a new blended learning environment are;

1. To improve ST through blended learning environment
2. To create an environment that provide various tools and pedagogical approaches to meet the needs of diversified learners

Development of eStatsThink:

(a) Analyze
Preliminary were conducted to determine the level of students’ statistical thinking among postgraduates’ students. It showed that, student weak in representing data as one of construct statistical thinking skills. So, this blended learning environment were introduced to improve the weakness.

(b) Design
Statistics education changes begins with calculation oriented and final answer, finally used technology as a tools or medium to interpret and analysing the answers (Franklin, Garfield, 2006). Moreover, teaching approach also changed from teacher-centered to student-centered. Student-centered approach is more effective in helping to improve students’ statistical thinking. Furthermore, a positive and effective class environment will awaken students’ statistical thinking (Garfield, 2008). Figure 1 below shows the eStatsTh!nk learning environment was introduced in this course.
eStatsThink is a new blended learning environment which aims in giving opportunity to students to collaborate with their groups, sharing, justifying and elaborate their ideas to enhance their statistical thinking skills. This blended learning environment practically were used recently in higher education instructions. Instructions theory by Carman (2005) produced five key elements for blended learning were (1) live event, (2) online content, (3) collaboration, (4) assessment and (5) reference materials. Theoretical foundations of statistical thinking in this environment are based from Jones et al. (2000), Garfield (2002) and Carman (2005) to enhance students’ statistical thinking skills especially for postgraduates’ student. eStatsThink implements the online game-based learning, discussion forum page through e-learning and WhatsApp group discussion and using free statistical software will give opportunity to collaborate with their group members, justify and elaborate their result and ideas to enhance students’ statistical thinking skills. eStatsThink has features that can promote student-centered learning since teacher or tutor just need to facilitate the student during the discussion and hands-on activity.

(c) Develop various with special features

The open source GNU-PSP was used because it is a free software application unlike SPSS which need licence and expensive. Some lab based tasks to support learning ST with GNUPP was developed. GNU PSP as one of free statistical software which is used compared SPSS to lessen the burden of our student in buying the licensed software. So, this is one of solution by using the free statistical software rather than using the illegal software.

A video which portray ST through a scenario highlighting Malaysian culture add fun to learning. Statistics education changes begins with calculation oriented and final answer, finally used technology as a tools or medium to interpret and analysing the answers (Franklin, Garfield, 2006). Moreover, teaching approach also changed from teacher-centered to student-centered. Student-centered approach is more effective in helping to improve students’ statistical thinking. Furthermore, a positive and effective class environment will awaken students’ statistical thinking (Garfield, 2008). Figure 1 below shows the eStatsThink learning environment was introduced in this course.

Online game-based learning helps teachers to create better teaching and learning environments. What is even more advantageous is that these could be presented at different stages of lessons, at the most appropriate moment to create a positive atmosphere that enhances learning without forcing students to “thinking about their learning”. In spite of that, teachers should consider when or what kind of games are to be incorporated by analysing different factors such as aim of the lesson and students’ prior knowledge. Currently, we found that widely used online tools that are readily available to customize their teaching for their students such as “Quizizz” since it is the most viable and practical with statistics education. Quizizz allows students to compete with each other and motivates them to study. Students take the quiz at the same time in class and see their live ranking on the leader board. Instructors can monitor the process and download the report when the quiz is finished to evaluate student’s performance. Using this app in the statistics education classroom helps stimulate students’ interest and improve students’ engagement (Fang, 2019).

(d) Implement

eStatsThink was implemented for four semesters in Statistics for educational research course. Teacher was applied the new learning environment actively and found that, students more interested and enjoy taking this course. Moreover, along four semesters, shows the improvement of students’ performance in Statistics.
there are no student fail in this course.

(e) Evaluate

The study for eStatsTh!nk has been carried out from the researcher in statistics education classroom for postgraduates’ education. Findings showed that, 71.43% (15 of 21 students) got A and 28.57% (6 of 21 students) got B whereas all students pass the final examination on statistics subject than previous semester which is 14.89% students not pass the final examination. Table 1 below also shows students has increased their marks in each construct of ST from midterm to final examination. This finding proved that even though the respondents came from different background field of study, eStatsTh!nk learning environment does help students to interact and enhance their statistical thinking skills especially construct of representing data through the provided tools and methods. Moreover, eStatsTh!nk also helps teachers or tutor in facilitating or scaffold their students with their peers in the discussion and hands-on activity freely.

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Increased (%) 80.96% 33.33% 28.57% 80.95%

The videos in eStatsTh!nk learning environment has been copyrighted under Universiti Teknologi Malaysia. This video can be commercialized to teachers, students and learning institutions where they can pay to access or to use as the learning process.

References


Garfield, J., Ben- Zvi, D., and Zieffler, A. (2008). Developing Students’ Statistical Reasoning: Connecting Research and...


Award


Won bronze medal in International University Carnival on e-learning (IUCEL 2016)
Transferring Astronomy Knowledge through Service Learning Approach

Othman Zainon

Department of Geoinformation, Faculty of Built Environment and Surveying, Universiti Teknologi Malaysia othmanz.kl@utm.my

Highlights:

Astronomy is the science of celestial observation and evaluation involving celestial objects and events that happened outside the earth’s atmosphere. However, some students have problem to understand some basic concept of astronomy. Therefore, there is a need to have an innovative approach for transferring the astronomy knowledge to the primary and secondary school students to get better understanding the knowledge of astronomy. This project was presented for transferring the knowledge of astronomy by using Service-Learning approach. This innovative astronomy service learning approach consists of five activities namely Astronomy Talks, Workshop, Exhibition, Stargazing and Space Exploration.

Key words: Astronomy; Service Learning; Knowledge Transfer; Approach; Innovative

Introduction

Knowledge of astronomy is often referred to as Queen in science (queen of science) almost in all human culture. Astronomy is very unique discipline, which combines the disciplines of physics, space science, theoretical mathematics, optics, jurisprudence and others branches of science discipline. The science of astronomy is often referred to as the queen of science in almost every human culture. People in ancient times were observed celestial objects, especially the Sun and Moon for the purpose of determining the time, day and season. Astronomy is a very interesting field because involving concepts that related to everyday phenomena. This has result the creation of equipment such as sundial to measure time, telescope for observation and quadrant for measuring angle. However, according to Parker and Heywood (1998), Sharp (1996), Summers and Manti (1995) not all suffered can provide a clear picture to the observer because the concepts involved in the phenomena of nature difficult to understand but very difficult explained scientifically. Reconciliation and the combined ideas of everyday phenomena observation with the concepts learned in the classroom usually produce misunderstandings concept or misconception. However, there is still no appropriate teaching and learning approach for school students and higher learning institution students to get a better understanding in the field of astronomy.

Therefore, an innovative NALI approach has been utilized to transferring the astronomy knowledge through Service Learning to the primary and secondary school students. This project was presented for transferring the knowledge of astronomy by using service learning approach. Service Learning is a teaching and learning method that integrates community involvement and service with academic coursework. It focuses on critical and reflective thinking. Students gain a deeper and more practical understanding of the course content through participation in service related to current social problems and critical reflection of the experiences. Through service-learning, students learn not only from the instructor and the text, but also from the clients served, from the community agency personnel, and from themselves. As part of the service-learning experience, students work with both individual clients and the agency itself.

Project Objective

The objectives of this project are first to increase understanding of the theoretical issues being addressed in the classroom. Second to stimulate critical thinking about the social arrangements discussed in the classroom and third objective is to gain a comprehensive view of the needs of the community being served. This Service Learning approach can motivate the student to get better understanding the knowledge of astronomy.

Research Methodology

According to Yoder (2006), service learning program must be an academic activity. The service learning implementation can be divided into three phases (Nadianatra Musa, et. al., 2017), namely, Phase 1: Service Learning Planning, Analysis and Design, Phase 2: Service Learning Delivery and Phase 3: Service Learning Evaluation, Reflection and Monitoring. Phase 1 involves planning, identifying and analysing problems or opportunities and incorporates the service learning and information systems development processes and activities. Firstly students were given the basic knowledge of astronomy and skills for about 9 weeks of curriculum schedule. The service learning will conducted at the 12 or 13 weeks of the semester. At the same time, students were also given a freedom to discuss the committee members. They also given a time to identify and analyse the problem or opportunities to conduct service learning at a selected community. The students must integrate the service learning within the curriculum, based on the requirements, needs and direction of the faculty programme. The nature of project should reflect the contents of the syllabus, community needs, and reflection on service learning activities. Next the students were required to attend the Briefing Session with Service Learning Committee and Lecturers involved in the course during the second week of semester. During the session, they were given the details of service learning and its
implementation including service learning requirements, guidelines and ethics, insurance coverage, driving licence and UTM safety precautions, list of villages, list of schools involved, list of SL supervisors and list of Community supervisors. After the briefing, each group of student needs to write a full proposal include the financial requirement, which normally determined by size and nature of the project, a size of class and scale of service learning implementation. Budget plan should be conducted to ensure service learning project can be implemented effectively and efficiently within the community. The students also must make sure that the technical support and IT requirements (software and hardware) of student, faculty and community. As part of the fieldwork for SL program, students are required to conduct 3 visits: (1) early semester, (2) middle semester and (3) end of semester. The first visit is important meeting between students, community and supervisor or instructor because students will be introduced to community by supervisor and students will collect data from community regarding their collaboration project before students accomplish the task. In the second visit, students will present their works to community and get feedback for improvement. In the final visit, students will hand over the products/modules to community and project closure.

Phase 2 is focusing more on the service learning implementation of faculty course within the community. This innovative astronomy service learning project normally is implementing for one or two days programme. The project consists of five activities namely Astronomy Talks, Workshop, Exhibition, Stargazing and Space Explorace as shown in Figure 1. First activity is the astronomy talks usually presented at one hour talks by expert or student. Second activity, the student will give about one hour to look and get some information at the mini astronomy exhibition and the participant will give a short quizzes. The third activity is the community will expose about one hour to the hands on workshop on astronomy. At the fourth activity, the students were given a chance to deliver the knowledge of astronomy that they have absorbed from the three activities before in the space explorace games. The students will divide in a groups and then they have to solve and complete the problem that given at four or five checkpoints. Finally fifth activity involve the interesting part is the stargazing activity using the telescope to observer the moon and planet at the night sky.

Phase 3 is the final task, reflection and evaluation stage. The students were asked to complete their tasks and reflect in terms of learning units they have learned, individual development, soft skill, communication skill, technical skill. Students are required to complete their student reflection form and student log book. The student reflection acquires information such as experience and responsibility as a citizen, knowledge and skills gained during service learning, the impact of service learning to community, the degree of understanding of the course and character traits. Students also need to present their works at university and lecturers will evaluate their works. Lecturers who are teaching the course can also reflect on the contribution of service learning to the course content and faculty program. The participation also required to do reflection in terms of community impact and university-community relationships.

### Finding and discussion

During the last visit by the students, the supervisor and community supervisor will evaluate the students in terms of various aspects including student-community relationship, communication skills, quality of work and performance, knowledge and skills. The participation is given a set of questionnaire for them to fill-in on the knowledge delivery and output of the service learning. The participation also required to do reflection in terms of community impact and university-community relationships.

### Table 1: Participation responds on the implementation of the project

<table>
<thead>
<tr>
<th>School name</th>
<th>No. of participant</th>
<th>Q1</th>
<th>Q2</th>
<th>Q3</th>
</tr>
</thead>
<tbody>
<tr>
<td>SMK Seri Pulai Perdana</td>
<td>43</td>
<td>39% (Yes)/61% (No)</td>
<td>84% (Yes)/16% (No)</td>
<td>100% (Yes)/0% (No)</td>
</tr>
<tr>
<td>SK Pengkalan Raja</td>
<td>60</td>
<td>31% (Yes)/69% (No)</td>
<td>80% (Yes)/20% (No)</td>
<td>90% (Yes)/10% (No)</td>
</tr>
</tbody>
</table>
Q1 - measurement of the level of knowledge of the participants about this technology/knowledge
Q2 - Do after the project is carried out, the participant have mastered the skill of part or whole of this method/technology
Q3 – This Project is very necessary

Besides, the students who involve as the facilitators also need to give their reflection on the implementation and their experience in handling the SL project. Following are the reflections given by the students and the community:

“Astronomical Literacy camp has successfully implemented on the date of 19.04.2019 up to 20.04.2019. On that date we have collaborated with the Museum of Kota Tinggi. The purpose of this camp is conducted to provide and improve the understanding and awareness of the knowledge of astronomy to students, especially primary school students. The purpose of the camp was held also to open the mind and knowledge to the students to explore the knowledge of astronomy. The objective of this camp students acquire and apply the knowledge and techniques learned during the Camp Program Literacy astronomy and capable of producing students who have “soft Skills” are high.”

“I would like to take this opportunity to thank all parties involved in the success of a service learning program entitled “Space Exploration Mission”. If without the cooperation of all parties, this programme will not be carried out smoothly and successfully. The program was held at the Kota Tinggi Museum for two days, from 18 April until 19 April 2019. Before the program, there is a lot of preparation has been made by the group members. My responsibility was entrusted to create posters and banner and involved in the exhibition session. I feel lucky to be able to apply their knowledge in the field of knowledge-creation of graphics. Not only that, I have worked with two other group members in providing video and exhibition to showcase session later.”

“Congratulations and thank you to UTM! This SL project is good, and we are very happy and looking forward to having more projects in future. SL project should be taken as a good example not only to local universities and private universities should incorporate this as well in their studies.”- Guru Besar SK Pengkalan Raja

Other information

This innovative service learning project has the potential to commercialize in the future for others higher education institutions that have astronomy courses with the five activities namely Astronomy Talks, Workshop, Exhibition, Stargazing and Space Explore.

This project also has received a silver award by the title “Astronomical Educational Kit” at Innovative Practises in Education and Industry Exhibition (I-PEINX) 2016

Acknowledgement

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Implementation of Active Learning Approach in Teaching Environmental Management Course

Norelyza Hussien
School of Civil Engineering, Faculty of Engineering, Universiti Teknologi Malaysia, 81310 Skudai, Johor.
norelyza@utm.my

Azmahani Abdul Aziz, Sitti Asmah Hassan, Siti Norafidah Jusoh, Nur Syamimi Zaidi, Khalida Muda, Mohd Badruddin Mohd Yusof, Shazwin Mat Taib
School of Civil Engineering, Faculty of Engineering, Universiti Teknologi Malaysia, 81310 Skudai, Johor
azmahani@utm.my, sasmah@utm.my, snorafida@utm.my, nsym@utm.my, khalida@utm.my, mbadruddin@utm.my, shazwin@utm.my

Highlights:
Active learning is an approach which emphasizes on the engagement of the learners with the course content that able to escalate the understanding of the learners on the subject matter. This study was conducted to analyse the students’ performance for Environmental Management course as active learning approach is applied in teaching and learning activities. This study was carried out for 5 groups of third year civil engineering students who enrolled in Environmental Management course for 5 different semesters. It was found that promoting active learning approach in lecture had improved student’s performance in Environmental Management course, especially in problem analysis skill.

Key words: active learning; student-centred; teaching activities

Introduction
Environmental management principle is becoming an important topic in academic, industrial and government environments. As the world moving towards sustainable idea, environmental management topic becomes a vital aspect to aid the transition of society and economy toward a brighter future. The next generation of professionals such as engineer must embed good environmental management within their practice. Integration of good environmental management principle can be introduced and emphasized via education at school and university level. For education to be effective, students must be engaged with deep understanding of good environmental management (Summerton et al., 2018). In order to achieve such engagement, an interactive teaching and learning approach such as active learning method is applied in teaching environment.

Active learning is a learning approach which the students are actively involved in teaching and learning activities rather than simply listening (Freeman et al., 2014; Mello& Less, 2013; Prince, 2004). This approach helps to develop generic skill as well as nurturing higher-order thinking skill among learners (Freeman et al., 2014). There are a variety of methodologies that can be implemented to enable active learning including collaborative learning, project-based learning, cooperative learning and problem-based learning (Prince, 2004; Livingstone& Lynch, 2000). Many studies also indicate the effectiveness of active learning in improving students' performance (Freeman et al., 2014; Mello& Less, 2013; Stowe, 2010; Prince, 2004). Therefore, this study is conducted to evaluate the effectiveness of active learning approach in improving civil engineering students' performance in Environmental Management course.

Project Objectives
The objective of the study is to evaluate the effectiveness of active learning approach in improving the performance of third-year Bachelor of Civil Engineering students of Universiti Teknologi Malaysia that enrolled in Environmental Management course.

Active Learning Approach in Environmental Management Course
Initially, the content of the Environmental Management course was delivered using a conventional method which is lecturing. However, as the university is demanded to produce graduates that have excellent and diverse skills in generic and higher-order thinking aspect, the assessment of the students’ performance for Environmental Management course was upgraded. But the students showed low achievement as the assessment was changed, which indicate the necessity to improve the teaching and learning method to be aligned with the assessment. Therefore, the active learning approach is introduced in the course with the intention to improve the students’ performance. Activities such as brainstorming, think-pair-share, jigsaw, gallery walk, project-based learning and case study were implemented during the course. Active and collaborative learning environments were introduced to shift the learning environment to student-centered learning. The online learning platform such UTM e-learning, padlet and kahoot were also used to upload learning materials such as notes, videos and assignments, conduct forum and feedback as well as communication platform, especially on project-based monitoring progress.
For every class conducted, the students are informed on the purpose of the learning outcome (as stated in the course information) and the expectation of skill acquire from the learning activities. The book-ends approach was used during teaching and learning activities. The approach divides the class into 3 segments namely advanced organizer, intermittent discussion and closure focused discussion (Smith, 2000). Advance organizer is a part where the students are introduced to learning topic; intermittent discussion is a segment that students can discuss on the learning topic (most of the active learning activities happen during this section), and; closure focused discussion is a segment of summarization of class session. The performance of the students was assessed based on the four (4) course learning outcomes as listed in Table 1.

