Real Application of Transformative Approaches for

Teaching and Learning in the 21st Century

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Special Dedication

This book is dedicated to UNIMAS academicians who work hard in conducting the best teaching and learning experience. This book is hoped to be an inspiration to educators on how to implement the teaching and learning process more effectively.

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Preface

"It's not just learning that's important. It's learning what to do with what you learn and learning why you learn things that matter." -Norton Juster

The Real Application of Transformative Approaches for Teaching and Learning in the 21st Century book was produced to appreciate the transformative work of lecturers in teaching and learning. This book is expected to serve as a guide to other lecturers in helping them to improve their teaching approach, delivery, and assessment of their courses. Lecturers can also use this book to develop their ideas and creativity in designing teaching and learning according to current needs and align with the learning outcomes of the course.

Global changes in the twenty-first century have altered the landscape of teaching and learning, particularly in delivery methods, approaches, and assessments. This is due to the fact that the student body is made up of generation Z, who have different styles of learning than that of the lecturers. Conventional methods used by lecturers are no longer an option for today's students. Therefore, lecturers must transform their teaching and learning in order to be relevant to today's students.

The combination of transformative approaches introduced becomes the strength of this book's content. Authors combine diverse approaches, delivery, and assessment in teaching to ensure the effectiveness of teaching to students. Moreover, the collaborative approach used provides an alternative for lecturers to minimize the burden on students for courses taken. This approach has the potential to have a greater impact, particularly in terms of student understanding of learning.

The element of creativity incorporated is also a strength of this book. Authors explain some terms and concepts using diagrams and figures to help the reader understand. The steps and procedures for carrying out teaching and transformative approaches are stated in a systematic manner to help the reader understand what is being conveyed.

The book also includes writers from various backgrounds. This distinguishes it as a unique and comprehensive manuscript. Readers are guided through conceptual and practical understanding of teaching and learning methods. The author's presentation of basic concepts and applications can help the reader understand knowledge more deeply and broadly.

Crafting a learning environment where students are able to explore and understand how the physical world works, and to connect complex scientific concepts to their daily lives is vital. It also includes building students' confidence in their ability to solve challenging problems and empowering them to build a better future for themselves and others. CTS is one of a better way of learning that will prepare students towards focusing on being very collaborative, self-motivated and self-directed all the time staying true to the lifelong learning values, which are imperative to carve a better future for the students in their field of choice.

The next project is related to the environmental issues relating to solid waste, wastewater, and hazardous waste viewed in the context of their treatments. This course has been implementing service learning (SULAM) as a part of an immersive learning approach since Semester 2, 2017/2018. In the previous years, i.e. 2017/2018, and 2018/2019, the

course assessment included either a final examination (40%, session 2017/2018), or a mid-term examination (30%, session 2018/2019). Although SULAM implementation in this course has generally improved the CLO achievement since 2017/2018, the pen and paper examination has resulted in some students not achieving the intended CLOs. Instructors were not sure on the effectiveness of examination in creating a deep learning experience for students.

Therefore, in semester 2, 2019/2020, mid-term examination was replaced with case-study analysis to (1) encourage higher order thinking skills among students and (2) cultivate the sense of commitment and responsibility among students to find innovative solutions towards waste management issues. In addition, students' e- SULAM projects as well as group discussion and engagement with target community were implemented on online platforms. Students' reflection on their e-SULAM projects was recorded on their e-portfolio. Implementation of immersive learning through blended learning in this course has resulted in improved CLO achievement as compared to the past two years. Students' reflection on their learning experience in this course implied the effectiveness of immersive learning (blended learning) approach in this course.

Besides that, the project involved transforming the typical class lecture into an interactive scientific communication environment. Students were exposed to the real scientific communication via workshop-style delivery, project-oriented problem-based learning (PoPBL) on proposal writing projects, and brainstorming/discussion activities during weekly meetings. The initiative eliminated the traditional lecture and end-of-semester assignment practices.

Another project is MATHX Project, a new project-based learning instrument that allows digital students to work collaboratively, purposely implemented to develop teamwork and student's management skills. Students translated acquired knowledge to applications and STEM projects. The integration of digital technology used in this project helps students create meaningful and enjoyable learning experiences in Mathematics.

