



**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).

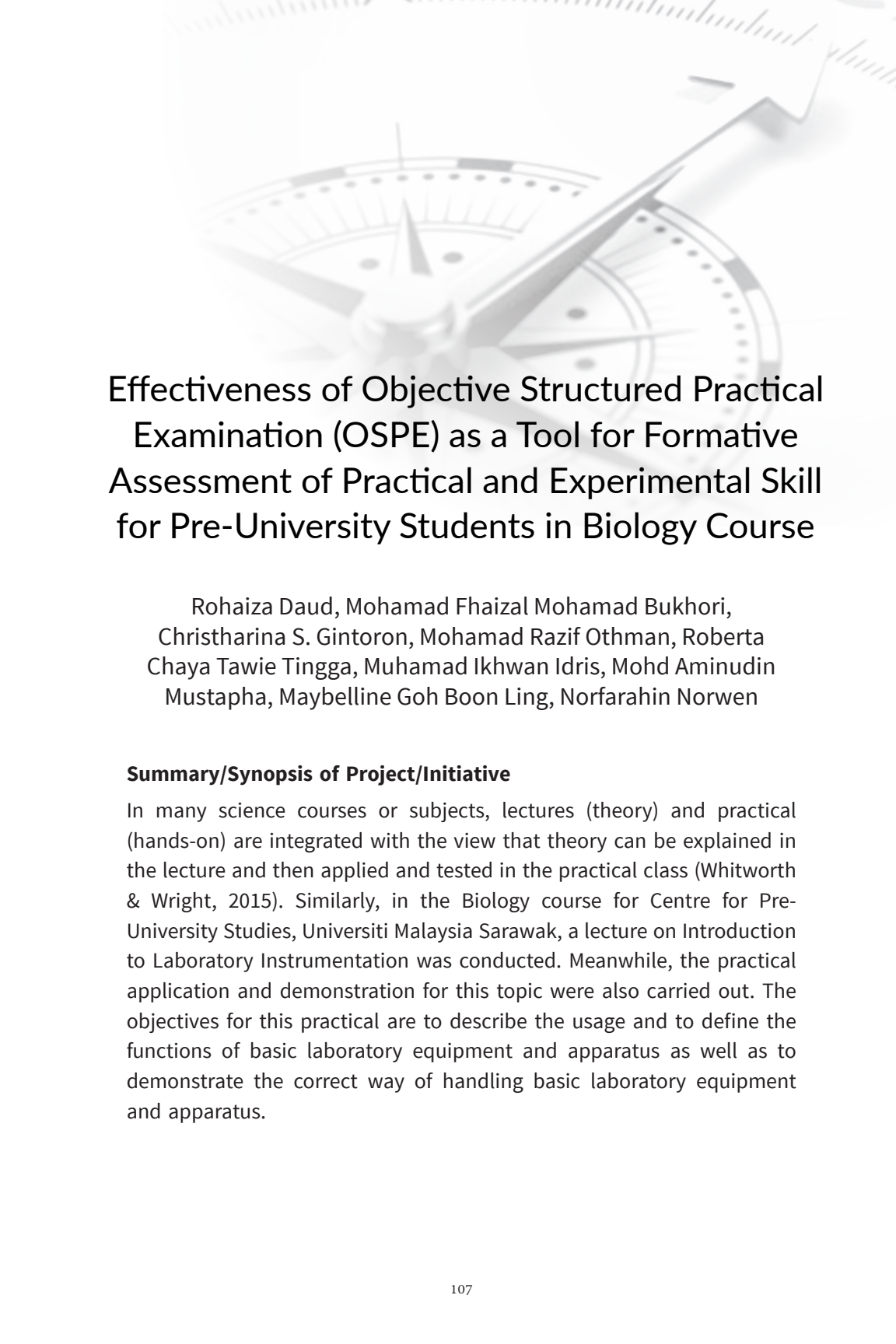
Furthermore, the enriching immersive learning experience during movement control order (MCO) was possible through blended learning substitution method. Finally, one project is related to social media and animation software offering several attractive features that may overcome the limitations of the 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.

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First of all, we are very grateful to the Deputy Chancellor Prof Datuk Dr Mohamad Kadim bin Suaidi and Deputy Vice Chancellor (Academic and International) Professor Dr Ahmad Hata bin Rasit for their support and opportunity in producing this book. This gratitude also goes to the Director of CALM, Dr Kartini binti Abd Ghani for her encouragement throughout the journey of realizing this book. We would also like to extend our acknowledgments to the Deputy Directors (Teaching Advancement), (Learning Technology), Coordinators and all administrative staffs in CALM for the support.