Table 1: Course learning outcomes of Environmental Management Course

<table>
<thead>
<tr>
<th>No.</th>
<th>Course Learning Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>CLO1</td>
<td>Identify the principle aspects that cause environmental pollution and classify the various types of environmental pollution</td>
</tr>
<tr>
<td>CLO2</td>
<td>Investigate and analyze the environmental impact and consequences to environmental component due to the presence of environmental pollutant</td>
</tr>
<tr>
<td>CLO3</td>
<td>Investigate and differentiate various mitigation measure and appropriate methods of environmental control to solve environment related problems towards sustainable development</td>
</tr>
<tr>
<td>CLO4</td>
<td>Produce report or presentation on the given case study that is related to current environmental issues</td>
</tr>
</tbody>
</table>

Research Methodology

This study was carried out among five (5) groups of third-year civil engineering students who enrolled in Environmental Management course for five (5) different semesters. For the first two semesters (semester 2 2016/2017 and semester 1 2017/2018), the teaching and learning approach used in the class is mainly lecturing, while, for 3 other semesters, the active learning approach is extensively used in the class. The performance of the students was compared and analyzed based on the teaching and learning approach used in the class.

Findings

Figure 1 shows the percentage of students achieved marks exceed 65% in Environmental Management course for each learning outcome for 5 different semesters. The figure indicates the low achievement for every CLO except for CLO4 for semester 2 2016/2017 and semester 1 2017/2018. However, the students’ achievement of CLO1, CLO2 and CLO3 improved for semester 2 2017/2018 and onwards. While, the percentage of students achieved marks above 65% decreased for CLO4 in semester 2 2017/2018, but increase again for semester 1 2018/2019 and semester 2 2018/2019. As CLO2 and CLO3 showed increment percentage of students getting marks above 65%, the CLO1 showed fluctuation trend as the lowest percentage recorded for semester 2 2016/2017 (28.6%) and the highest percentage recorded on semester 2 2017/2018 (77%).

Figure 2: Percentage of students achieved marks above 65% for every course learning outcomes of Environmental Management course
Significant improvement of students’ performance can be seen from Figure 1 especially for CLO2 and CLO3 as the active learning approach is implemented in Environmental Management course. Both CLOs measured the problem analysis skill and the active learning proven to aid in nurturing higher-order thinking skill. Activities such as brainstorming, think-pair-share, project-based learning and case study that conducted during the course, frequently used environmental related issues to be analyzed and these methods also require the students to provide solution and mitigation measure. As the students usually exposed to these kinds of teaching and learning activities, more than 90% of the students achieved marks above 65% for semester 2 2017/2018 and onwards.

The figure also illustrates that active learning approach able to improve student achievement drastically as all CLOs for semester 2 2017/2018 (the first semester that active learning approach implemented in the course) obtained percentage above 70% as compared to percentage of CLO1, CLO2 and CLO3 for previous two semesters that unable to exceed 45% achievement. Though, the percentage of students achieved marks above 65% shows escalation as the active learning approach implemented in the course, percentage of CLO1 that measure fundamental knowledge was lower for semester 1 2018/2019 and semester 2 2018/2019 as compared to semester 2 2017/2018. This is probably due to the number of students enrolled in the course which were 31, 43 and 52 students for semester 2 2017/2018, semester 1 2018/2019 and semester 2 2018/2019 respectively. The number of students in the class plays a significant role in the effectiveness of active learning approach as the active learning is particularly beneficial in small classes (Freeman et al., 2014). Moreover, the insufficient facilities to facilitate active learning activities may become drawback in the implementation of the active learning approach. Therefore, it is important to provide a conducive environment to optimize the active learning approach in the class.

Conclusion

The study showed the active learning approach able to improve the students’ performance for Environmental Management course especially in analyzing the environmental management problem issues. Eventually, it will help in nurturing higher-order thinking skill. However, conducive environment such as numbers of students enrol for the course and sufficient facilities need to be emphasized to ensure the effectiveness of active learning approach.

References


Continuous Teaching and Learning Process for SKEE1013

Madihah Md Rasid, Dalila Md Said, Noorazlinda Ahmad, Mohd Kamarudin Abd Hamid

Abstract

Course of Electrical Circuit Analysis, SKEE1013 is offered to first year students. In this course, students are exposed to the basic electrical circuit theory where it is essential for electrical engineering students. There are three learning outcomes of this course. One of them is, students should be able to apply concepts of energy storage elements for analysing first and second order transient DC circuits. However, none of the sections achieved this particular outcome on academic session 20172018 because they unable to understand the principle of energy storage itself. As part of the solution to overcome this issue, student-centered learning approach is implemented in section 8 as shown in Figure 1.

This approach including peer instruction activities, group based hands-on activities, various and continuous assessment to ensure the particular outcome is achieved. In this approach, student gained knowledge and understand effectively from activities. Students actively research by doing discussion, peer study and find out information from reference books instead of relying on lecturer. In addition, laboratory experiences is offered to students to enhance their understanding. This approach is successfully implemented on academic session 20182019, and as the result, only section 8 among of 13 sections achieved this learning outcome.
Sorotan:

Kata Kunci: Transformasi; Pelajar; Fakulti

Pengenalan
Sistem pendidikan di Malaysia menawarkan beberapa jalur program persediaan untuk memasuki universiti seperti program asasi, matrikulasi dan STPM. Dalam konteks ini, pihak universiti berperanan untuk memastikan transisi pembelajaran dan kehidupan pelajar baru dilaksanakan dengan memastikan kepelbagaian latar belakang pelajar. Secara umumnya, pelajar tersebut akan dilihatkan dengan program orientasi universiti yang dilaksanakan sepanjang masa selama seminggu. Bagi Universiti Teknologi Malaysia, program Minggu Mesra Mahasiswa dilaksanakan untuk memberikan penerangan berkenaan universiti, memberikan motivasi, membantu nilai berkembang dan membantu pelajar baru menyesuaikan diri dengan sistem pembelajaran dan kehidupan di dalam kampus.

Walaubagaimanapun, pelajar universiti akan berada di dalam kampus bagi selama masa beberapa tahun untuk melengkapi pengajian. Tambahan pula, kehidupan universiti adalah bertepatan dengan fasa penting pembangunan insan yang selaras dengan usia pelajar universiti (Lewis, H.R., 2006). Malah, kecemerlangan pendidikan universiti harus dibina secara holistik termasuk melibatkan pemupukan nilai murni dan jiwa kemanusiaan untuk setiap komuniti universiti termasuk pelajar (Omar, W., 2009). Justeru, program pembangunan pelajar yang
bermula daripada tahun pertama perlu disusun dengan melihat impak secara jangka masa panjang.

Dengan itu, satu kerangka program pembangunan pelajar yang inklusif dan bersepadu perlu dibangunkan. Tawaran program pembangunan pelajar yang transformatif secara berpusatkan fakulti merupakan inovasi yang dapat dilaksanakan bagi mencapai matlamat tersebut. Ini kerana mengikut amalan konvensional sesuatu universiti, pihak fakulti diberikan tanggungjawab untuk membangunkan prestasi akademik dan nilai ‘intelligence quotient IQ’ pelajar. Manakala, pembangunan kemahiran insaniah serta nilai ‘emotional quotient EQ’ dan ‘spiritual quotient SQ’ menjadi tanggungjawab kolej kadiaman serta pihak dan persatuan umum di luar fakulti.

Sedangkan, kesepaduan pembinaan IQ-EQ-SQ pelajar berpotensi untuk disinggeri di peringkat fakulti. Tambahan pula, proses pemantauan pembangunan setiap pelajar lebih mudah dilakukan di fakulti kerana kewujudan sistem penasihat akademik fakulti. Apa yang perlu dilaksanakan adalah dengan mempertua fungsi sistem penasihat tersebut berhampiran dengan melibatkan portofio selain akademik.

Pembangunan aktiviti pelajar baharu tahun pertama adalah bertujuan membangunkan aspek pengurusan dan kemahiran kendali serta daya juang. Selain itu, pemeriksaan nilai dan karekter positif pula akan membantu membangunkan kecemerlangan akademik dan keperibadian unggul pelajar selari dengan konsep pembelajaran sepanjang hayat. Bagi mencapai matlamat tersebut, antara cadangan aktiviti pelajar baharu adalah melibatkan penerapan amalan dan praktis 7 tabiat yang disusuli dengan kemahiran kelangsungan ikhtiar hidup.

**Kandungan**

Pembangunan program untuk pelajar baharu pada semester awal adalah bagi memenuhi aspirasi membina motivasi pelajar, memupuk semangat kerjasama dan sedia berkhidmat serta meningkatkan kemahiran dan pengurusan diri. Dalam hal ini, tiga matlamat utamanya adalah untuk menerapkan kemahiran berfikir secara kritis dan menyelesaikan masalah, membangunkan kemahiran dan strategi pembelajaran yang lestari, serta menerapkan pembangunan keyakinan, ketahanan dan memupuk semangat daya juang pelajar. Kemahiran ini boleh diterapkan selama dengan pembangunan akademik dan personaliti pelajar universiti pada masa awal.

Sebagai aktiviti yang pertama, pelaksanaan modul tersebut adalah bergantung kepada komitmen yang diberikan oleh ahli fakulti. Dengan itu, satu jawatankuasa pembangunan pelajar perlu dibentuk bagi memudahkan penyelarasan dan pemantauan program bersama penasihat akademik. Seterusnya, caedahan pembangunan modul boleh dilaksanakan secara kreatif seperti melalui bengkel pembelajaran secara aktif, Pelaksanaan sebenar dapat memfasilitasi pelajar didekamkan dengan praktis yang dapat berkekal selama selari dengan mahathmin teori.

Yang pertama, pembangunan modul tersebut adalah bergantung kepada komitmen yang diberikan oleh ahli fakulti. Dengan itu, satu jawatankuasa pembangunan pelajar perlu dibentuk bagi memudahkan penyelarasan dan pemantauan program bersama penasihat akademik. Seterusnya, caedahan pembangunan modul boleh dilaksanakan secara kreatif seperti melalui bengkel pembelajaran secara aktif, Pelaksanaan sebenar dapat memfasilitasi pelajar didekamkan dengan praktis yang dapat berkekal selama selari dengan mahathmin teori.

Mengikut amalan Fakulti Sains, kesepaduan antara modul teori dan interaktif telah berjaya dilaksanakan seperti melalui aktiviti pembelajaran berdasarkan senario, tayangan video dan permainan interaktif. Hal ini adalah penting terutama untuk membina dimensi tabiat yang berkaitan dengan hubungan sesama individu. Selasah tabiat ini yang dinyatakan adalah sesuai dengan pembangunan akademik dan personaliti pelajar universiti pada masa awal.

Sebagai aktiviti yang pertama, pelaksanaan modul tersebut adalah bergantung kepada komitmen yang diberikan oleh ahli fakulti. Dengan itu, satu jawatankuasa pembangunan pelajar perlu dibentuk bagi memudahkan penyelarasan dan pemantauan program bersama penasihat akademik. Seterusnya, caedahan pembangunan modul boleh dilaksanakan secara kreatif seperti melalui bengkel pembelajaran secara aktif, Pelaksanaan sebenar dapat memfasilitasi pelajar didekamkan dengan praktis yang dapat berkekal selama selari dengan mahathmin teori.

**Jadual 1: Persepsi pelajar selepas bengkel modul 7 tabiat**

<table>
<thead>
<tr>
<th>Kriteria Penilaian</th>
<th>Setuju (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mengetahui matlamat dan keutamaan hidup.</td>
<td>84</td>
</tr>
<tr>
<td>Menunjukkan kesungguhan dan keseronokan dalam pembelajaran.</td>
<td>76</td>
</tr>
<tr>
<td>Menunjukkan sikap yang positif terhadap pembelajaran akademik di dalam kelas dan aktiviti pembangunan di luar kelas.</td>
<td>79</td>
</tr>
<tr>
<td>Menunjukkan inisiatif dan semangat sukarela dalam menghadiri dan melaksanakan aktiviti.</td>
<td>75</td>
</tr>
<tr>
<td>Menunjukkan kesungguhan dalam menerima tanggungjawab dan berusaha untuk melaksanakan dengan baik.</td>
<td>81</td>
</tr>
<tr>
<td>Menunjukkan semangat sokakawan dalam semua aktiviti samada di dalam mahupun di luar kelas.</td>
<td>81</td>
</tr>
</tbody>
</table>

Selanjutnya, matlamat pembangunan pelajar tahun pertama dicadangkan dapat dicapai melalui pelaksanaan aktiviti bertujuan ikhtiar hidup di luar kampus. Selain dapat menerapkan pembelajaran 7 tabiat secara amali, program sebenar dapat menguji ketahanan fizikal dan mental pelajar serta menerapkan daya juang terutama
dalam menghadapi situasi sukar. Dengan itu, pelajar dapat mempraktikkan pengetahuan dan kemahiran untuk ikhtiar pembelajaran dan kehidupan mereka semasa berada di universiti.

Fakulti Sains mencadangkan modul ikhtiar hidup berdasarkan beberapa objektif termasuk menyediakan simulasi cabaran yang bakal di hadapi sewaktu pembelajaran yang memerlukan pelajar menggunakan kemahiran berfikir kritis dan penyelesaian masalah. Selain itu, aktiviti turut dirancang bagi menyediakan simulasi keyakinan, daya tahan dan daya juang pelajar bagi menempuh tahun-tahun pembelajaran universiti. Kemudian, pelajar diterapkan dengan aplikasi kemahiran kerjasama dan ikhtiar hidup yang dikaitkan dengan kemahiran dan strategi pembelajaran di universiti. Jadual 2 menunjukkan data peratusan persepsi 59 pelajar Jabatan Kimia, Fakulti Sains UTM yang melibatkan perubahan pengetahuan, kemahiran dan sikap masing-masing selepas mengikuti modul tersebut. Walaupun data tersebut mencatatkan peratusan yang sedikit rendah berbanding modul pertama, aktiviti ini didapat telah memberikan impak yang besar kepada pelajar berdasarkan kajian yang dilakukan terhadap pelajar sebelumnya pada tahun terakhir pengajian mereka. Peratusan yang rendah ini telah dijangkakan kerana pelajar telah mengikut modul yang memerlukan ketahanan fizikal dan mental mereka.

<table>
<thead>
<tr>
<th>Kriteria Penilaian</th>
<th>Setuju (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kebolehan untuk bekerja dan kekal efektif di dalam situasi yang mencabar ketahanan mental dan fizikal.</td>
<td>69</td>
</tr>
<tr>
<td>Kebolehan untuk memahami dan menyuaikan diri dalam melaksanakan pelbagai tugas dan suasana bekerja.</td>
<td>68</td>
</tr>
<tr>
<td>Mampu memberikan komitmen secara berterusan dan mengekalkan fokus dalam apa jua aktiviti yang diberikan.</td>
<td>68</td>
</tr>
<tr>
<td>Mencari penyelesaian dengan menggunakan pelbagai sumber dari dalam dan luar kampus.</td>
<td>66</td>
</tr>
<tr>
<td>Sentiasa berusaha untuk melakukan penambahan dalam pelaksanaan aktiviti dan kemahiran diri sesuai dengan keperluan semasa.</td>
<td>68</td>
</tr>
<tr>
<td>Mengamalkan idea yang kreatif dan inovatif dalam setiap aktiviti yang dilakukan.</td>
<td>66</td>
</tr>
</tbody>
</table>

Kesimpulannya, program pembangunan pelajar yang berpusatkan fakulti menawarkan potensi yang besar dalam membangunkan pelajar universiti yang holistik dan seimbang secara teratur dan berstruktur. Bagi pelajar tahun pertama, pelaksanaan aktiviti segera pada modul-modul yang dicadangkan dapat membantu mereka dalam menyuaikan diri dengan pembelajaran dan pengalaman baharu di universiti. Pada akhirnya, sinergi pihak berkepentingan yang mempunyai pelbagai kepakaran sama ada di peringkat fakulti dan universiti adalah penting bagi menjayakan semua hasrat yang dinyatakan.

Penghargaan

Setinggi penghargaan diucapkan kepada Fakulti Sains, Universiti Teknologi Malaysia.

Rujukan


Non-Conventional L&T Strategies in Soil Mechanics Course: Students Perception towards Knowledge, Motivation and Skills Development

Siti Norafida binti Jusoh, Azmahani Abdul Aziz, Siti Asmah Hassan, Norelyza Hussien, Norzairahetty Mohd. Yunus, Muhammad Azril bin Hezmi, Dayang Zulaikha Abang Hasbollah

Universiti Teknologi Malaysia
snorafida@utm.my, azmahani@utm.my, sasmah@utm.my, norelyza@utm.my, nzairahetty@utm.my, azril@utm.my, dzulaikha@utm.my

Highlights

This study focused on the implementation of non-conventional learning and teaching strategies in teaching Soil Mechanics Course and investigation on what are the impact on students' perceived knowledge, motivation and skills development after undergoing each activities. A number of 51 first year engineering students from School of Civil Engineering, Faculty of Engineering, Universiti Teknologi Malaysia involved in this study. Data were collected via reflective journal after each activities. These finding suggested that the variation strategies of learning and teaching (L&T) give more fun, relax and good insight to classroom environment and thus lead to enrichment of knowledge, increase interest of future geotechnical engineer practises and improve the communication and presentation skills among students.

Key words: Non-conventional learning and teaching; Skills development; Motivation

Introduction

In civil engineering, soil mechanics course is one of important technical subject which deals with complexity of the structure of natural soil strata. This course contains both element of information and mount of analyses in soil work. In spite of inevitable gaps of knowledge on soil conditions, one have to take advantage of all learning and teaching methods (L&T) to at least enrich the engineering students and average engineer to know about soil mechanics proper at present time [Terzaghi et al., 1995]. This is an agreement with what Mohd Yusuf et al. (2016) mentioned that the challenges of the 21st century require engineering graduates who are not only well versed in technical knowledge, but also in professional skills, such as problem solving, team working and communication skills. Therefore, the 21st Century Learning and Teaching initiated by Ministry of Education (MOE) which champions a student-centred learning process is right method to be applied in this course (BERNAMA, 2019). In this study, several strategies in non-conventional learning and teaching (NCTL) has been adopted and implemented in Soil Mechanics course for session 20182019 at School of Civil Engineering, Universiti Teknologi Malaysia.