The following project is related to the assessment in learning. In order to improve learning via assessment conduct, assessment must be objective, significant, and magnitude. OSPE has/have been adapted and implemented for Biology students in Centre for Pre-University Studies to assess know-what and know-how practical competencies following the objective and structured manner with direct observation of the students' performance. The assessment provides meaningful learning experience to the students as it can assess all three domains (cognitive, affective, and psychomotor).

Furthermore, the enriching immersive learning experience during movement control order (MCO) was possible through blended learning substitution method. Finally, one project is related to social media and animation software offering several attractive features that may overcome the limitations of the existing educational portals. The team introduced the use of YouTube, Instagram, and Doodly as supplementary platforms for teaching Environmental Biotechnology in Semester 2 2019/2020 which resulted in excellent academic performance and positive feedbacks from the students.

Finally, this book discussed also describe the course MDP30609 Community Medicine and Public Health posting, the assessment has been modified by adopting the Alternative Assessment method. The Alternative Assessment is regarded as comprehensive, where it assesses the candidates' ability to integrate writing task and performance, divergent thinking in solving problems and enhancement of meaning skills.

Acknowledgement

Inquiry-based Assessment – Transforming Wonder into Knowledge

Kuryati Kipli, Kasumawati Lias

Summary/Synopsis of Project/Initiative

Transformative or transformation learning is one of the learning theory which focuses on enhancing the student's ability to learn by initiating their critical thinking based on new information [1]. Through transformative learning, the educators can create active learning [2], where the students or learners can thrive. There are many approaches to perform transformation learning. As for Digital Signal Processing (DSP) course, an inquiry-based assessment is designed for the students. It is based on real-inquiry-based problems to measure the targeted Learning Outcome (LO). The assessment is initiated and adapted based on the structured inquiry formation to attain the breadth and depth on the specific knowledge and information. This is then supported by the related evidence and facts gathered using and during the investigative processes.

Project Rationale

In Digital Signal Processing (DSP), one of the most challenging parts is to elaborate on the windows filtering topic. Since the students are not able to visualise the application of the windows filtering, they might lose their interest to know more on the subject matter. Thus, a transformative learning needs to be introduced to create an active learning environment as well as to attain their interest to learn more and initiate critical thinking to solve the subject matters revolving around windows filtering.

In addition, it is difficult to show to the students the definition, examples, applications and significant of windows filtering in DSP. There are various types of windows filtering such as Rectangular, Triangular, Hamming, Hanning, Blackman and Kaiser Window. The students should understand how windows filtering applies and works in DSP. Each window has its unique characteristics that required good understanding to ensure the targeted LO is accomplished. Hence, the inquiry-based assessment is carried out for transformation learning to facilitate the students to learn, observe and appreciate the importance of windows filtering in DSP.