NCTL strategies can be as a peer activity, cooperative learning, problem solving learning, experiential learning and many more. Cooperative learning methods are very vast in their applications; it is a structure task with class time working in 4 to 6 member heterogeneous groups [Slavin, 1983]. In the meantime, problem solving learning or also known as collaborative problem solving can support students in creating positive peer relationships, which are also beneficial in achieving learning objectives [Roseth et al., 2008]. Beneficial peer interaction in problem-solving situations is based on the group members' positive interdependence, that is, shared objectives and achieving joint success [Haataja et al., 2019].

However, although there has been a considerable amount of work evaluating the effects of different learning and teaching methods, the student perception towards L&T activity to the enrichment of knowledge, motivation to learn and skills development has remained unexplored. Reflection of student perception for each chapter that has been conducted via different L&T strategies during a first year soil mechanics course in this study. As enrichment of knowledge, motivation and skill development is a crucial benefit for engineering student enrichment, this study examines the student perception towards variation of NCTL strategies that directs the educator's momentary interpretations and pedagogical decisions while learning and teaching processes.

Project Objective

The objective of this project is to investigate the implementation of non-conventional learning and teaching (NCTL) strategies in teaching Soil Mechanics Course and what are the impact on students’ perceived knowledge, motivation and skills development after undergoing each activity.

Non-conventional learning and teaching (L&T) Strategies in Soil Mechanics Course

In Soil Mechanics, there are total of four (4) different chapters. All chapters were introduced with different L&T strategies. For the first chapter, the introduction and soil basic properties, students learn of soil origin and composition
thus need to derive equation of soil basic properties and applied it to soil analyses. As this is course teach to first year student, for this chapter; educators introduce a simple non-conventional L&T activities; i.e. the peer discussion activity. Next, in second chapter, a jigsaw activity and gallery walk was performed with 4-6 member heterogeneous groups in total of 10 groups. A visit to laboratory then carried out while in chapter three; soil compaction. Finally, blended learning (combination of video and slide presentation) was applied in last chapter of water in soil. Details of activity in each strategy is presented in Table 1.

<table>
<thead>
<tr>
<th>Chapters</th>
<th>Strategies</th>
<th>Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction and Basic</td>
<td>Peer activity</td>
<td>• Start with individual task, students are given 2 to 3 minutes to search</td>
</tr>
<tr>
<td>Soil properties</td>
<td></td>
<td>information about keywords/new terms in topics via any search engine web</td>
</tr>
<tr>
<td></td>
<td></td>
<td>using their own mobile phone</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Students then were paired to answer a question selectively from three (3)</td>
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<tr>
<td></td>
<td></td>
<td>different questions in class and followed by a group discussion (exchanging</td>
</tr>
<tr>
<td></td>
<td></td>
<td>information with others pair)</td>
</tr>
<tr>
<td>Soil Classifications</td>
<td>Jigsaw and gallery walk</td>
<td>• Task of pre-reading of two different soil classification methods were</td>
</tr>
<tr>
<td></td>
<td></td>
<td>given a week before activity</td>
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<tr>
<td></td>
<td></td>
<td>• In class session, expert of every topic sit in one similar group and</td>
</tr>
<tr>
<td></td>
<td></td>
<td>prepare solution of selected previous final year question in mahjong paper</td>
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<tr>
<td></td>
<td></td>
<td>for 30 to 45 minutes</td>
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<tr>
<td></td>
<td></td>
<td>• All expert involve in activity and need to understand the question and</td>
</tr>
<tr>
<td></td>
<td></td>
<td>solution achieved</td>
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<tr>
<td></td>
<td></td>
<td>• When ready, all home group member gathered again and start with</td>
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<tr>
<td></td>
<td></td>
<td>presentation for 5 to 8 minutes for each gallery</td>
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<tr>
<td></td>
<td></td>
<td>• Finish activity – lecturer wrapped up, suggest correction (when needed)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>and upload the pdf of student presentation in online (Whatsapp/e-learning)</td>
</tr>
<tr>
<td>Soil Compaction</td>
<td>Laboratory visit</td>
<td>• Visit to geotechnics laboratory at M50 for a class session of 2 hours</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Instrumentation of soil compaction such as soil container, compaction</td>
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<tr>
<td></td>
<td></td>
<td>mould and compactor were introduced</td>
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<tr>
<td></td>
<td></td>
<td>• Student then divided into groups of 5 people and carried out guided soil</td>
</tr>
<tr>
<td></td>
<td></td>
<td>compaction curve activity on graph paper</td>
</tr>
<tr>
<td>Water in Soil</td>
<td>Blended learning</td>
<td>• A blended learning consists of presentation video, slide presentation and</td>
</tr>
<tr>
<td></td>
<td></td>
<td>class exercises on flownet and stress diagram were carried out</td>
</tr>
</tbody>
</table>

Research Methodology

The study was carried out among a group of 51 first year Civil Engineering students (61% male and 39% female) took Soil Mechanic course in the academic year of 2018/2019. A qualitative research methodology was carried out to achieve the research objective. Student’s reflections at the end of each activity are collected as data sampling and analyze using thematic analysis.

Result and Discussion

Thematic analysis was employed to analyse the data. Feedback gathered from the students’ reflective journals have raised student’s enrichment of knowledge, motivation to learn/long life learning and skills development as follows:

i) Enrichment of knowledge

Majority of students mentioned that with implementation of variation NCLT methods, they sense the importance of understanding this course. Another reflection, student also mentioned that educators had well planned the teaching content from simple to more complicated (equation derivation) thus help to increase their understanding for whole chapter (R38) and could learn many types of problems in short time (can see variations of questions – R1). One of student even proposed a diagram of equations derivation and showing deep understanding of respective chapter.
Most of the students share positive motivation towards this subject. They mentioned their feelings in sentences such as ‘looking forward to seeing what geotechnical engineering have in store for me in the future’, ‘looking forward for an opportunity to learn more about what would be the challenge and hardship as a future engineer’ and sometimes it was mind blow to me when see and learn all of this knowledge and I get really excited while study this topic’. A student (R29) also stated that ‘will take opportunity share knowledge about soil mechanics to others’.

iii) Skills development

In skill development, as variation of NCLT covers from the simple peer activity, jigsaw/gallery walk, visit to laboratory and blended learning, most of student mentioned development skill in communication, teamwork and self-learning/problem solving. As example, ‘enable me to explain to other students/friends’ – R13; ‘communicate and get along with our classmate well – R27’; ‘this activity (jigsaw/gallery walk) is very effective because we learn by ourselves’ – R6; R1; and ‘can share opinion/idea to others – R10).

On the other hand, students also mentioned that ‘lecturer conducted plentiful interesting activities in our class in order to help us learn better and faster about soil mechanics(R19)’ and ‘lecturer able to engage me in learning process using variety of learning strategies and able to relate the lesson to students’ prior knowledge’[R23]. Another student (R22) stated that ‘all activities we do in our class going very well and very helpful to apply it on the field’. R30 depicts that she ‘had learnt many things from these methods including team working and understanding the topics better and more thoroughly through watching the real processes in videos’. This reflections show that variation of NCLT strategies was an effective and efficient means for this class. Furthermore, NCLT strategies not only focus for enrichment of knowledge, but also offer the opportunity to motivate the students to become an engineer, create communication skills and inspires teamwork. However, the students also expressed the concern of some improvement in conducting the activities such as small the number of member in each teams and time management. Figure 1 shows picture of some activities of NCTL conducted in this course.

**Conclusion**

This study suggests that educators can see on how variation of pedagogical approaches can be effectively implemented in their classroom. Integration of activity relates to course content positively conveyed students’ knowledge, promoted motivation and skill development. All these feedbacks gave a conclusion that the students need the pedagogical approach should be change from teacher centred learning to student centred learning. The selection of activities according to level of chapter is suitable and can be implemented for L&T classes in future.

**Continual improvement**

A few suggestions for continual improvement is as follows:

1. To address point about time management and prior preparation by student before attending the group activity (jigsaw/gallery walk) will help student and educator to have smooth sailing of activities during the class

2. Although gallery walk could not be carried out for longer class session, lecturer has taken action to upload the presentation materials (of all group but with corrections) in online medium, therefore, student could continue to learn and ask (if any) [R19 – luckily, our lecturer had those representatives to post their respective solutions in Whatsapps group so the rest of us are able to continue to study about them] or lecturer can choose to postpone and continue gallery activity in next class session for better understanding.

**References**


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Mobile Learning Apps for Language Listening Skill

Yu Kok Hui
Universiti Teknologi Malaysia, Skudai, Johor
kokhui1985@graduate.utm.my

Muhammad Wajihuddin Johari
Universiti Teknologi Malaysia, Skudai, Johor
wajihuddinjohari@gmail.com

Mohammad Naim Rahim
Universiti Teknologi Malaysia, Skudai, Johor
naim rahim@graduate.utm.my

Norah Md Noor & Zainudin Abu Bakar
School of Education, Faculty Science Social and Humanities,
Universiti Teknologi Malaysia, Skudai, Johor
norah@utm.my & p-zain@utm.my

Highlights:
This Mobile Learning application is an innovation that was built to help students practising their listening skills. Listening skills are seldom highlighted even though it is one of the important skills needed for learning English language. Artyushina & Sheypak (2018) has found that to study English using mobile phones can consolidate our students’ understanding of what is being presented, or further contextualize the language to improve their ability to use it in communicative practice. To study English supposes this process to be non-durable, i.e., not only in the classroom under the guidance of the teacher. So, to study with the help of mobile technologies and handheld gadgets is a good opportunity to improve the quality and effectiveness of English learning anytime/anywhere. So, this product that includes a mobile application and three sets of cards containing the QR codes and questions was built. It is basically designed to enhance students listening skill as preparation for MUET listening test but also recommended for anyone who is interested in improving English language listening skill. The product can help both students and teachers to foster listening.

Key words: mobile learning apps, listening skills, MUET.

Introduction (Project or Innovation)
Several methods had been done to make it easy for both teachers and learners in making an effective language learning session. Learning English as second language in 21st century has become easier by incorporating technology in education. Technological literacy in using computer and technology tools is important to improve productivity and performance in learning (Selfe, 1999 as cited in Abedalla, 2015). Hence, the emergence of Mobile-Assisted Language Learning (MALL) where the usage of smartphones as a medium of learning.

Content (Project or Innovation)
Learners encounter several challenges in learning or acquiring a second language since they may not be speaking the language occasionally. This frustration does not only occur to the learners but also the teachers who are teaching the language. Learning language is associated with four skills which are reading, writing, speaking, and listening. While all skills are important, listening skill is usually overshadowed by the other three. Often people relate knowledge of second language with the ability to speak or write whereas listening is like Cinderella who has been overlooked by the older sisters (Nunan, 2002). Listening is a fundamental skill in communication as quoted by Rost (1994), listening is the ability to formulate thought and to able verbal communication with others.

Due to that, it is important to create a learning kit that able to engage students practicing their English listening skills. So, the overall purpose of this study is to develop mobile application for English language listening practices as well as to determine the students’ perceptions towards the effectiveness and benefits of using mobile application in English language listening practices.

This Mobile Learning Apps consists of a mobile app and question cards. The mobile app is lightweight with only 4.25MB in size. Meanwhile the cards which are categorized into 3 levels: Beginner, Intermediate and Advanced, have dimension of 5 x 3.5 inches. Basically, the Pocket Audio Learning Kit allows users to practice listening anytime and anywhere, provided the users’ phones have internet connection. The mobile app allows the users to scan the QR code from the cards, in order to listen to the audio from the phone. Based on the audio, users will then answer...
the questions provided in the cards. Users are able to check their answers by scanning the QR code from the cards. In addition to that, listening tips and strategies are included in the mobile app.

In order to find out user perceptions on the effectiveness of this product, 10 students who are going to take the MUET exam has been selected as a respondent. The findings of this study highlighted a fact that students learned better when they were involved with technology particularly the mobile application. 70 percent of the participants in this study strongly agreed that they will use this learning kit for practicing English language listening skill. It intended that m-learning really motivated the students to perform better. As found by Atyushina & Sheypak (2018), study English using mobile phones can consolidate our students’ understanding of what is being presented, or further contextualize the language to improve their ability to use it in communicative practice. To study English supposes this process to be non-durable, i.e., not only in the classroom under the guidance of the teacher. So, to study with the help of mobile technologies and handheld gadgets is a good opportunity to improve the quality and effectiveness of English learning anytime/anywhere.

Accordingly, the study highlights on how this learning kit benefits the students to practice English language skill motivationally. Since, students reflected that they are interested to use the mobile application and its cards which really motivated them to enhance their listening comprehension. More ever, there are some other studies that have proven the concomitant role of technology beneficial for language learning (Darmi & Albion, 2014).

Furthermore, teaching and learning with mobile devices became easy for both teachers and learners. Whereas, Azeez & Al Bajalani (2018) claimed that researchers developed effective and authentic instructional materials and delivered on mobile assisted language learning devices (smartphones) when connected to the internet through which accessing the platform on which learning materials were uploaded. The finding of the current study exposes that 70 percent of the participants’ strongly agreed that this learning kit provided a different way than how they learn in school.

In sum, this study highlights a fact that students learned better when they were involved with technology particularly
the mobile application. 70 percent of the participants in this study strongly agreed that they will use this learning kit for practicing English language listening skill.

Conclusion

The idea for this mobile learning apps for listening skills was triggered when we saw students having difficulties in doing their listening test. The reason for the problem occurred is because the students received very few to no exposure and practices pertain to listening skill. Hence, this product has a commercial potential to be accepted by the education community because of the acceptance during proposal and production stages. As a part of education community, it is hoped that this product will be able to be used by all the students.

References


PBL Through Agro-STEM
Thilagavathi Arichanan & Faizal Reza Abidin

Abstract

Project-based learning (PBL) is one of the key elements in the development of new national curriculum. A Science project is an activity carried out individually or in groups to achieve a certain goal that takes a long time and exceeds formal teaching hours. (DSKP Science Form 1 KPM, 2017). The purpose of this research is to share the experience of developing Agro-STEM via a PBL called, "Grow Your Own Food". In this project, Form 1 students worked in a group of 2 prepared their DIY organic fertilizer from edible waste product to grow own vegetable in classroom. A vertical method was adapted for this project. The students also incorporate trading element in this project by planning to market the products to the teachers in our school. Barter system will be used where participants in a transaction directly exchange single use plastic waste to obtain the vegetables. This will help to eradicate single use plastic waste in school environment and create awareness to form a sustainable ecosystem among the school community members. The duration of the project is 4 months. The activities are comprehensive of all four elements in STEM. Besides learning, entrepreneurial culture too will be cultivated through enhancing smart partnership with various stake holder’s activity. The school can convert waste to fertilizer with the collaboration of local council and generate income for school. The students will be able to strengthen their 21st century skills and move towards the 11, 12, and 13th Sustainable Development Goals. PBL will empower and equip the students with necessary knowledge and skills in STEM towards preparing pupils for long-life learning experience. (DSKP Science Form 1 KPM, 2017).
Undergraduate Research Program (UGRP)

Nursyafreena Attan
Department of Chemistry, Faculty of Science, Universiti Teknologi Malaysia
nursyafreena@utm.my

Razali Ismail
Department of Chemistry, Faculty of Science, Universiti Teknologi Malaysia
zali@kimia.fs.utm.my

Hasmerya Maarof
Department of Chemistry, Faculty of Science, Universiti Teknologi Malaysia
hasmerya@kimia.fs.utm.my

Roswanira Abd Wahab
Department of Chemistry, Faculty of Science, Universiti Teknologi Malaysia
roswanira@kimia.fs.utm.my

Nursyafreena Attan
Department of Chemistry, Faculty of Science, Universiti Teknologi Malaysia
nursyafreena@utm.my

Highlights:
Undergraduate Research Program (UGRP) in Department of Science, Faculty of Science provides a research environment for first year student. Scenario-based learning and project-based learning approach are applied to provide continuous experience in real research problem thus improving their research skills before doing final year project. Students able to developed critical thinking, analytical skills and organizing skills through the culture furthermore motivated to continue their studies. This will help UTM sustain and remain strong as a research university.

Key words: Undergraduate research program; Scenario based learning

Introduction (Project or Innovation)
Research culture requires nurturing and continuous life-long learning process. Proper encouragement and support can have a huge impact on the results of research contribution to university. Undergraduate Research Program (UGRP) is aimed to create and promote a sustainable research environment among undergraduate students starting from their freshmen year. This initiative could accelerate research activities and help UTM continuously sustain as a research university.

In this program, students will choose their supervisors based on their research interest. The supervisor will be their mentor for at least a year to learn about research skills and what it need to be a skilled researcher. Through the program, basic research skills will be given to students through seminars, personal mentoring, tagging with someone from research group, making proposals and handling projects.

Program objectives
The objectives of the UGRP are:
1. to create and promote research culture among the undergraduate students starting from their freshmen year in the university,
2. to be a pioneer model in establishing research culture among the academic staffs and students in supporting UTM as a research university and

3. to create opportunities for undergraduate students in establishing their research skills in order to be excellent scientist and as a component of their educational experience.

NALI approach implemented

This UGRP mostly using scenario-based learning approach with real-life situation and virtual interactive to make decision thus solving problems. Students not only have a close engagement with lecturers but they also are provided with research environment practically and understand the nature and consequences of their decision. Through scenario-based learning, students can enhance their experience manifold and make the process motivating, relatable and continuously interesting.

UGRP also use project-based learning to embark research culture with deeper knowledge from active exploration of real-work research problem. At this stage, students are not only knowing but also able to doing work on research that engaging them in solving problem.

This program starts for as early as first year and second semester students with introduction of basic research and establishing their research skills until they are ready to do their final year project. From nurturing process, it will become culture and it may give high impact toward the postgraduate intake.

Impact to Students’ Learning

Some of the impacts to student’s learning from UGRP are as following:

1. Learn new skills, instrumentation, interpretation of data, etc.
2. Communicating the results in the form of poster, oral and written presentations at local, regional, national and international conferences
3. Developing new critical thinking, analytical skills and organizing skills
4. Producing high impact final year project
5. Complete final year project early
6. Publish work in refereed scientific journal, with high quality and recognition
7. Motivated to further studies

Commercialization

URGP is one of a fragment from MyRoadmap at Faculty of Science. MyRoadmap are currently expanding to other faculties in UTM, other universities and even globally. A comprehensive module will be published for commercialization purposes.

Awards Received

Our highest achievement so far was Faculty of Science recently won one of the prestige award in UTM which is Anugerah Kualiti Akademik (AKA) 2018. MyRoadmap won the Best Practices in teaching and learning.
A Prototype of Online Learning Environment for the Purpose of Creative Thinking Cultivation

Azri Syazwan bin Atan
Fakulti Sains Sosial dan Kemanusiaan, Universiti Teknologi Malaysia
azre192@gmail.com

Mohd Shafie bin Rosli
Fakulti Sains Sosial dan Kemanusiaan, Universiti Teknologi Malaysia
shafierosli@utm

Highlights
It’s important that higher education students need to have creative thinking skill as higher institutions courses today intend to develop people with skills in analyzing problems, logical arguments, expecting probabilities and exploring new ideas. Implemented PBL in the e-learning system can create a learning environment to students where they can access anywhere, to enhance their thinking skill where the activity explicit to train them how to brainstorming and seek new development or problem solving activity. In this intervention, the development of framework for enhance creativity thinking is being produce.

Key words: E-Learning; Learning Framework; Creativity

Introduction (Project or Innovation)
As the education environment rapidly change, one of demanded thinking skill that suppose student require are creativity thinking skill. The development of this e-learning environment is aimed for offering interactive learning to enhance level of creativity among undergraduate students at the Faculty of Social Sciences and Humanities, School of Education, University of Technology Malaysia. The effectiveness of this e-learning development were tested with pre and posttests to see the impact of e-learning which is based on integration of Problem Based Learning methods and creative problem solving (CPS) models to produce collaborative learning. This study also examines how learning processes affect creative thinking skills among students of higher education institutions. Impact of this study, it serves as a guide for lecturers, teachers and researchers in enhancing creative thinking. They can refer to how this creative thinking process is implemented, what kind of activities need to be implemented and how students can be helped to shape their creative thinking.

Content (Project or Innovation)
The need for creative thinking skills today not only helps students in university throughout the course of the study, where each of them will involve in research and creative activities. It also one of thinking skill that frequently been challenging for them during interview after graduate where the employer seeks a candidate with a realistic opinion, idealistic and active during discussion or group work. One of agenda Ministry of Education is to produce graduates who are highly marketable and meet the industrial level of expectation, and creativity thinking skill one of the criteria that need to have among fresh graduate and especially candidate how will be a teacher.

Preliminary test was conducted in 2018 before the intervention session take place, 80 student education student were selected using creativity thinking test to measure the latest result level of creativity among them, and surprisingly the marks show mean at 26.96 with minimum marks 9% and the maximum marks 53%, this indicate the level of creativity among education student still at very low level.

The development of ICT in higher education institutions has made teaching and learning bring benefits to organize, structure work and study activities faster and effectively by using e-learning platform. E-learning is a technology that is versatile and impactful to modern education, various studies have been carried out to prove that e-learning has the potential to enhance individual skills such as those conducted by Mohd Shafie Rosli, Baharuddin Aris and Maizah Hura Ahmad (2016), Ahmad Fakharuddin Mat Zin, Mohd Shafie Rosli and Nor Shela Saleh (2019), Sudirman Mustapha, Mohd Shafie Rosli and Nor Shela Saleh (2019). However, few studies have been conducted to study the effectiveness of e-learning in enhancing creative thinking especially among Bachelor of Education students.
Objectives

The objectives of the research are formed, which are

a. To develop e-learning intervention to enhance creative thinking

Content (Project or Innovation)

This study aims to produce an effective lesson framework using e-learning (Moodle) as a platform base a Creative Problem Solving Model to enhance creative thinking toward student.

Development methods was implemented using Alex Osborn’s CPS model as the main structural of lesson plan, integrated in the learning activities in e-learning environment using moodle as application for teaching and learning to achieve the aims and objectives of the study, which is to enhance students’ creative thinking skills. In formulate the learning activity, all of the seven key aspect has been apply to a related and suitable learning activities, and the pre and posttest using creativity thinking test customize base on Torrance Thinking Creative Test (TTCT) to measure the level of creativity and investigate the effectiveness of the e-learning that been develop.

A quasi experimental research design been used, where by 23 undergraduate student School of Education in UTM were involved during the intervention process using a purposive sampling technique where the criteria such as i) undergraduate student ii) experience using e-learning. Data were collected for 14 weeks in series of time, each week they need to answer semi structured interview open ended question, and after the posttest, three of the student were randomly selected for an interview session, to collects further data in developing lesson framework.

Findings and Discussions

As a result of the findings show the implementation problem-based Learning techniques using CPS integrated in e-learning applications to enhance students’ creative thinking are effective and the result of the framework can provide educators with the tools for teaching purposes.

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Perfecto Mini Studio
Fatanah Khatun bt Ahmad @ Amzah, Noor Khamisah bt Ismail, Napisah bt Sidik & Zulaida bt Awang
Sekolah Pendidikan, Fakulti Sains Sosial & Kemanusiaan, Universiti Teknologi Malaysia, 81310 Skudai, Johor.
fatanah.khatun@mara.gov.my, khamisah1978@gmail.com, napisah.sidik@mara.gov.my, puanzulaida@gmail.com

Abstrak
Portable Mini Studio ini direka untuk memudahkan pelajar mengambil gambar produk untuk aktiviti pemasaran mereka dengan lebih cantik, profesional dan berkesan. Ini adalah bagi memenuhi keperluan silabus E-Technopreneur bagi suptopik Pemasaran Digital bagi pelajar semester 1, 2 dan pelajar Diploma bagi Institusi Kemahiran MARA Tan Sri Yahaya Ahmad, Pekan dan Institusi Pendidikan MARA (IPMa) diseluruh Malaysia. Akibat kekangan dan masalah dalam menghasilkan gambar dengan lebih cantik, maka kami sebagai tenaga pengajar Unit Keusahawanan telah sepakat untuk menghasilkan produk ini bagi kemudahan pelajar. Portable Mini Studio ini direka khas dengan menggunakan Impra Board dengan 5 sisi papan ini boleh dibuka untuk memudahkan penggunaan “props” memungkinkan gambar yang lebih cantik. Produk ini disediakan bersama dengan “wallpaper” bercorak dinding papan dan batu-bata serta alas tapak bercorak rumpun serta diberikan sekali pasu bunga mini dan papan kecil yang boleh ditulis dan di padam. Mini studio ini boleh digunakan dalam berbagai pelbagai sudut mengikut kreativiti dan kesesuaian produk. Produk ini tidak terhad untuk kegunaan pelajar sahaja, namun ia boleh memenuhi pasaran pengguna luar yang menjalankan perniagaan terutama perniagaan di atas talian. Tambahan pula dengan harganya yang mampu milik serta tahan lama serta cukup dengan kelengkapan “props” memungkinkan produk ini akan mendapat sambutan yang hebat.

Kata Kunci: Portable Mini Studio, 5 sisi Impra Board, mini studio

Pengenalan:
Projek yang kami ingin hasilkan ini adalah hasil dari refleksi semasa pengajaran Subjek E-Technopreneur 1, E-Technopreneur 2 dan Digital Entrepreneurship kami iaitu merangkumi pelajar semester 1, 2 dan pelajar Diploma. Pelajar di anggarkan adalah seramai 400 orang pelajar.

Sehubungan dengan itu, subjek yang terlibat ini mempunyai pelbagai mata pelajaran yang menggunakan platform Facebook, Instagram dan juga perisian Whatsapps. Justeru itu, pelajar di kehendaki mengambil gambar produk masing-masing dengan cantik supaya dapat menarik minat para pelanggan untuk membeli produk mereka. Namun begitu, mini studio yang disediakan agak kecil dan tidak mempunyai latar belakang yang bercorak. Kekangan ini akan menyebabkan pelajar masih bermasalah dengan mengambil gambar dengan lebih cantik kerana tidak berkemahiran untuk mengubahsuaian gambar menggunakan aplikasi Photoshop.

Hasil dari soal selidik yang telah dibuat bagi merancang keperluan memudahkan membuat inovasi terhadap mini studio yang sedia ada sekarang, kami dapatkan inovasi tersebut perlu dibuat kerana ia akan memberi pilihan kepada pelajar untuk menghasilkan gambar produk yang lebih cantik dengan menyediakan mini studio yang mempunyai pelbagai latar belakang yang bercorak serta “props” dan boleh diperbentuk daripada pelbagai sudut yang boleh mengoptimumkan kreativiti pelajar. Sehubungan dengan itu, dapat meningkatkan kualiti imej gambar produk yang diambil oleh pelajar yang akan dimuat naik dalam media sosial. Pelajar tidak perlu mempunyai kemahiran menggunakan aplikasi “photoshop” untuk mengubahsuaian gambar. Produk ini juga dapat menghasilkan alat bantu mengajar yang menarik untuk memudahkan proses pengajaran dan pembelajaran dalam kelas.
Kajian Lepas:

Objektif:
Objektif diadakan Mini Studio Portable adalah untuk membantu pelajar mengambil gambar dengan lebih mudah, cantik dan efektif. Portable Mini Studio ini juga mudah untuk di bawa ke mana-mana kerana ia ringan. Portable Mini Studio ini juga boleh digunakan sebagai alat bantu mengajar.

Produk:
Portable Mini Studio ini menggunakan Impra board supaya ia ringan dan mudah untuk dibawa kemana-mana. Ia juga mempunyai 5 sisi yang boleh dibuka dan dicantum bagi memenuhi kehendak pengguna untuk mengambil gambar dari pelbagai sudut. Sesuatu penyambung digunakan bagi mencantumkan 5 permukaan sisi tersebut. Produk ini menggunakan LED bagi mendapatkan pencahayaan yang bagus untuk gambar. Saiz produk kami adalah berukuran 30cm x 30cm x 30cm. Di sampling itu juga, selepas ujian di lakukan, mereka dikehendaki menjawab soalan soal selidik.

Metodologi:
Portable mini studio ini telah menjalani ujian rintis di mana melibatkan 12 orang pelajar dan 2 orang pengajar dari Institut Kemahiran MARA Tan Sri Yahaya Ahmad. Mereka dikehendaki untuk menarik, membuka dan memasang semula mini studio tersebut. Di samping itu juga, selepas ujian di lakukan, mereka dikehendaki menjawab soalan soal selidik.

Kami telah membuat beberapa garis panduan dalam membangunkan produk kami di mana mengikut konsep ADDIE iaitu membuat analisis produk sedia ada dan baru, membuat rekabentuk, membuat pelan pembangunan, perlaksanaan projek dan juga kajian pasaran. Sehubungan dengan itu, produk yang kami ingin buat ini adalah ubahsuaian produk mini studio yang sedia ada. Untuk memastikan kami dapat membuat produk dengan baik, kami telah merangka pembahagian produk dalam membina produk menggunakan Carta Gantt dan perancangan bahan material yang terbaik.

Hasil dapatan:
Hasil dapatan daripada soalan soal selidik melalui aplikasi Google Form, mini studio ini dapat menghasilkan gambar yang cantik dan menarik dan dapat mengatasi masalah utama dalam penghasilan gambar untuk dimuat naik dalam media sosial. 100% responden bersetuju bahawa Portable Mini Studio dapat menghasilkan gambar yang cantik dan menarik sekaligus dapat menyelesaikan masalah utama dalam penghasilan gambar produk. Data menunjukkan inovasi mini studio ini bukan sekadar boleh menyelesaikan masalah pengajaran dan pembelajaran malah mempunyai nilai komersial.

Cadangan:
Portable mini studio ini perlu dibuat lubang pada bahagian atas untuk membolehkan pengguna mengambil gambar sudut dari atas dan pengguna tidak perlu mengangkat sepenuhnya bahagian atas tersebut. Bilangan lampu LED perlu ditambah agar mendapat pencahayaan yang lebih terang memandangkan saiz portable mini studio yang agak besar. Portable mini studio ini boleh direka bentuk agar saiznya boleh dilaraskan sama ada pengguna ingin mendapat saiz yang kecil ataupun besar.

Rumusan:
Projek mini studio ini adalah untuk menyelesaikan masalah menghasilkan gambar produk yang cantik dalam pengajaran dan pembelajaran E-Technopreneur di IKM TSYA, Pekan Pahang dan Institusi Pendidikan MARA lain. Saiz dan bentuk mini studio yang sedia ada menghadkan kreativiti pelajar untuk menghasilkan gambar produk yang cantik. Selain itu, mini studio yang sedia ada memerlukan pelajar mempunyai kemahiran “Photoshop” untuk mengubahsuaikan gambar menjadi lebih cantik sedangkan majoriti pelajar IKM dan IPMa yang lain tidak mempunyai kemahiran tersebut. Hasil dapatan dari soal selidik, responden yang terlibat dengan ujian rintis menguatkannya lagi...
alasan kami untuk mereka bentuk Portable mini studio yang baru. Portable mini studio ini dapat menyelesaikan masalah pelajar dalam pengajaran dan pembelajaran di samping mempunyai komersial untuk dijual kepada peniaga-peniaga “online” dan juga institusi Pendidikan yang lain sebagai alat bantu mengajar memandangkan institusi Pendidikan MARA melaksanakan silihbus Digital Keusahawanan.

Rujukan:


CONCEIVE-DESIGN-IMPLEMENT-OPERATE (CDIO) KNOWLEDGE AND SKILLS FOR INNOVATIVE CAPSTONE PROJECT

Hanifah Jambari, Norjulia Mohamad Nordin, Ishak Taman, Nur Hazirah Noh@Seth, Mohamad Rasidi Pairan

Abstract

Nowadays, the competitions among countries to recruit engineering students as workers do not focus on talents, but also on the reserve of it. The advancement of education in engineering field plays a big part in enhancing comprehensive domestic strength because the scientific revolution will contribute to important modifications of the industrial landscape. Therefore, Conceive-Design-Implement-Operate (CDIO) understanding and techniques are required for enhancing this field of education particularly for innovation of capstone project. Thus, this study was identified student knowledge and skills consist of teamwork, problem-solving, and communication skills of the CDIO in capstone project involved two school which are School of Biosciences & Medical Engineering (SBME) and School of Electrical Engineering (SKE) at Universiti Teknologi Malaysia (UTM). Our respondents consist of 28 and 30 of third-year students from SBME and SKE respectively. Besides, this study also was identified the importance of the CDIO approach in the innovative capstone project. The method that used was a quantitative survey by using 5 Likert scale questionnaires. The average mean for all research questions indicated that the majority of respondents agreed that the CDIO knowledge and skills in the capstone project are important in engineering education. Hence, the engineering students must possess not only the skills such as teamwork, problem-solving, and communication but also needs more knowledge that helps them to employability and adapt to real-world engineering problems.

Background of problem/Issues

Engineering graduates should have several technical knowledge and skills that contribute to enhance and improve their role in business and society and also enable students to perform their work with professionalism and success. Students should have the knowledge and abilities for example; teamwork, communicating skills, solving problems and critical thinking where all these outcomes are present in the CDIO Syllabus outcome which is standard 2 (Zhuang, 2008).

According to Crawley et al., 2014, where the new and global challenges that exist nowadays have proven that those skills are essential in order to improve and enhance an engineer’s masterpiece. All the engineering courses are asked to produce innovative methods in order for their students to acquire soft skills in addition to the core and technical subjects. Teamwork is a vital skill for an engineer to possess as almost every task and projects will have the involvement of two or more professionals in a multidisciplinary line. With that being said, soft skills like management and communicating skills are important for accomplishing objectives and aims effectively and teamwork can also be a very important and useful skill for improving the development of all the skills.

The serious concern of engineering integration – the recognizing process of basic content knowledge with sound pedagogies required to fulfill engineering-oriented curriculum if engineering design – is the way for integration to occur and the teachers need to be completely set to include it into their teaching practice.

Jonassen (2000) stated that a design problem is an example of the most complicated and ambiguous goals kinds of problems that students face. For a student to learn the engineering design, the process needs more involvement more from the teacher which translates to not just entering the class and giving instructions according to a design process, but also explains and guides on how to use or make drawings (Warner, 2003). According to De Miranda et al. (2008), the big problem in this is what preparation and training should the teachers get for them to teach engineering design skills, particularly by the in-service teacher professional development program. Thus this research is investigated either the CDIO knowledge and skills that implemented in SBME and SKE together with the NALI to provide the undergraduate students with the appropriate skills with in line with industry and technology development.

Objectives

The following are the objectives of this study:-

i. To identify the important of CDIO in SKE and SBME for innovative capstone project
ii. To analyse CDIO knowledge for an innovative capstone project.
iii. To analyse CDIO skills for an innovative capstone project.

Methods (Design and Development)

For the purpose of this study, a non-experimental approach was used to identify the importance and the impact of CDIO approach in terms of skills and knowledge for an innovative capstone project. A quantitative data survey of 5
Likert scale questionnaire was used to collect the numeric data among the students. The online survey of the same 5 Likert scale questionnaire using Google form was used specifically for the lecturers.

These researches focused on 58 third year students were selected, where 28 of them are from SBME and the remaining 30 students are from SKE. These students had the experience of conducting the innovation capstone project using the CDIO approaches.

A pilot test was firstly conducted where 5 students was chosen randomly from engineering department to answer the questionnaire. These students are those who also had the experience in conducting the CDIO approach. The Cronbach’s Alpha for the reliability was then calculated. The results obtained by SPSS software recorded the Cronbach’s Alpha of 0.865, reflecting that the instrument has a high degree of reliability.