The philosophy of inquiry-based assessment is inspired from the inquiry-based learning model. During the "discovery learning" movement, the inquiry-based learning paradigm originated in the 1960s relies on the premise that individuals will learn through scenarios and problems, and social interactions [3]. Rather than memorizing information from written documents, instructors or lecturers encourage students to produce inquiries that would satisfy their curiosity, enabling them to expand their knowledge-base and improve their skills and conceptual frameworks. Inquiry-based learning is not a technique or practice in itself. It is a process that has the potential to increase the intellectual engagement and deep understanding of students or learners [3]. It urges them to develop their questioning, research and communication skills. Besides, it also encourages them to collaborate outside the classroom by either solving problems, creating solutions or tackle real-life questions and issues. Nevertheless, inquiry-based learning also initiates the students/ learners to participate in the creation and amelioration of ideas and knowledge [3]. Five (5) steps of the inquiry-based learning model [4] are summarized in Figure 1.
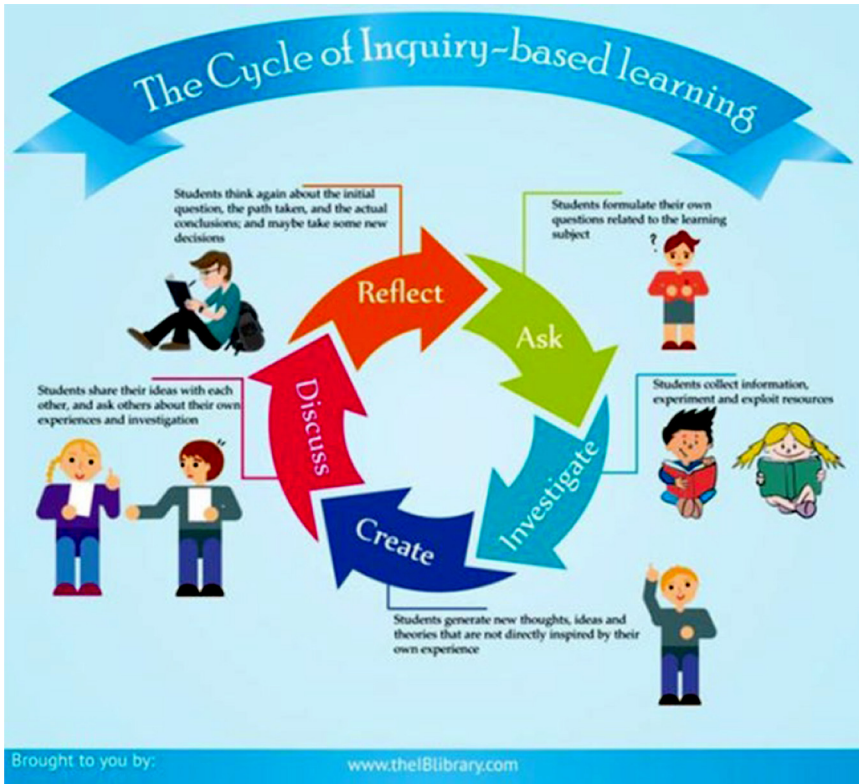
Figure 1: Inquiry-Based Learning model

Based on Figure 1, inquiry-based learning is a continuous cycle in finding as much as possible, the related knowledge that relates to real-world applications. Hence, it is a suitable approach to be applied in ensuring the students can understand well regarding the windows filtering topic.

Approach

The inquiry-based assessment is implemented based on four (4) principles of inquiry-based learning [5], as follows:

- Principle 1
  Learners are in the center of the entire process, while instructors or lecturers, resources, and technology are adequately organized to support them [5].
- Principle 2
  All learning activities revolve around information-processing skills [5].
- Principle 3
  Instructors or lecturers facilitate the learning process, but also seek to learn more about their students and the process of inquiry-based learning [5].
- Principle 4
  Emphasis should be placed on evaluating the development of information-processing skills and conceptual understanding, and not on the actual content of the field [5].

Then, Figure 2 presents the implementation steps of this inquiry-based assessment. Based on Figure 2, programming with MATLAB software is needed to carry out the inquiry-based assessment so that the students can observe the digital output of the signal processing related to the aligned LO. Also, this assessment required students to present their inquiry-based learning output in creative video presentations. The marks are given based on their video and their report writing. The rubrics for video marking and report writing are provided to the students through UNIMAS Learning Management System (LMS) which is known as eLEAP. The platform acts as their reference and teaching medium as well as provide for the learning and assessment transparency purposes.

In an instructional setting, inquiry-based assessment can give instructors or lecturers the opportunity to allow students/learners to fully explore problems and scenarios, so that they can learn from not only the results

but also the process itself. They are encouraged to ask questions, explore their environments, and obtain evidence that supports claims and results. They are also given support to design a convincing argument on how they reached the end result.

Therefore, this inquiry-based assessment assists students/learners in researching, analyzing, applying, and appraising knowledge in DSP, especially windows for filtering areas. The students/learners can understand; how the idea/formula was developed, why the rule or formula works and when they can properly apply the rule, idea or formula.

This is because the process of posing open questions and answering them by means of original approaches empowers students to take charge of their learning. Barring hiccups, they should develop an understanding of the concept using their own methods and thinking styles. The same principle applies to experiential learning which places students at the core of the learning experience.