Findings/Outcome

The quantitative method survey with 5 Likert scales was used in this study. Table 1 displays the standard deviation, mean and median which were calculated using SPSS 18.0 to find which Item the students agree and do not agree with the most. There are two categories of students from different school, namely from the School of Biosciences and Medical Engineering (SBME) and the School of Electrical Engineering (SKE). The results and finding of this study are elaborated in sub-section as follows;

Items the Importance of CDIO in Capstone Project

| No. | Item                                                                 | FBME |  |    | M | E | S               | T | M | E | S | T |
|-----|----------------------------------------------------------------------|------|---|----|---|---|-----------------|---|---|---|---|---|---|
| 1   | CDIO approaches of learning would be a waste of time.                 | 2    | 2 | 1  | 3 | 3 | 1               |   |   |   |   |   |
|     |                                                                     | 0    |   | 0  | 0 |   | 50              |   |   |   |   |   |
|     |                                                                     | 0    |   | 9  | 7 | 7 | 7               |   |   |   |   |   |
| 2   | CDIO requires more time to execute the lesson.                       | 3    | 4 | 1  | 3 | 4 | 0               |   |   |   |   |   |
|     |                                                                     | 0    |   | 0  | 0 |   | 7               |   |   |   |   |   |
|     |                                                                     | 7    |   | 0  | 7 | 7 | 6               |   |   |   |   |   |
|     |                                                                     | 1    |   | 8  | 3 | 3 | 4               |   |   |   |   |   |
| 3   | CDIO strengthens the capabilities and skills of the students.         | 4    | 4 | 1  | 3 | 4 | 0               |   |   |   |   |   |
|     |                                                                     | 0    |   | 0  | 0 |   | 0               |   |   |   |   |   |
|     |                                                                     | 2    |   | 0  | 9 | 9 | 8               |   |   |   |   |   |
|     |                                                                     | 1    |   | 3  | 0 | 3 | 0               |   |   |   |   |   |
| 4   | CDIO approach, teacher must act as facilitator and not a lecturer.   | 4    | 4 | 0  | 4 | 4 | 0               |   |   |   |   |   |
|     |                                                                     | 0    |   | 50 |   |   | 0               |   |   |   |   |   |
|     |                                                                     | 3    |   | 8  | 1 | 1 | 7               |   |   |   |   |   |
|     |                                                                     | 6    |   | 3  | 3 | 3 | 8               |   |   |   |   |   |
| 5   | CDIO motivate students to be independent.                            | 4    | 4 | 0  | 4 | 4 | 0               |   |   |   |   |   |
|     |                                                                     | 0    |   | 0  | 0 |   | 7               |   |   |   |   |   |
|     |                                                                     | 3    |   | 5  | 1 | 1 | 7               |   |   |   |   |   |
|     |                                                                     | 9    |   | 7  | 7 | 7 | 0               |   |   |   |   |   |
| 6   | CDIO help students measure their own performance.                    | 4    | 4 | 0  | 4 | 4 | 0               |   |   |   |   |   |
|     |                                                                     | 0    |   | 0  | 0 |   | 0               |   |   |   |   |   |
|     |                                                                     | 3    |   | 7  | 1 | 1 | 4               |   |   |   |   |   |
|     |                                                                     | 2    |   | 2  | 3 | 3 | 3               |   |   |   |   |   |
| 7   | CDIO promote the responsiveness of the faculties’ activities towards | 4    | 4 | 0  | 4 | 4 | 0               |   |   |   |   |   |
|     | the enhancement of students’ academic performance.                  | 0    |   | 0  | 0 |   | 0               |   |   |   |   |   |
|     |                                                                     | 2    |   | 8  | 0 | 0 | 6               |   |   |   |   |   |
|     |                                                                     | 1    |   | 3  | 0 | 3 | 9               |   |   |   |   |   |
| 8   | CDIO develop the study habits of the students.                       | 3    | 4 | 0  | 4 | 4 | 0               |   |   |   |   |   |
|     |                                                                     | 0    |   | 0  | 0 |   | 0               |   |   |   |   |   |
|     |                                                                     | 0    |   | 7  | 0 | 0 | 8               |   |   |   |   |   |
|     |                                                                     | 5    |   | 3  | 7 | 7 | 3               |   |   |   |   |   |
| 9   | CDIO challenge students to become more competitive.                  | 4    | 4 | 0  | 5 | 4 | 7               |   |   |   |   |   |
|     |                                                                     | 0    |   | 50 |   |   | 0               |   |   |   |   |   |
|     |                                                                     | 3    |   | 7  | 1 | 1 | 3               |   |   |   |   |   |
|     |                                                                     | 9    |   | 4  | 3 | 3 | 9               |   |   |   |   |   |
The mean value for Item 1 until 11, where Item 2 until Item 10 for both faculties recorded that the students mostly “agree” with the statement. Besides, Item 2 recorded the mean value of 2.00 for SBME students, which mean most of the students “disagree” with the statement. However, the result shows the mean value of 3.37 for SKE students reflecting that most of the students chose “neutral” for the statement.

Items for CDIO Knowledge

Table 2 listed the Items for students’ survey of the CDIO knowledge in a capstone project

<table>
<thead>
<tr>
<th>No. Item</th>
<th>SBME</th>
<th>SKE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Median</td>
</tr>
<tr>
<td>12</td>
<td>4.46</td>
<td>4.00</td>
</tr>
<tr>
<td>13</td>
<td>4.64</td>
<td>5.00</td>
</tr>
<tr>
<td>14</td>
<td>4.54</td>
<td>5.00</td>
</tr>
<tr>
<td>15</td>
<td>4.04</td>
<td>4.00</td>
</tr>
<tr>
<td>16</td>
<td>4.50</td>
<td>4.50</td>
</tr>
<tr>
<td>17</td>
<td>4.00</td>
<td>4.00</td>
</tr>
<tr>
<td>18</td>
<td>2.48</td>
<td>2.00</td>
</tr>
</tbody>
</table>

Table 2, shows the item statement about CDIO knowledge of the students for the mean value of item 12 until 18. Item 13 and 14 shows the value of median were different for both faculties. For SBME the median and mean value were 5.00, 4.64 (Std. =0.56) and 4.54 (Std. =0.69) respectively which mean most students strongly agreed with the statements but for SKE the mean and median values were 4.00 (Std. =0.74) for item 2 and the median value was 4.00 with mean value was 4.27 (Std. =0.74) for the item 14. That means, most of students agreed with the statements. The item 12, 15, and 17 the median values for the both faculties was the same which 4.00 with different values of mean.
and standard deviation except item 5 which that the median values was 4.50. But, we can assume most students from both faculties were agreed with that statement. Finally, for the item 18 which that there were different values of median in both faculties which from SBME, the median value was 2.00 and the mean value was 2.48 (Std. =1.42) which mean most of students disagreed with the statement. But, for SKE the median value was 4.00 and mean 3.76 (Std. =1.21) which mean most of student agreed with the statement.

Items for CDIO Skills

<table>
<thead>
<tr>
<th>No.</th>
<th>Item</th>
<th>SBME</th>
<th>SKE</th>
</tr>
</thead>
<tbody>
<tr>
<td>819</td>
<td>Improved student team-working skills. (Teamwork skill)</td>
<td>4.82</td>
<td>4.23</td>
</tr>
<tr>
<td>920</td>
<td>Improved student problem solving skills. (Problem solving)</td>
<td>4.57</td>
<td>4.10</td>
</tr>
<tr>
<td>102</td>
<td>Enjoyable and improve the social skills than formal lectures (Communication skill)</td>
<td>4.29</td>
<td>4.03</td>
</tr>
<tr>
<td>112</td>
<td>Sessions enable student to fully participate as a team member. (Teamwork skill)</td>
<td>4.61</td>
<td>3.93</td>
</tr>
<tr>
<td>122</td>
<td>Develop student responsibility, tolerance, ethics, friendship, and punctuality (Communication skill)</td>
<td>4.64</td>
<td>4.00</td>
</tr>
<tr>
<td>132</td>
<td>Student can design, implement and innovate their product in capstone project. (Problem solving)</td>
<td>4.57</td>
<td>4.07</td>
</tr>
<tr>
<td>142</td>
<td>Student can produce a final product or system in given time. (Problem solving)</td>
<td>4.25</td>
<td>4.23</td>
</tr>
<tr>
<td>152</td>
<td>Student can improve their communicatio n skills. (Communication skill)</td>
<td>4.25</td>
<td>3.73</td>
</tr>
<tr>
<td>162</td>
<td>Students in group can cooperate well and helpfulness each other. (Teamwork skill)</td>
<td>4.25</td>
<td>4.00</td>
</tr>
</tbody>
</table>
Table 3, shows the statement about the CDIO approach that related to the skill for the mean value of item 19 until 26. From the item 19, 20, 22, 23 and 24 the median values for SBME are the same which 5.00 with the different values of mean which are 4.82 (Std. =0.39), 4.57 (Std. =0.50), 4.61 (Std. =0.50), 4.64 (Std. =0.49) and 4.57 (Std. =0.69) respectively, that mean most of the students strongly agreed with that statements. But, the median results shows differently in SKE where the median value was 4 which most students agreed with the statements with the different values of mean which were 4.23 (Std. = 0.90), 4.10 (Std. = 0.76), 3.93 (Std. = 0.87), 4.00 (Std. = 0.59) and 4.07 (Std. = 0.78) respectively. The item 21 26 and 27 shows that the medium value from both faculties are same which 4.00 except for the item 25 and 27 were 4.50 for SBME, but we assumed that most students agreed with the statement with the different values of mean. For SBME the mean values were 4.29 (Std. =0.85), 4.25 (Std. =0.89), 4.25(Std. =0.84 and 4.25 (Std. =0.88) respectively while for SKE the mean values were 4.03 (Std. = 1.03), 4.23 (Std. = 0.77), 3.73 (Std. = 1.26) and 4.00(Std. =0.75).

**Potential for commercialization**

Collaboration with stakeholders for examples Politeknik Malaysia, School and MTUN.

**Technology used**

All the modules use technology for example Arduino, Motor DC, Augmented reality and Virtual reality, mobile and simulation

Incorporation elements of Education 4.0 / 21st Century 4C’s Skills (Collaboration, Communication, Critical Thinking, Creativity)

Referring to Education 4.0 /21st Century 4C’s Skills this CDIO in capstone project students can improve the skills of problem solving, team-working, communication skills, critical thinking and also creativity thinking.

Furthermore the research included differences school which are School of Engineering and School of Biomedical Engineering those apply CDIO effectively to identify the knowledge and skills for implemented capstone project. The research also include testimonial of students who are involve in the capstone project.

**Impact on learning and teaching - Performance, Engagement and Empowerment**

The effectiveness of learning and teaching is more interactive and active learning has been applied which has been approved from results of the survey by using questionnaire.

The IP such as copy write has been registered to protect the research. Furthermore the teaching and learning regarding of capstone project has been involved in the Grand Challenge competition UTM 2018 with awarded as silver medal.
Automobile Virtual Reality Module (AVRM)

Mohd Azman Abas  
School of Mechanical Engineering, Faculty of Engineering  
Universiti Teknologi Malaysia  
81310 Johor Bahru, Johor, Malaysia  

Arman Abd Hamid  
Integrasi Erat Sdn Bhd  
I-83-G & I-83-1, Jalan Teknologi 3/9, Bistari De Kota, PJU 5,  
47810 Petaling Jaya, Selangor, Malaysia

Highlights:
This project develops a virtual reality simulation for the automobile course in the vocational education and training area. The virtual reality trains the student to dismantle and assemble a typical automobile engine. While in the process of that, the virtual reality module simultaneously teaches the student on engine components, systems and operations. The value-added of virtual reality is expected to complement the existing conventional teaching and learning approach in producing industry-ready skills graduates for the automobile industry.

Key words: virtual reality; automobile; vocational; technical; training

Introduction
With a renewed focus and direction given by Prime Minister Tun Dr Mahathir Mohamad to fulfil the national agenda of Vision 2020, Technical and Vocational Education and Training (TVET) education strives to provide a skilled Malaysian workforce which can benefit the industry. According to the Malaysia Education Blueprint, there will be an increase in demand for an additional 1.3 million TVET workers by 2020 in the 12 National Key Economic Areas identified under the government’s Economic Transformation Programme. Polytechnic and Community College Education Department Senior Director, Zainab Ahmad stressed that TVET needs to come up with new curricula to stay relevant in catering the industry’s demand. This must be supported by up-to-date equipment, facilities and machineries for the students. Particularly in the TVET automobile courses, teaching materials which consist of actual car components such as engine, transmission, brake, suspension, tools and equipment are indispensable as part of their training and learning process. A well-known common issue in this is the availability of these teaching materials in institutions for the students to learn from. Some institutions are reported to have outdated materials while some other institutions have insufficient materials to cater to the high number of student entry. In addition, the operational expenses to purchase and maintain these materials are a burden to most institutions. In certain ways, this issue has affected the teaching-learning experiences and effectiveness in the automobile courses. By tackling this issue, it is believed that there is large potential to further increase the quality of graduates as what have been demanded by the industry. Therefore, this project proposes a virtual reality simulation approach, the ‘Automobile Virtual Reality Module’ (AVRM) to compliment the conventional method for the teaching and learning in regard to automobile cars. The AVRM is a virtual reality experience that trains the student to dismantle and assemble a typical automobile engine. The AVRM simultaneously teaches the student on engine components, systems and operations. This project develops the AVRM through a collaboration between UTM (Academics) and Integrasi Erat Sdn Bhd (Industry). This project does not only aim to answer the issues related to the teaching materials in institutions as addressed above, but also aligns with NALI goals and meets the government directions. The AVRM has been initiated between UTM and Integrasi Erat Sdn Bhd and has reached the conceptual stage as of June 2019. The AVRM is expected to be deliver up to the TR7, working pre-commercialization prototype for demonstration and introductory sales by 2020. Below are the main objectives of this project:

1. To provide virtual reality platform for the automobile vocational education and training,
2. To incorporate NALI initiatives of scenario-based learning and student edutainment,
3. To develop the module that is aligned with the government vocational and working standards.

Background
National Agenda

TVET has become one of the main agenda for Malaysia to further enhance the local industry and economy. The Malaysia Education Blueprint states that there will be an increase in demand for an additional 1.3 million TVET workers by 2020 in the 12 National Key Economic Areas (NKRA) identified under the government’s Economic Transformation Programme. To fulfill the national agenda of Vision 2020, TVET sector in Malaysia must strives to provide a skilled Malaysian workforce. As such, empowering the education and direction of TVET is among the nine core annual
achievements under the Ministry of Education Malaysia [2]. Thus, to meet the NKRA while aligning to the Ministry of Education core achievements in Malaysia TVET, various/diverse participations from agencies, institutions and industries are critically important. Among the initiatives that has started by TVET agencies is the transformation focus and initiatives which generally encompasses school programmes, graduate programmes, marketing, entrepreneurship and accreditations [4].

ICT Tools

The quality and marketability of TVET graduates must be further improve through the modern digital industry and information technology that is known to be the major industry platform in the remaining 21st century. With the implementations of Fourth Industrial Revolution (IR4.0), new curricula using ICT tools has immersed in making sure that the graduate skills and competencies will be relevant to cater the upcoming industry demand. This must be strongly supported by the in-trend equipment, Internet-of-Things, artificial intelligence, augmented reality and virtual reality as the key skills especially in building work for the younger generations. As reported by UNESCO in [5], it has now become an essential for TVET to introduce the ICT tools in teaching and learning that promote lifelong learning, enhance engagement, authentic learning and knowledge creation. Simulations, three-dimensional virtual reality, videos, collaboration software and mobile devices are among the tools that can make the training much more engaging and effective. In addition, these tools are also capable to assist teachers to inculcate positive attitudes towards learning and build transversal competencies [6].

Discussion

Virtual Reality

Among the ICT tools highlighted above, virtual reality is among the main tools that is proven to raise engagement and increase knowledge retention for students of all categories. Particularly in vocational education, virtual reality provides students the opportunity to experience the reality of being in an unfamiliar working scenario which is the absolutely key to success in vocational training. The ability to experience training in virtual reality will be invaluable such as viewing a working engine from all angles without leaving the lecture room. Availability of virtual reality allow students to revisit challenging practice and situations at their own pace. The ability to go back to scenarios again and again, without additional expense or inconvenience, is a great advantage in the teaching and learning approach. Virtual reality is particularly powerful in this context, for example to see working procedure or technique is performed in the real world. Virtual reality also gives students a holistic coverage on the tools, equipment and facilities in the actual industrial environment.

TVET Automobile

The classifications of learning in TVET based on information-processing theory were conceptualised for the automobile students and like any other TVET courses including the five learned capabilities: cognitive strategies, verbal information, attitudes, intellectual skills, and motor skills. This classification system is related to the assumptions that learning must emphasise the significance of psychomotor domain learning in addition to Bloom’s affective and cognitive domains [7]. As such, local TVET institutions have included significant sessions into respective automobile courses for the students to have psychomotor domain learning through the practical training on the actual engine, chassis, brake and suspension system. Nevertheless, there are common issues that these institutions are facing which is related to insufficient training material; car, engine, transmission, etc., high operational cost and student’s safety. Additionally, the teaching and learning materials need to be constantly updated and aligned with the upcoming global automobile technologies in making sure that the knowledge of graduates is adequate for the highly evolving technologies. As of today, these issues are still being faced by many local TVET institutions without any clear solution. Recent interviews with a TVET trainers, Ahmad Shamsul Mohd Nisab from DRB-HICOM University of Automobile Malaysia and Mohd Shazly Farith Mohd Alias from Institut Kemahiran Bella Negara (IKBN) have personally stated that these common issues are among the main limitations that institutions are facing to further improve the effectiveness of the teaching and learning in producing better graduates. With the ever-increasing number of students entering TVET institutions, more investment is required to increase the quantity and quality of the teaching materials. The investment must also include operational cost to maintain and sustain the quality of the teaching materials over time. Safety concerns over materials and the student itself is critically important which is also a limitation for the institutions to introduce the practical training to first year students. Therefore, this project offers a highly potential product as a new and clear solution to assist, better yet tackles the common issues and concerns that the Malaysian TVET institutions have been facing.

Deliverables

With the above being discussed, this project which is based on a collaboration between UTM and Integrasri Eral Sdn Bhd develops a virtual reality package known as the AVRM which is a new approach for the TVET automobile students to learn, train and experiences car-repairing processes. The end-product of this project will be a virtual reality system which consists of a virtual reality gear and simulation software that will cover the automobile course module in car’s dismantling, assembling and servicing. The AVRM does not only answer the issues addressed above, but also incorporates New Academia Learning Innovation (NALI) initiatives. The course will consider the compliances, requirements and standards that have been established by the related Malaysian ministries (Ministry of Education, Ministry of Human Resources, Ministry of Youth and Sports, Ministry of Rural Development and Majlis Amanah Rakyat) to align with the direction and initiative by the government. This project targets to deliver the AVRM that meets Technology Readiness Level (TRL) 7 by 2020, capable for introduction to students in Malaysian institutions.