Students' Engagement/Involvement

The inquiry-based assessment can be seen as a departure from the curriculum that reinforces relevant content and improves understanding of core concepts. It includes open-ended inquiries into a matter or a problem that requires the students/learners to engage in evidentiary and creative reasoning problem-solving, as well as discovering "problems." With this kind of assessment, the students/learners show more curiosity than normal regarding a specific topic, which satiates by using their questions to introduce an inquiry activity. In doing so, the students/learners effectively retain essential information gleaned during the assignment given. Thus, the ability of cognitive learning is assessed.

Meanwhile, the techniques and steps implementation for MATLAB programming for the given real-inquiry-based questions assesses the psychomotor ability. These MATLAB programming skills are significant in the real workforce, especially where signal processing is required. By

using programming, signal from the electrical and electronic devices can be processed to attain the required information and is significant for instrumentations maintenance and troubleshoot. From the video presentation, it shows that most of the students can apprehend the MATLAB programming skills with EEGLab tools for windows filtering. As observed from their submitted videos and reports, all groups can transform the inquiry-based assessment into valuable knowledge to achieve the targeted LO.

In addition, the inquiry-based assessment is implemented in a group of 4 or 5 students. Their attitudes, especially taking the role in leadership and any team members, are significant in running the given tasks. It is important to ensure the assessment can be carried out successfully. Furthermore, students' communication skills, especially oral and written skills were also imposed in this assessment. A good presentation of the outcomes of the inquiry-based assessment is important to ensure less confusion and argument on the constructed idea and knowledge. Their creativity in presenting their outcomes is the additional leverage for their oral and written presentation. All the mentioned skills are assessed using the prepared rubrics. Based on the evaluation, most of the students can collaborate well as a team and present their outputs either through an oral or written report. In terms of video contribution, the students can deliver a creative presentation.
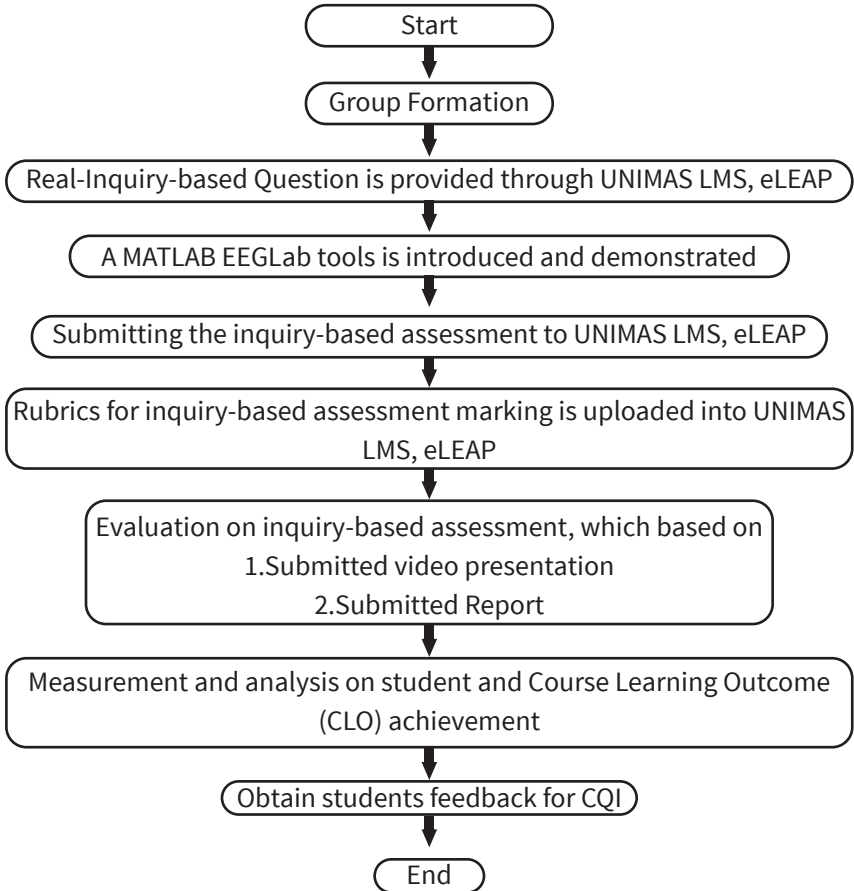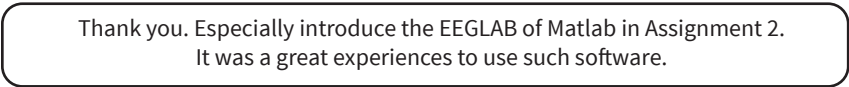
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Figure 2 - Implementation steps from Inquiry-Based Learning

Impact on Students' Learning

As the teaching, learning, and assessment are carried out during Movement Control Order (MCO) periods, the students' reflective learning is very important to record. Not only is it important for the targeted LO, but it is also used for the overall teaching and learning process to ensure that the teaching, learning, and assessment process were well planned, conducted, and implemented. The students' feedback for this course

is obtain in terms of; i) Internet infrastructure ii) Online Test 2 iii) CLO achievement (student's perspective) iv) Overall teaching, learning and assessment process.

The responses are obtained either through Padlet, Google form survey, or student evaluation survey. Padlet and Google form survey were posted at eLEAP to be filled and completed by the students, while student evaluation survey is carried out at the end of the semester. Most of the students are engaged in their learning reflection. Students' feedbacks and comments are important to be used for continual quality improvement (CQI) process.

> Thank you. Especially introduce the EEGLAB of Matlab in Assignment 2. It was a great experiences to use such software.

Figure 3: Student reflection on inquiry-based assessment

Most students have engaged in active learning, especially when the inquiry-based assessment is distributed through eLEAP, the students show their interest and passion to carry out the given tasks. They were asked many interesting questions, especially when MATLAB demonstration for EEGLab tools is conducted. Their curiosity is further developed. The inquiry-based assessment is in its best place to be implemented to actively involve the students in the learning process. Consequently, the students wonder with regards to the windows filtering and this transformed into knowledge. Furthermore, it is in line with an old adage that states:

"Tell me and I forget, show me and I remember, involve me and I understand."

The last part of this statement is the essence of inquiry-based assessment learning.

Improvement Project/Initiative in Future

Inquiry-based approach has been successfully carried out where the students are engaged actively in learning activities. For the next implementation of the course, project-oriented problem-based learning was planned to not only cater to one specific LO, but to all LOs in the course.

Related Learning Outcome Clusters MQF 2.0

The inquiry-based learning requires cognitive and psychomotor practical skill by executing the MATLAB programming to attain the windows filtering program in biomedical applications. Furthermore, it also acquires students to work in group and present their outcomes, findings and observations in creative and innovative video presentation and report writing, where this requires IT and digital proficiency skills. Thus, by referring to Learning Outcome Clusters MQF 2.0, this inquiry-based learning outcome is aligned to MQF Clusters 2, 3A, 3B, 3C and 3D for cognitive, practical skills, interpersonal, communication and digital skills, respectively [6].

Acknowledgement

References

- R. Nelson, S. Garcia, E. Bonner, V. Marone, T. Yuen and J. Browning, "Engaging Engineering Faculty in Transformative Practices," 2018 International Conference on Learning and Teaching in Computing and Engineering (LaTICE), Auckland, New Zealand, 2018, pp. 65-71, doi: 10.1109/LaTICE.2018.000-4

- R. Nelson, V. Marone, S. A. Garcia, T. T. Yuen, E. P. Bonner and J. Browning, "Transformative Practices in Engineering Education: The Embedded Expert Model," in IEEE Transactions on Education, 2020, doi: 10.1109/TE.2020.3026906

- Chizhu Ma, Rui Xiao, Yongjun Wei and H. H. Yang, "An inquiry-based learning approach on a educational technology course," 2011 IEEE International Symposium on IT in Medicine and Education, Cuangzhou, 2011, pp. 422-424, doi: 10.1109/ITiME.2011.6130867

- F. C. W. Andy, "To arouse students' interest in learning: Does inquiry based learning make a difference," 2015 IEEE International Conference on Teaching, Assessment, and Learning for Engineering (TALE), Zhuhai, 2015, pp. 295-300, doi: 10.1109/TALE.2015.7386062.

- Malaysia Qualification Framework 2.0

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