NALI Approach

With the capability and independency of this project to develop its own module, content and software, the AVRM
incorporates the scenario-based learning with the interactive virtual reality as the edutainment in embracing the NALI initiatives. The AVRM module and content were structured and taken from the industry as the simulation storyline that requires the student to solve real-world problems. Through the virtual reality asset and environment created, the student is expected to use their problem-solving skills and critical thinking to complete the given task in the AVRM. Students will have the opportunity to solve the problems in groups and reflect the assessment that will be provided in the software. With these features, the AVRM supports the NALI objectives in producing skilled-ready graduates, unique teaching practice and interactive teaching materials.

Methodology
The AVRM project was initiated by detail CAD modelling of a complete internal combustion engine and components that is typical in today’s passenger cars. The CAD models were embedded into the virtual simulation software that was developed in this project. The teaching and learning module of the AVRM which was then developed and structured to suit the application in virtual reality simulation. In order to create and attract the student’s interest, the assets of the AVRM which consist of the virtual environment, background and task scenarios were fused with the module in the software. Finally, the software was integrated with a commercial virtual reality hardware to produce a complete solution as a virtual reality simulation for the automobile course. As of now, this project focuses on the engine module before proceeding to other areas such as the transmission, suspension and brake system.

Potential Markets
AVRM is targeted mainly for the teaching and learning in TVET automobile programmes. TVET programmes in Malaysia are offered by seven ministries that include Ministry of Education which offers the most TVET programmes to the highest number of students. There are over 1,000 TVET institutions across Malaysia of which 506 are public institutions. With an estimation of 98,000 students signing up annually in TVET programmes when most of the TVET institutions are offering automobile programmes, the availability of the AVRM can assist in tackling the common issues faced by the institutions while further improve the quality of graduates to fit in with the demand of the industry. With the content and software of the AVRM be fully developed locally by Malaysian, brings in an additional advantage on the continuation of lifecycle to cater to the evolution of the courses and standards over time. Using the local expertise of the members in this project, the content of the AVRM can be expanded and tailored to suit certain needs by educational institutions or the automobile industries.

Acknowledgement
The authors would like to thank Integrasi Erat Sdn Bhd for the continuous and constructive support given. A special thanks to Mohd Fadhirul Saminan and Muhammad Hanafi Md Sah from UTM for their assistance.

References


HoloRead: Pyramid Hologram Application for Preschool Children’s Learning

Nurul Maziah Mohd Barkhaya
Department of Educational Sciences, Mathematics and Creative Multimedia, School of Education, Faculty of Social Sciences and Humanities, Universiti Teknologi Malaysia 81310 Johor Malaysia
nrlmaziah29@gmail.com

Noor Dayana Abd Halim
Department of Educational Sciences, Mathematics and Creative Multimedia, School of Education, Faculty of Social Sciences and Humanities, Universiti Teknologi Malaysia 81310 Johor Malaysia
noordayana@utm.my

Noraffandy Yahaya
Department of Educational Sciences, Mathematics and Creative Multimedia, School of Education, Faculty of Social Sciences and Humanities, Universiti Teknologi Malaysia 81310 Johor Malaysia
p-afandy@utm.my

Highlights
HoloRead is a pyramid hologram application which is used as a visualization tool in preschool children’s learning in order to enhance their English literacy. HoloRead is one of the learning tool which based on augmented reality technology, thus this tool provide the three-dimensional (3D) concept of the studied objects to be displayed. Specifically, this application is useful for all government preschool in Malaysia due to the content of HoloRead is accordance to the syllabus of National Preschool Curriculum Standard. Therefore, this study focuses on the effectiveness of HoloRead towards preschool children’s learning with the consideration of the development process. Thus, ADDIE Model was selected as the backbone for the entire developmental process of HoloRead.

Key words: HoloRead; visualization tool; English literacy; ADDIE Model

Introduction
Recently, the advancement of technology creates a positive impact in educational field. Entirely, the used of technology in education are essential to share, develop, and provide information as early as possible in a child’s education (Eady and Lockyer, 2013). Thus, during preschool years, the use of technological tools is believed to be able to enhance children’s understanding towards learning via their visualization experiences (Hong and Trepanier-Street, 2004). Generally, growing up in the world of cutting-edge technology, children are more likely to engage with computer-mediated toys (Kara et al., 2014) and spend most of their time playing with them (Johnson and Christie, 2009). Therefore, with the adults guide, the use of visualization tools with the integrated of multimedia elements (such as sound, audio, animation, and 3D image) should be design properly. As the nature of children is they love to play, they are curious and like to try out new things (Bruce, 2011), thus the visualization tool with the technology embedded will help to harness the children’s school readiness, shaping the children’s cognitive, social, and language development. Through this study, researcher will be explained in detail on the designing and developing a visualization tool named HoloRead in order to enhance literacy in English language among preschool children.

Content
The objective of this study is to investigate the effectiveness of HoloRead towards children’s cognitive ability in order to enhance their literacy skills. Literacy is an ability of individual skill to acquire knowledge which is involved of the cognitive process (Tsao, 2008; UNESCO, 2008; Street, 2006; Bhoffa, 2006). Thus, a visualization tool which is incorporated with the 3D technology are believed will enhance students’ literacy skills (Heale, 2015; Merchant, 2009). In past two decades, Wileman (1993) was introduce a term named ‘visual literacy’ to emphasize on the strong relationship between the individual ability to understand an information through the form of graphic, object, and pictorial. Therefore, HoloRead becomes an effective visualization tool because of that 3D display appears like floating on the air with 360-degree portrayal if the image (Suleiman, 2014). Hence, that display perceived as something magical by children (Bujak et al., 2013). Besides, HoloRead allows viewers to view that subject learned.
from different angles due to the pyramid shape of reflective tool has been used to visualize the 3D display (Walker, 2013). Hence, the display will lead children to predict and interpret from various perspectives (Upadhye, 2013). Finally, this process will improve their cognitive development and indirectly will increase the children’s understanding and achievement.

In this study, HoloRead are covered the entire English syllabus National Preschool Curriculum Standard (NPCS). Specifically, there are four sub-applications of HoloRead, and they are shows as in Table 1.

Table 1: The HoloRead Sub-Applications content accordance to NPCS

<table>
<thead>
<tr>
<th>Sub-Application</th>
<th>Content</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alphabet Sound</td>
<td>Alphabet A to Z</td>
<td>Represent by 3D animated model of animals based on alphabetical orders</td>
</tr>
<tr>
<td>Recognise Syllable</td>
<td>Rimes</td>
<td>Represent by 3D animated model of animals, objects, or verbs according to rimes (basic phonics) of single syllable words</td>
</tr>
<tr>
<td>Enjoy Reading</td>
<td>High Frequency Words</td>
<td>Represent by 3D animated model of objects and simple sentences based on the suggested high frequency words</td>
</tr>
<tr>
<td>Amazing Phrases</td>
<td>Simple Phrases</td>
<td>Represent by 3D animated model of animals and simple phrases</td>
</tr>
</tbody>
</table>

According to Table 1, all the learning syllabus are covered through each sub-application. For the entire development process, researcher decided to use ADDIE Model by Rossett (1987) because of this model proposed a systematic step through its five phases which are Analysis, Design, Development, Implementation, and Evaluation.

A. Analysis

In this initial phase, four elements will be considered to be analyzed (Aldoobie, 2015). The first element is the analysis of learners. This study involved of 50 preschool children from government preschool which are 25 children for experimental group and another 25 children for control group. Besides, the highlighted issues are the literacy and weaknesses of current learning tool in preschool classroom learning. The data for the issues were obtained from a conducted preliminary study (Nurul Maziah and Noor Dayana, 2018). The second element is the analysis of instructional goals. The goals of HoloRead development is to help teachers to diversify he current learning tools in order to enhance children’s literacy skills in English language. Then, the third element should take into account is the analysis of instructional development. The hardware used to develop HoloRead is a computer with a specific specification such as Intel i7, nvidea 960M, 1T HDD, and 8GB RAM. While Unity and Photoshop has been used to develop the HoloRead. Finally, researcher needs to analyze the learning objectives that will be covered by the HoloRead. There are two main topics in Communication Core Principle (English) which are related to literacy skills: reading and writing.

B. Design

A classroom learning tool must be designed effectively by complying with the criteria needed to ensure its effectiveness and usability for learning (Eady and Lockyer, 2013). Structurally, the preparation of storyboard is one of the important processes in designing phase to depict the actual flow of an application. As been state earlier, HoloRead consists of four sub-applications and have the different content respectively. In first sub-application which named as Alphabet Sound, children will be introduced to all of the 26 alphabet letters. Specifically, each letter will come out with the animated 3D model of animals with their sound. For the second sub-application which is Recognise Syllable, researcher was simply explained on the rimes. The selections of rimes are based on the suggested rimes provided in NPCS. For the third sub-application with the title of Enjoy Reading has used the high frequency words (HFW) to form simple sentences. For the Amazing Phrases of sub-application, researcher chooses the simple phrase is made up of two or three words. To be specific, the use of phrase in HoloRead content emphasize on the combination of adjective and noun. Thus, Figure. 1 depicts the interface of HoloRead content.
C. Development

Before the HoloRead will be implemented in actual experiment, there are few criteria should be considered. Those criteria include the size of LED monitor to be used, the size of pyramid prism, and the appropriate class to be used then. Normally, the selection of pyramid prism to reflect the HoloRead content depends on the size of the LED monitor. Since the activity will be implemented in a small group with four children respectively, researcher decided to use 19.5 inch of LED monitor and the perimeter of 6cm (length of the top base) + 30cm (length of the bottom base) + 22cm (length of the left side) + 22cm (length of the right side) for the pyramid prism. Besides, the pilot study has been conducted to minimize the risk and to ensure some of the technical issue will be fixed before the implementation of actual experiment. From the pilot study, there is no big issue regarding to those criteria. There is a suggestion to conduct the HoloRead activity in computer laboratory due to the lighting issue and to have a better view of the HoloRead content.

D. Implementation

HoloRead application will be tested in preschool classroom learning in a period of six weeks. This activity will be conducted in computer lab and in the small group consist of four children for each group. Then, each group will be assigned a teacher to guide and help the children when they learn through HoloRead. Each group will be supplied with one LED monitor and one pyramid reflective tool to display the HoloRead content. The whole interactions and behaviours among children throughout the activity will be recorded using a video recorder.

E. Evaluation

In this final phase, the effectiveness of HoloRead will be evaluated through the pre-test and post-test results in order to measure the increment of literacy among preschool children. Apart from the conducted tests, the behavioral patterns in term of interactions will be measured using behavioral checklist and analysed through content analysis. The aim of this measurement is to examine the dominant behaviours in children when they learn through HoloRead.

As a conclusion, this abstract explains on the important aspects to design and develop HoloRead. This pyramid hologram will emphasizes on children’s visualization experience in order to enhance their English literacy before entering to primary school. The use of technology-based of visualization tools is to grab the children’s attention in learning from the beginning till the end of a class session. Hopefully this new trend in education will provide valuable insight for teachers to integrate this technology as an additional learning tool in preschool classroom learning.

Acknowledgement

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References


IMPLEMENTATION OF PEER INSTRUCTIONS IN ENHANCING SPECIAL NEEDS STUDENTS’ PERFORMANCE IN HAIR STYLING THROUGH YOUTUBE

Hemarani A/P Munisamy
SMPK Vokasional Indahpura
School of Education, Faculty of Social Science and Humanities, Universiti Teknologi Malaysia
henira83@yahoo.com

Mohd Rustam Mohd Rameli
School of Education, Faculty of Social Science and Humanities, Universiti Teknologi Malaysia
mrustam2@utm.my

Yeo Kee Jiar
School of Education, Faculty of Social Science and Humanities, Universiti Teknologi Malaysia
kjyeo@utm.my

Abstract

Peer instruction is an instructional strategy and also known as an active learning in effective way to engage students for increasing performance among learning disability students in vocational school. Accordingly, there have been no studies conducted on the implementation of Peer Instruction by using YouTube (professional in hair styling) in learning hair-styling among learning disability students. The objective of this study is to enhance the students’ performance in hair styling after implementing Peer Instructions among learning disability students and to identify the students’ performance in learning hair styling skills after using YouTube. Peer Instruction through YouTube was used towards 9 students in a single group in pre and post-test research designs. The findings proved that Peer Instructions has a positive impact on performance compared to traditional teaching methods with the support of YouTube as an instructional tool in teaching hair styling skills. These methods place a high value on social interaction, compared to those encouraging individual learning in line with the current trends of Blended Learning in education. Implications of these findings for classroom practice and further research are discussed.

Keywords: Peer Instruction; YouTube; learning disability students; special education; vocational training.

Introduction

Peer Instruction is an instructional strategy for engaging students during class through a structured questioning process that involves every student active in the lessons. Peer instructions will held in small group discussion of conceptual questions interspersed with lectures, increasing engagement and providing formative feedback on student thinking. Peer instruction is an easy way to add interactively to a traditional lecture course without making drastic changes. It can get your students engaged and talking, and help you learn and respond to what your students are thinking, both of which can lead to improved student learning. Implementation of Peer instruction through YouTube has been used in vocational education, which provides online access to vast quantities of free public video in a broad spectrum of topics. This research emphasises on student-centred instructional method that implements the Peer Instructions and video by experts approaches in accordance with the New Academia Learning Innovation (NALI). Many researchers implemented Peer Instruction and YouTube in mainstream education rather than special need education. The students have become more productive, creative, and innovative when peer instruction through YouTube was adopted in teaching and learning activities. Peer Instructions is proven able to engage students in active learning and also in solving problem creatively and collaboratively. This participation is beneficial in two ways. First, it helps to hear students explain the answer in their own words. While the teacher’s explanations may be the most direct route from question to answer – the most efficient in terms of words and time – those provided by the students are often much more effective at convincing a fellow student, even if less direct. In this way, students will be able to understand the problem better when they use different sources to get the answers, which involve critical thinking, and simultaneously able to improve their soft skills such as communication and teamwork skills, engaging problem-solvers, as well as continuous and self-directed learners. At the same time, it will also foster the development of students’ thinking and improve their abilities in learning. In some cases, Peer Instructions has also proven able to facilitate thinking and problem solving, assist the mastery learning, inspiring, and engaging the students. This involvement helps the teacher to have better understand the problems the students are facing and address them directly in lecture. Finally, the personal interactions during the discussions can help the teacher keep in touch with the class.
Research Objectives

This study aims:
1. To investigate the significant difference of hair styling performance in the aspect of work process, outcome and attitude after implementing Peer Instructions by using YouTube among learning disability students;
2. To investigate the significant difference of overall hair styling performance after using YouTube among learning disability students.

Research Methodology

A pre-test and post-test research was conducted involving a single group of students. 9 students were selected as the sample. The students were learning disability students who are taking hair styling course. There are two instruments used to collect the data which are performance test which consists of three parts, namely the work process, outcomes, and attitude while the second instrument is observation form incorporates a more structured questioning process which consisting open-ended questions as item (This can lead to interesting discussions, because for many problems, more than one strategy is possible). The data was analysed using Wilcoxon Test.

Finding and Discussion

<table>
<thead>
<tr>
<th>HAIR STYLING</th>
<th>Hair Braiding</th>
<th>Mean</th>
<th>Hair Bun</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Z</td>
<td>Sig.</td>
<td>Z</td>
<td>Sig.</td>
</tr>
<tr>
<td>Work Process</td>
<td>Pre</td>
<td>-2.859</td>
<td>.004</td>
<td>29.400</td>
</tr>
<tr>
<td>50%</td>
<td>Post</td>
<td>-2.816</td>
<td>.005</td>
<td>31.200</td>
</tr>
<tr>
<td>Outcome</td>
<td>Pre</td>
<td>-2.410</td>
<td>.016</td>
<td>19.600</td>
</tr>
<tr>
<td>30%</td>
<td>Post</td>
<td>-2.911</td>
<td>.004</td>
<td>24.200</td>
</tr>
<tr>
<td>Attitude</td>
<td>Pre</td>
<td>-2.810</td>
<td>.005</td>
<td>9.600</td>
</tr>
<tr>
<td>20%</td>
<td>Post</td>
<td>-2.814</td>
<td>.005</td>
<td>16.600</td>
</tr>
<tr>
<td>Total</td>
<td>Pre</td>
<td>-2.816</td>
<td>.005</td>
<td>58.600</td>
</tr>
<tr>
<td>100%</td>
<td>Post</td>
<td>84.800</td>
<td>2.805</td>
<td>83.600</td>
</tr>
</tbody>
</table>

Table 1: Total findings from pre and post-test

To reflect on the students’ performance by implementation of peer instructions, a paired sample Wilcoxon Test was conducted to compare the total score obtained in the pre and post-test. The test revealed a significant difference, where the post-test for Hair Braiding and Hair Bun statistically has significant difference in the work process part as compared to pre-test with $Z = 2.859$, $p < .004$ and $Z = 2.816$, $p < .005$. There are also significant difference showed for outcomes part with $Z = -2.410$, $p < .016$ and $Z = -2.911$, $p < .004$. The attitude part also recorded significant difference with $Z = -2.810$, $p < .005$ and $Z = -2.814$, $p < .005$. Lastly, the total ranks recorded were statistically has significant difference both styles with $Z = 2.816$, $p < .005$ and $Z = 2.805$, $p < .005$. In sum, students’ performance in hair styling increase after the implementation of peer instructions models through YouTube as the teaching aid.

<table>
<thead>
<tr>
<th>Performance In using YouTube</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>YouTube followed with open-ended questions item</td>
<td>Pre</td>
</tr>
<tr>
<td></td>
<td>(.302)</td>
</tr>
<tr>
<td></td>
<td>3.575</td>
</tr>
</tbody>
</table>

Table 2: Total findings from pre and post-test for performance after using YouTube
To report on the students’ performance, open-ended questions was used and conducted by Wilcoxon Test compare the total score obtained in the pre and post of students’ performance in using YouTube in learning skills. The observation revealed a significant the total ranks recorded were statistically has significant difference in interest with mean 1.925 and SD = .302 and the increase of interest after using YouTube is 3.575 and SD = .318. It is helpful when possible to “try out” the questions on a small group of students before and after class to make sure that there are no ambiguities in the wording and their interpretation is accurate. As a conclusion, the result showed that students’ performance in hair styling increase after the use of YouTube as the teaching aid.

Conclusion

This study has implications on the learning of hair styling in the vocational education for learning disability students. Efficient teaching methods should be practiced, specifically in dealing with the hair styling practice. Peer Instructions through YouTube can be used to enhance the basic knowledge in hair styling. In addition, the effectiveness of Peer Instructions through YouTube can be studied to determine its strengths and weaknesses, especially in vocational education for learning disability students. More importantly, the teacher can also use Peer Instructions through YouTube as an authentic tool for the students to increase their performance and activate the students’ schema to construct the meaning and to provide critical thinking. This study also proven that peer instructions able to increased students’ conceptual understanding and traditional quantitative problem solving hair styling, supports better retention of knowledge, increases course satisfaction and retention for students and increases student engagement. Related to this, previous studies have shown that there is a positive relation between peer instruction through YouTube and students’ achievements and performances. The findings from the observation also suggests that students often seem more comfortable seeking guidance from their peers, as compared to pursuing clarification from the instructor, and therefore engage in the course at a higher level when there is the opportunity for peer instruction. It is also synergistic with the other 21st century skills serving as an authentic goal of communication (discussed above), and enhancing critical thinking and creativity. The findings of this study could also serve as a guide to the Ministry of Education, in particular to the Teacher Training Division, to encourage all vocational teachers to implement peer instructions through YouTube in developing skills like Problem-solving skills, making real-world connections and using multiple representations among learning disability students.

References


HUMANISING EDUCATION THROUGH
THE “OUTDOOR CLASSROOM” DESIGN PROJECT

Norliza Mohd Isa
Landscape Architecture, Faculty of Built Environment and Surveying
Universiti Teknologi Malaysia
norliza@utm.my

Dr Abdul Rahim Hamid
Landscape Architecture, Faculty of Built Environment and Surveying
Universiti Teknologi Malaysia
abdul.rahim@utm.my

Hayati Bte Abdullah
School of Mechanical Engineering, Faculty of Engineering, Universiti Teknologi Malaysia
hayatiabdullah@utm.my

Highlights:
The Outdoor Classroom Design Project features the implementation of face-to-face Immersive Experiential Learning. It defines learning as a process, during which knowledge is generated through meaningful experiences for students. David Kolb’s four-stage learning cycle model was utilised in the project through (1) concrete experience, whereby students gain experience through the process of designing, (2) reflection and observation, in which students make reflective observation to review what has been designed and experienced, (3) abstract conceptualisation, whereby students conceptualize new ideas based on their learning about design principles, and (4) active experiment, in which students applies what they have learnt based on their understanding and experience. Efforts in instilling human values to students of the Generation-Z, and hence transform their attitudes in this Outdoor Classroom Design Project form a significant element in humanising education. This is important because the Generation-Z (Gen-Z) students grew up with the convenience of advanced technology, as well as easy access to information and knowledge. These students are more critical, creative and expressive than the previous generations, yet their heavy reliance on technology in their daily lives make them prefer to interact virtually than to interact and engage in activities in real life. This could lead to students being more individualistic yet vulnerable. To address this conundrum, this Outdoor Classroom Design Project was introduced to the students as early as their first year of study in Landscape Architecture. By combining two approaches, namely Community-based Learning and Project-based Learning, a new learning approach, the Community Project Based Learning (CPBL), is proposed. This novel idea features the collaboration between the school community and corporate bodies.

Key words: Outdoor Classroom; Community Project; Landscape Architecture

Introduction

Today’s students are the Gen-Z or digital natives who are born in an era of advanced technology. They are shaped by the internet culture, social media, and smartphones. Zirschky (2015) in his book Beyond the Screen (2015) denotes this generation as the “connected but alone generation”. Virtual social life dominates more than the reality of life. Technology dependence among students lead to individualistic attitudes, as well as a preference for acquiring fast and easy outcomes. We propose that one of the solutions to counter this is to implement immersive learning via real projects with community involvement, in an effort to nurture the sensitivity of the students towards the environment and in their real life. This project adapted Kolb’s (1984) four-stage learning cycle model through (1) concrete experience, (2) reflection and observation, (3) abstract conceptualization, and (4) active experiment (Figure 1).
Project Objectives

To achieve the goal of Humanising Education, there were three objectives outlined in this Outdoor Classroom Design Project, namely:

1. To bring Gen-Z students to the world of reality through an Immersive Learning Experience, by conducting a landscape design project through problem solving, and finding creative solutions in an “Outdoor Classroom” design;
2. To improve the quality of communication and self-confidence through interactions with the community;
3. To encourage students to work collaboratively, and instil human values such as patience and diligence.

The involvement of real communities and real problems in the design process was targeted to have a significant impact on the students’ learning experience and hence measurable achievements.

Project Methodology and Approach

The innovative learning approach formulated for this project integrates the Community-based Learning (CBL) and Project-based Learning (PBL) approaches, leading to the Community Project Based Learning (CPBL). This new approach to learning was introduced to the first year students of Landscape Architecture.

Figure 1: Kolb’s (1984) four-stage learning cycle model

Figure 2: The Community Project Based Learning Approach (CPBL)
There are conceptual differences between CBL and PBL. CBL integrates community engagement with learning to enrich the experience by emphasizing the concept of reflection and reciprocity (kifarah). It features “experiential learning” with the community in order to provide students with real-life experience in dealing with the issues that they are taught in class, via an ongoing effort in analysing and solving community problems. Whereas PBL is a teaching method in which teachers make “learning come alive” for their students by carrying out a real project.

In contrast to conventional learning methods, the first-year students of Landscape Architecture prior to the current study had only focused on the basic principles of design and planning landscapes. Projects were usually in the form of proposals only, with drawings and mock-up models without actual construction work.

The novel CPBL has been redesigned by giving students the opportunity to experience real-life projects by carrying them out within a limited time frame. A key feature of this project was the opportunity given to students to apply what they have learned in the classroom to the community and vice versa. The main idea is to give something back to the community through CPBL, by thinking through solutions to each problem encountered in the project.

One important aspect of CPBL is that it is designed as a potential solution to the issues arising from the impact of technology on Gen-Z in the context of learning. Behaviourism learning theory states that learning is a process of socialization, in which the relationship between external stimuli and individual reactions can be constructed to produce behavioural changes. According to Williams & Anandam (1973), learning is a permanent change in behaviour that results from experience or training. Thus, it is crucial for this project to be introduced to the first-year students as a step towards changing their behaviour right at the outset of their undergraduate Landscape Architecture studies. Such learning is considered successful if the behaviour and attitudes change towards the better from previously. Table 1 shows the framework of design via CPBL.

<table>
<thead>
<tr>
<th>No.</th>
<th>Isu pembelajaran</th>
<th>Objektif Projek</th>
<th>Pembelajaran Bermokna Pada Pelajar</th>
<th>Kaedah Pentaksiran</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.</td>
<td>Kurang keyakinan diri dan mudah rapuh dengan isu-isu huraian</td>
<td>Meningkatkan kualiti komunikasi dan keyakinan diri melalui kehidupan dan pengalaman beribadah komuniti.</td>
<td>C15 Memperkayakan kemahiran komunikasi dan penggunaan media dalam pembelajaran.</td>
<td>CLO4: Penguasaan komunikasi rekabentuk secara lisan dan visual - Verbal Presentation dan audiovisual secara berkala</td>
</tr>
</tbody>
</table>

The CPBL is also designed to enable the formative assessment of three learning goals:

1. CLO2: Design community landscapes and outdoor spaces by applying the planning principles of sustainable and liveable communities;
2. CLO3: Work collaboratively as a team with clients, allied professions, and the community while undertaking a range of different team roles;
3. CLO4: Communicate effectively using verbal and visual presentations which are done manually.

In line with the student-centred 21st Century learning goals, the elements implemented through the CPBL are aimed at enhancing the cornerstones of (1) critical and creative thinking, (2) communication, and (3) collaboration. This CPBL approach is able to provide students with meaningful learning through a systematic, transferable, and scalable learning process as shown in Figure 3.
Processes 1 to 5 in Figure 3 show student activities in systematic steps within the CPBL. This methodology is transferable to projects from various communities other than schools, such as housing community, hospital community and so on. In addition, it can also be applied to the second and third year Landscape Architecture studios through added complexity and enhanced learning goals. Furthermore, CPBL is scalable in terms of area, number of communities, and project cost depending on time, budget and learning outcomes of the higher-level courses.

Project Outcome

There are three Program Learning Outcomes (PLO) to be achieved in the first year Landscape Architecture studio which incorporates CPBL, namely PLO2 or Application (AP), PLO4 or Communication Skills (CS), and PLO5 or Teamwork (TW), through three Course Learning Outcomes (CLO). Within the three learning outcomes of these studios, immersive experiences can also be achieved in the Cognitive, Psychomotor and Affective aspects.

a) Cognitive is of level C6, which is Creating: the process of designing the “Outdoor Classroom” by taking the principles of landscape design into account when approaching the community;

b) Psychomotor is of level P4, which is Mechanism: the process of construction at the medium level in which students conduct observations by involving all senses of sight, hearing, touch, and smell during the design process stages of Site Inventory, Analysis and Synthesis;

c) Affective is of level A3, which is Valuing: the process of evaluation, commitment and responsibility while working in a collaborative team.

Figures 4 to 6 shows the students in action as they carry out the processes embedded in the CPBL, as outlined in Figure 7.

Conclusion

The nexus of CBL and PBL has given rise to an innovative CPBL which was applied to the first year Landscape Architecture studio in the form of an Outdoor Classroom Design Project. Students’ learning outcomes has been measured using three PLOs and three CLOs. The outcomes were designed to instil human values to Gen-Z students through providing meaningful experiences in their learning journey. Further research into the application of CPBL could be carried out at higher level Landscape Architecture studios, as well as to fine-tune the design approach and processes involved.
Figure 4: The student presentation and critique sessions periodically demonstrates an improvement in application of knowledge.

Figure 5: (left) Students learn from mistakes in the early stages of construction; (right) final product after collaborating with workshop staff.

Figure 6: Students learn to make decisions about the selection and purchase of paints, and the use of recycled materials.
Figure 7: PCBL implementation process

References


Quality improvement in Electrical Circuit Analysis Course through Implementation of Non-Conventional Group Activity for Bachelor of Engineering (Electrical-Electronics) Program

Mastura Shafinaz Zainal Abidin
School of Electrical Engineering, Universiti Teknologi Malaysia, 81310 UTM Johor Bahru, Johor, Malaysia.
m-shafinaz@utm.my

Nurul Ezaila Alias
School of Electrical Engineering, Universiti Teknologi Malaysia, 81310 UTM Johor Bahru, Johor, Malaysia.
ezaila@utm.my

Highlights

Some innovation in group activity has been implemented in Electrical Circuit Analysis course among the students of Bachelor of Engineering (Electrical-Electronics) program in School of Electrical Engineering, Universiti Teknologi Malaysia (UTM). In this study, the non-conventional group activity where there are more interactive and collaborative tasks have been adapted in classroom activity instead of common discussion practice between group members. This is an effort for continuous quality improvement (CQI) which focusing on three course learning outcomes (CLO) of this course. The relationship between type of activities and implementation towards the students’ performance have been evaluated based on their average score in CLO’s key performance indicator (KPI). The students’ feedback based on testimony and in the end of course (EOC) survey were also been observed. Based on the findings, the implementation of this non-conventional group activity gives impact on CLO performance score. Moreover, it able to improve students’ skills development especially in team working and ability to solve the engineering problems critically and systematically.

Key words: group activity; non-conventional activity; teamwork; CQI; CLO

Introduction

Cooperative learning is an active learning technique that has been extensively studied and proven to be effective in helping students to learn and give them feedback about their current performance and provide chances for improvement [1]. Implementation of non-conventional activity in classroom is expecting students to engage with materials, software and equipment, participate in class’s activity, and collaborate among themselves. In engineering area, students are encouraged to be challenged with a complex, real-world problem, students work in teams to understand the problem and propose solutions. Students must analyze the nature of the problem, identify what they need to know and how to find needed information, and apply what they learned to generate ideas for possible solutions [2]. Therefore, we proposed to adopt non-conventional activity in the cooperative learning strategies into engineering course. Students could learn more when they participate in class activity, able to apply, practice and hands-on directly what they have learned in class [3]. This interactive approach is definitely differ from traditional teaching’s styles where students are expected to sit for hours, listening and absorbing information presented by the lecturer.

The Accreditation Board for Engineering and Technology (ABET) emphasizes six (6) professional skills to be integrated in the undergraduate curriculum that includes communication, teamwork, understanding ethics and professionalism, engineering within global and societal context, lifelong learning, and knowledge of contemporary issues, project management and critical thinking [4]. Therefore in this study, we have emphasized the implementation of non-conventional group activity in order to improve students’ quality in CLOs achievement and their ability in teamwork, communication and critical thinking skills.

This study involved two groups of first year students of Bachelor of Engineering (Electrical-Electronics) Program from the School of Electrical Engineering, UTM who registered in Electrical Circuit Analysis course in 2017/2018-1 and 2018/2019-1 academic sessions. Both groups were allocated with the same CLOs but some differences in their group activity’s approaches and assessments. Basically, there are four CLOs that stated in the course information (CI) for Electrical Circuit Analysis. However, only three CLOs will be underlined in this study which are: CLO1- Apply the basic laws, theorem and methods of analysis for solving problems in DC circuit; CLO2- Apply concepts of energy storage elements for analysing first and second order transient DC circuits; and CLO4- Work in a team. Comparison were made between these two groups of students corresponds to their quality achievement.

Methodology

In this study, the achievement data of 126 and 141 students for Bachelor of Engineering (Electrical-Electronics) program in respective 2017/2018-1 and 2018/2019-1 academic session who registered in Electrical Circuit Analysis
course were involved. For fair comparison, both students’ background is almost comparable with GPA’s entry of 3.5 to 3.7. The learning activities and assessment were constructed align to the targeted CLOs for this course. Basically, all cooperative tasks involved in course have been designed to be done in group since the CLO4 is aimed to develop the students’ ability of work in team. The total of 5 activities in group have been implemented to all students participated throughout the semester. These activities contribute to 15% of coursework mark. As stated in the course information (CI), this CLO4 is addressed to the seventh program learning outcome (PLO7) where students must be able to function effectively as an individual, and as a member or leader in diverse teams as stated in the.

For 2017/2018-1 students, the 5 group activities consisted of 1 hands-on and 4 common discussion. On the other hand, the 2018/2019-1 students were divided into 2 groups. Group 1 (87 students) had performed the standard practice which consisted of 4 common discussions and only 1 hands-on activity. Differently for Group 2 (54 students), the non-conventional group activities had been adopted which consisted of 1 common discussion, 2 hands-on activity and 2 simulation tasks. With the targeted course learning outcome to demonstrate team working skills and communicate effectively as stated by CLO4 for this course, the cooperative group activity is designed with the assessment tools that consist of individual and group evaluation. In addition, peer review has also been conducted to contribute as auto-rating factor in calculating the final assignment mark for each student. Then, the final mark for each student are determined by multiplying the group mark with the auto-rating factor. For each activity contributed to 3% of mark. The details of group activity is shown in Table 1.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Common discussion</td>
<td>Common discussion</td>
<td>Hands-on</td>
<td>DC circuit</td>
</tr>
<tr>
<td>2</td>
<td>Hands-on</td>
<td>Hands-on</td>
<td>Simulation (Virtual experiment)</td>
<td>First and second order transient DC circuits</td>
</tr>
<tr>
<td>3</td>
<td>Common discussion</td>
<td>Common discussion</td>
<td>Simulation (Virtual experiment)</td>
<td>AC circuit</td>
</tr>
</tbody>
</table>

Activity 1 and 2 were purposely designed for students to cover the topics related to basic DC circuit analysis. This topic is similar scope as stated in CLO1 for this course. Students are required to solve a basic DC circuit analysis together with group members through common discussion. In hands-on activity, the students are required to perform the circuit assembly task on the breadboard. Students got the experience to independently take the electrical component from the laboratory. After that, they did the hands-on activity in the classroom and demonstrate it to the lecturer. The activity 3 and 4 cover on analysis of first and second order transient DC circuits, which similar scope as CLO2. In the simulation or virtual experiment task, the students were required to construct and study the circuit via simulation tool platform, ie Partsim, Multisim etc. Lastly, activity 5 is mainly focus on analysis of AC circuit, whereby students need to solve AC circuit analysis of the given problems through discussion with members and finally present to peers.

Results and Analysis

Figure 1 shows the comparison on average score for CLO1 KPI achievement between 20172018-1 and 20182019-1 students. It seems that activity 1 and 2 shows contribution towards achievement of CLO1 because they were directing on the same topic scope. As described in Table 1, there were two samples group of students in 20182019-1. One group had accomplished the hands-on task once, which similar approach as implemented in 2017018-1, while another group had performed the hands-on task twice. Based on the chart shown, it is clearly indicates that more hands-on task abilities to improve the learning outcome performance. Performing the task once may expose the students with an experiential hands-on. However, by conducting more than once may allow them to progress more and able to apply well the basic laws, theorem and methods of analysis for solving problems in DC circuit. Thus, it results in better score in KPI achievement.

The comparison on average score for CLO2 KPI achievement between 20172018-1 and 20182019-1 students is shown in Figure 2. The better result of average KPI score was achieved by the Group 2 which the task had include the simulation activity. Although the similar circuits’ type containing resistor and energy storage elements were distributed to all group to be studied, the students’ group with simulation activity might have better opportunity and flexible to observe the real behaviour of the circuit like transient parameters and graph plots. In contrast, for those who perform in common discussion might only analyse the parameters mathematically and a bit difficult in observing the effect of changes in circuit parameters. It can be concluded that by adapting the usage of virtual simulators and technology is useful to give better impact in students’ learning.

Figure 3 indicates the average score for PLO7 KPI achievement for 20182019-1 students by applying different approaches in group activity and cooperative learning task. The implementation of various approaches as group tasks activities seem to be better as it introduced more alive and collaborative ambient for students. They will have better opportunity in learning space such learning from peers, observation from virtual experiment conducted and
hands-on experience. Thus, it may help them to acquire better as proven by the PLO7 score shown in Figure 3. Moreover, they got experience to adapt on real engineering application that might be faced in future.

**Figure 1:** Comparison on average score for CLO1 achievement between 20172018-1 and 20182019-1 students.

![Figure 1](image1.png)

**Figure 2:** Comparison on average score for CLO2 achievement between 20172018-1 and 20182019-1 students.

**Figure 3:** Comparison on average score for PLO7 achievement using different group activity’s approaches for 20182019-1 students.

**Conclusion**

Based on this initial study in the implementation of different approaches or tasks in group namely non-conventional group activity for Electrical Circuit Analysis course among Bachelor of Engineering (Electrical-Electronics) program students, some significant impact has been identified compared to traditional group activity practice. Besides polishing the students’ skills such as team working, effective communication, inter-person responsibility, planning and time management, this innovative approach also benefits in the CLO and PLO achievement. A positive trend has been observed upon implementation of this non-conventional group activity practice among students’ score where it enhances students’ understanding on the basic laws and concept of energy storage on DC circuits which is essential for this course. It also makes the learning environment more interesting and challenging with variety of tasks related to real application. Therefore, it is recommended to extend this kind of approaches to other programs and courses in School of Electrical Engineering as it is beneficial to everyone.

**Acknowledgement**

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**References**


Cekal: Digital Synergy Learning in Improving Student Performance

Mohd Asnorhisham Adam, Muhammad Sabiq Mohd Noor & Nadiatun Azreen Othman
Pusat Kolaboratif Pembelajaran Literasi dan Numerasi, Pejabat Pendidikan Daerah Pasir Gudang
asnorhisham@gmail.com, msabiq3@gmail.com

Sanitah Mohd Yusof & Megat Aman Zahir Megat Zakaria
Fakulti Sains Sosial dan Kemanusiaan, Universiti Teknologi Malaysia

Abdul Rahim Hamdan
Fakulti Pembangunan Manusia, Universiti Pendidikan Sultan Idris

Highlights:
Teaching and learning sessions in Malaysia through the transformation phase to support the Industrial Revolution 4.0 by implementing the 21st century learning elements: Innovation and learning skills, Career and life, and media, information and technology skills. To achieve this goal, the interactive learning to delivery the learning content and student learn based on student centered learning through the virtual learning environment (VLE) site had a positive impact on students. Accordingly, this study aimed to discover the changes in student performance using the VLE site based on the ADDIE model. As a result, the interactive design and structured teaching content, active student engagement will provide the needs of students in the Industrial Revolution 4.0 and reform the smart society or society 5.0 besides supporting the use of green technology.

Key words: VLE, 21st century learning, ADDIE model, Student based learning, Industrial revolution 4.0

Introduction
Digital learning is an initiative of the Ministry of Education Malaysia (MOE) in improving the quality of knowledge delivery for students. It is reflected in the seventh agenda of the Malaysian Education Development Plan (2013) which focusing on improving teaching quality through ICT. E-learning as a learning platform to replace traditional methods whereby students can create meaningful learning experiences and provide opportunities for teachers to apply different teaching approaches and methods (Noemi & Moktar, 2013). The interactive content in E-learning have attracted students to learn more about the topics in detail.

The ministry has introduced a virtual learning environment (VLE) using Frog VLE as the platform. Its a learning platform for exploring knowledge through the Learning Management System (LMS) that provides students with an impact on their mental, thinking, concept, attitude and behavior (Badrul Hisham, Ahmad Rizal & Kamarul Azman, 2013). It is designed to assist teachers in teaching and learning across the internet as well as facilitating educational courses through the web (Jain, 2015). It is also a web-based education that resembles the real world of education through the integration of conventional and virtual learning (Junus, N.F, 2013). It is a platform that teachers can use to ensure that the teaching objectives are met by providing appropriate teaching activities (Shariffudin, 2007). According to Radin Sili (2012) the integration of information technology based on learning style and level of learning helps teachers to plan effective teaching activities. In addition, the integration of webpages and existing widgets provided can engage students in learning the lessons learned.

NALI Approach
This study is based on the blended learning where student learn through e-learning site, Frog VLE. The activities prepared based on students centered learning where student will learn and developed the knowledge using internet resource. Teachers will facilitate students on completing task given. The sites developed by providing various activities for collaboration and communication purpose besides quizzes and assessments. It’s encouraged sharing of knowledge between teachers and students. Cloud based site allow the students to access at any device anywhere. The ease of access to educational courseware from this sites may reduce the paper consumption to support green technology.

Research Methodology
The research design for this study is a quasi-experimental conducted at a primary school in Pasir Gudang district involving a sample of 31 students in year 5. These students studied the Malay Language study in a syllabus as determined by the Ministry of Education Malaysia (MOE). The instrument for this study is the pre and post test which the question prepared based on unit specification Test Justification Table (JSU) for Bahasa Melayu Subject by Johor State Department of Education.

To develop a systematic VLE site, It is developed based on the ADDIE model. There are five phases in this model
which begin with the analysis phase, design phase, development phase, implementation phase and evaluation phase. In developing this page, each phase needs to be planned and organized specifically in terms of the content materials, the widgets and webpages choose and structured site interface to meet the student needs (Ladbrook & Parr, 2015). Interactive and attractive design plays an important role in increasing student engagement to avoid the low achievement and boredom during the learning session (Fredricks et al., 2011).

Research Finding

This research use the pre and post test of Malay Language comprehension questions. The purpose of using the instrument is to find the different result after using e-learning in student learning process. The student marks analyze using T-test. The test results are shown in Tables 1 and 2.

<table>
<thead>
<tr>
<th>Type of test</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre Test</td>
<td>48.00</td>
<td>9.46</td>
</tr>
<tr>
<td>Post Test</td>
<td>62.52</td>
<td>14.96</td>
</tr>
</tbody>
</table>

Table 2 Different between Pre and Post Test

<table>
<thead>
<tr>
<th>Pair</th>
<th>Min</th>
<th>SD</th>
<th>t</th>
<th>df</th>
<th>Sig. (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre -Post Test</td>
<td>14.52</td>
<td>9.90</td>
<td>-8.16</td>
<td>30</td>
<td>.000</td>
</tr>
</tbody>
</table>

Conclusion

Digital education is an educational agenda that every educator needs to understand and ensure the knowledge is optimally channeled. To achieve this goal, knowledge of student-centered teaching integrated to the e-learning site should mastered by teachers. Through these pages, student learning is managed by teachers to integrate the 21st Century Learning elements from variety of sources. The sites design and development based on ADDIE model can create a positive learning environment. The development of the interface, implemented in accordance with the VLE learning theory, enables pupils to actively engage in all activities and enhance student learning quality and performance. As a conclusion, the synergy inherent in e-learning enabled the application of 21st century learning to support the Industrial Revolution 4.0 and reform a smart society or society 5.0.

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Shariffudin, R. S. (2007). Design Of Instructional Materials For Teaching And Learning Purposes: Theory Into Practice. IT in Education, 1, 97
Collaborative Teaching Approach Manual (CTAM): Malay Language

Mohd Asnorhisham Adam, Muhammad Sabiq Mohd Noor, Muhammad Iskandar Amil

Pusat Kollaratif Pembelajaran Literasi dan Numerasi, Pejabat Pendidikan Daerah Pasir Gudang
asnorhisham@gmail.com

Sanitah Mohd Yusof
Fakulti Sains Sosial dan Kemanusiaan, Universiti Teknologi Malaysia

Abdul Rahim Hamdan
Fakulti Pembangunan Manusia, Universiti Pendidikan Sultan Idris

Muhammad Khairul Anuar Hussin
SMK Taman Universiti 2

Highlights:
The Collaborative Teaching Approach Manual (CTAM) is a special teaching guide for two teachers in the same classroom based on the Cook and Friend model (2010). The construction of the CTAM is based on the ADDIE Model. The CTAM has been tested on the mastery of the basic literacy standards of the level one Malay language literacy. The study was conducted on a quasi-experimental basis in teaching and facilitating. This study was conducted in a primary school in Pasir Gudang district involving a study sample of 70 second year students. The t-test was used to test the hypothesis of the study. The study found that there were significant differences among experimental groups using the CTAM in achieving the overall standard of literacy in the students' Malay language. The findings show that the use of CTAM can improve the level of literacy skills more effectively for the student.

Key words: Collaborative Teaching Approach Manual (CTAM); Malay Literacy (ML); Special Remedial Teacher (SRT); Malay Literacy Teacher (MLT); Teaching & Facilitating (T&F)

Introduction, Objective and Statement of problem
The changing educational curriculum in Malaysia demands that teachers change in line with the goals and objectives of change. Teachers now need to take proactive and collaborative actions by sharing information in performing their assigned tasks and responsibilities. In pedagogy, when two or more teachers share a lesson with a group of students in the same classroom, it is called collaborative teaching (Cramer, 2010). In collaborative teaching, teachers share ideas or information, provide moral support and encouragement when facing personal or professional difficulties. Collaborative teaching enhances effectiveness and creativity as a result of the unifying of the two minds. Teachers do not work alone, instead refer to each other for ideas for the advancement or improvement of T&F.

The use of CTAM is tested against the mastery of the basic standard of writing first-grade Malay language literacy. In addition, this approach aims to increase the level of mastery of 12 basic standard constructors of writing Malay language literacy through the Ministry of Education Malaysia's Malay language literacy standard. Through the use of CTAM to determine the difference in students' proficiency in writing Malay language at pre and post-test levels between conventional teaching approaches and collaborative teaching approaches.

The problem of mastery of the basic Malay language standard among primary school students still exists and guides even when various programs have been implemented. According to KPM (2017) the achievement of basic Malay language learners through the UNUS2.0 program has steadily declined from 2012 to 2017 with a record 8965 students failing. In addition, even though this student has mastered it, it is still weak and lagging behind in the KSSR mainstream curricula after 3 years of schooling. There were also students who were literate but inconsistent until they had to be restored by MLT or SRT. The cause of this problem is due to students being unable to receive adequate guidance by the SRT (Mohd Asnorhisham Adam & Abdul Rahim Hamdan, 2016, 2017).

MLT guidance in T&F is crucial to enable the sustainability of the basic Malay language standard. According to the study (Mohd Asnorhisham Adam et al, 2017; 2018) factors that make it difficult for MLT to differentiate in the classroom due to the large number of students. The large number of pupils in one class after being grouped through the streaming class has been a source of difficulty for teachers to implement T&F and focus on mastery of the basic Malay language standard of students. MLT is unable to carry out remediation, enforcement and enrichment activities when there is a large number of students in the mainstream class of up to 40 students in one class. MLT is difficult to implement in T&F when faced with a wide variety of student-level mastery. MLT is also difficult to manage
student behavior well because it cannot identify problems and levels of mastery. MLT also faces difficulties in implementing bridging in the regular classroom. In addition, the teacher who is recovering this student is not cooperating, discussing, sharing and working in teams to work on this student’s language skills.

As a result of these factors, teachers feel burden and depressed because they are unable to properly recover students. In addition, teachers who lack training and are unclear with the implementation of the LINUS and Special Remedies programs are contributing to teacher stress. This is, in addition to no problem sharing with friends or administrator attention. Therefore, an approach needs to be developed specifically in the teaching of teachers to overcome the problems of varying levels of mastery and the large number of students in one class.

The needs of students in the school are fundamental to the formation of a collaborative teaching team. The combination of resources such as the expertise, interests, knowledge, skills, experiences, personalities and time of each member of the teaching team is especially important in collaborative teaching of various disciplines. As such, a collaborative teaching approach is an alternative approach to enhancing mastery of the basic Malay language standard language. Therefore, a Manual of Collaborative Teaching Approaches to Mastery of Level One Malay Language Standards should be created to help teachers implement collaborative teaching to maximize their impact. Thus, this study provides a Level 1 Malay Language Collaborative Teaching Approach Manual: Requirements and Concepts to help level one Malay language teachers implement a collaborative teaching approach so that level one students master basic Malay language standards.

This study was carried out in two phases, namely the development phase of CTAM based on the ADDIE (1987) model and the CTAM evaluation phase. The construction of the CTAM is also carried out in two phases, namely the development phase of the collaborative teaching approach based on Cook and Friend’s (2010) model and the developed CTAM assessment phase.

Methodology

This study uses an experimental and descriptive quasi-experimental design using quantitative methods. The T-test quantitative method was used to obtain data on the mean difference in student achievement in year 2. Both control and experimental groups were given pre-test tests, while the post-test was given at the end of the study. The researcher also collected quantitative data of pre and post-test on student performance differences in T&F. Two classes of students were selected as the study sample. One class used a collaborative teaching approach (experimental) while another class used a conventional (control) teaching approach.

This study involved 70 year 2 students consisting of 33 students in the control group and 37 experimental groups. All students have the traits that they have not yet mastered in 12 literacy constructions in Malay. Researchers have explored issues that have left students unable to master 12 Malay language literacy constructs through pre-tests, observations and interviews. Different classroom observations were made for teachers and students in T&F sessions. In addition, the document review was also carried out based on the two (2) or final LBM screening instruments in 2017 along with the pupils’ Individual Mastery Reporting Form. This screening instrument was prepared by the Malaysian Examination Board. Pre and post-test were conducted using the year two (2017) screening instrument.

This study took about a month involving two teachers comprising one MLT and one SRT. The concept of a collaborative teaching approach involves two teachers: MLT and SRT. This approach is based on the model introduced by Cook and Friend (2010) in which teaching and facilitating take place in the same classroom. This study received the cooperation and support of the FasLINUS Officer, the District Education Office acting as the mentor. Prior to the implementation of this approach teachers will discuss with FasLINUS officials and administrators on various aspects of management and T&F such as the current status of student, data analysis of constants, issues and student background. In this study, a total of four mentors were given to teachers in one month. With this collaborative teaching approach SRT and MLT can share the task of delivering more interesting and effective Malay language content. In addition, the implementation of remediation, enforcement and enrichment can also be successful.

Findings, Discussion and Recommendations

Student Demographics

This section presents the profile of the students from the background to getting enough data. The study consisted of year two students of session 2018. The study sample also consisted of students who had not mastered the basic literacy standards of the Malay language. The total number of pupils was 70 students, divided into 37 pupils with a collaborative or experimental teaching approach and 33 pupils with a conventional teaching or control approach. Table 2 shows the sample profiles of quantitative studies.

Table 2: Sample Profile of Quantitative Studies.

<table>
<thead>
<tr>
<th>BNo</th>
<th>Group</th>
<th>Year</th>
<th>Sex</th>
<th>Male</th>
<th>Female</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Control</td>
<td>2</td>
<td></td>
<td>29</td>
<td>4</td>
<td>33</td>
</tr>
<tr>
<td>2</td>
<td>Experimental</td>
<td>2</td>
<td></td>
<td>28</td>
<td>9</td>
<td>37</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td>57</td>
<td>13</td>
<td>70</td>
</tr>
</tbody>
</table>
Table 2 also shows the total number of pupils in the control group of 33 consisting of 4 girls and 29 boys. Meanwhile, the experimental group consisted of 37 students consisting of 9 female students and 28 male students. The age of both groups was eight (8) years. Based on the results of the current Malay literacy screening test it was found that this group did not master the Malay language literacy. KPM (2015) has designated students who do not serve all 12 constructs or any of the constructs in the screening category as non-domiciled. Therefore both groups are homogeneous.

Table 3: Achievement Mean Control and Experimental Group Test on Stage Pre by conventional and Collaborative teaching Approach

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Mean</th>
<th>Standard deviation</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>33</td>
<td>20.15</td>
<td>15.18</td>
<td>0.152</td>
</tr>
<tr>
<td>Experimental</td>
<td>37</td>
<td>16.06</td>
<td>18.40</td>
<td></td>
</tr>
</tbody>
</table>

Significant at level <0.05

Table 3 shows the mean performance between the control and experimental groups at the pre-test level with conventional and collaborative teaching approaches. From these findings, 2 groups of students were analyzed. The control group was 33 students and the experimental group was 37. For the control group student category, a mean score of 20.15 was achieved with a mean deviation of 15.18. The experimental group, meanwhile, achieved a mean score of 16.06 with an average deviation of 18.40. From the analysis, the t test recorded a score of 0.152. This indicates that there was no significant difference in mean achievement between the control and experimental groups at the pre-test level in conventional and collaborative teaching approaches.

Table 4: Achievement Mean Control and Experimental Group Test on Stage Post by conventional and Collaborative teaching Approach

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Mean</th>
<th>Standard deviation</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>33</td>
<td>35.15</td>
<td>18.92</td>
<td>0.00</td>
</tr>
<tr>
<td>Experimental</td>
<td>37</td>
<td>47.83</td>
<td>17.18</td>
<td></td>
</tr>
</tbody>
</table>

Significant at level <0.05

Table 4 shows the mean performance between the control and experimental groups at the post-test level with conventional and collaborative teaching approaches. From these findings, 2 groups of students were analyzed. The control group was 33 students and the experimental group was 37. For the control group pupil category, a mean score of 35.15 was achieved with a mean deviation of 18.92. The experimental group, meanwhile, achieved a mean score of 47.83 with a mean deviation of 17.18. From the analysis, the t test recorded a score of 0.00. This indicates that there is a significant difference in mean achievement between the control and experimental groups at the post-test level in both conventional and collaborative teaching approaches.

Based on the study findings, the impact of this collaborative teaching approach is that teachers are able to manage students’ classroom and behavior well in T&F activities. In addition, teachers are more focused and can guide students more effectively. When problems arise in the areas of management and T&F teachers will discuss and collaborate together to find the best solution to achieve their goals and objectives. Pupils are more interested in learning at the same time, making it easier for teachers to practice recovery, enrichment and enrichment. The teachers involved in this study agree that this collaborative teaching approach is effective in increasing the literacy level of first-grade Malay language literacy.

CTAM is an innovative teaching method that can effectively manage the diversity of students in the field of education. The effectiveness of the use of the CTAM depends on the involvement and role of the parties as a whole and in cooperation with the implementers. The impact of this is that diverse students whether mastery of the basic literacy standards of the Malay language or any other subject can prevent them from falling out of education.

During the process of collaborative teaching approaches, information sharing between all parties is essential to prevent students from falling out during the T&L process. Discussions are also important to get more information and avoid making assumptions in the process of collecting student information and making decisions together.

The results show that the use of CTAM can increase the level of mastery of basic literacy levels of Malay language learners. In addition, this approach also assists teachers in the management and pedagogy of teachers specializing in student rehabilitation, enrichment and enrichment activities. Therefore, CTAM is effective in increasing the level of basic literacy standards of Malay language learners.

References


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