Thanks to all award recipients who have contributed to the chapters of the book. They are Associate Professor Dr Cheah Whye Lian, Dr Kuryati binti Kipli, Dr Melody Kimi, Mohamad Faizuan bin Mat, Abdul Halim bin Hashim, Dr Chung Hung Hui, Dr Norazlina binti Bateni, Ahmad Alif bin Kamal, Dr Yvonne Michelle Campbell, Nor Hayati binti Jaya, Dr Rafeah Wahi, Professor Dr Zainab binti Ngaini, Norhunaini binti Mohd Shaifullah, Rohaiza binti Daud, Associate Professor Dr Afzan binti Ahmad Zaini, and Dr Nurashikin binti Suhaili. Not to forget to everyone who have been involved directly or indirectly in producing this book, our deepest appreciation goes to all of you.



Effectiveness of Objective Structured Practical Examination (OSPE) as a Tool for Formative Assessment of Practical and Experimental Skill for Pre-University Students in Biology Course

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Summary/Synopsis of Project/Initiative

In many science courses or subjects, lectures (theory) and practical (hands-on) are integrated with the view that theory can be explained in the lecture and then applied and tested in the practical class (Whitworth & Wright, 2015). Similarly, in the Biology course for Centre for Pre-University Studies, Universiti Malaysia Sarawak, a lecture on Introduction to Laboratory Instrumentation was conducted. Meanwhile, the practical application and demonstration for this topic were also carried out. The objectives for this practical are to describe the usage and to define the functions of basic laboratory equipment and apparatus as well as to demonstrate the correct way of handling basic laboratory equipment and apparatus.

To pursue study in higher academic programmes (i.e., degree programmes), it is important for pre-university students to have high value placed on the skills learned in laboratories and practical. Lecturers in degree programme or future employers will be very interested in the skills the students can display as a result from active participation in laboratory classes and practical, as well as the knowledge and understanding attained during their pre-university studies (Briggs et al., 2012).

To assess or evaluate the basic knowledge and practical skills of the students on selected basic laboratory equipment and apparatus, meaningful exam system or formative assessment has been designed and adapted

which is Objective Structured Practical Examination (OSPE). To evaluate the effectiveness of this assessment, a total of 136 students participated in this study by answering the questionnaire given. Likerts scale was applied to measure the degree of agreement with each statement.

Project Rationale

Effective teaching and learning in Biology involve perpetual state of show and tell methods. Therefore, hands-on laboratory teaching conducted will encourage and increase better understanding in students. Students can retain the knowledge and skills longer when they experienced the practical. On the other hands, laboratory teaching is also important as it forms and integrate effective science teaching methods (Abrahams & Millar, 2008). This can be done by encouraging the students to derive various scientific principles, theories, concepts, and methods on their own by being personally involved in the experiment work.

To assess whether the theory and skills learned during the lecture and practical classes are achieved, an assessment must be conducted, especially to evaluate the achievement of course/subject learning objective. This is because, assessment is known to drives the learning process. However, a single examination will never fulfil all functions of assessment/evaluation, such as assessing / evaluating knowledge,

comprehension, skills, motivation, and feedback. For example, written examinations assess/evaluate the cognitive aspects, which is only one aspect of the competency (Rajkumar et al., 2016).

Therefore, structuring the assessment through emphasizing the objective of the course will gain a better and a more valuable practical assessment. For example, using OSPE as the formative assessment to assess basic knowledge and practical skills of the students in basic laboratory equipment and apparatus. The justification is based on that the student's assessment should be integrating good teaching practices, including course planning, tied to the learning outcomes, and meeting individual's needs.

Assessment is one of the essential parts in effective teaching and learning process. It must align with the learning objectives for specific lesson. In addition, the purpose of assessment must also align to improve student's learning performance. In other words, allowing students to learn and experience in the real contexts.

In this case, OSPE plays role as an assessment that allows diverse learning opportunities made available to students with different learning style and preference (Vinod, 2017). As mentioned before, assessment shouldn't be limited in the form of high stakes which test arbitrary facts and concepts and become a disadvantage to certain students. Assessment shouldn't be focused on teaching students how to answer tests. Assessment should guide the students to develop creative, critical thinking and decision-making skills which are valuable into becoming wise and productive individuals, holistic in all areas. Along with this, the lecturer is responsible to explain the standard criteria in the rubrics so that students will know what will be expected.

Approach

This assessment plays an important role in helping the students to be aware of the inadequacies of know-what and plan for the summative assessment. In addition, this assessment also helps the instructor (lecturer) to recognize the level of subject mastery, acknowledgement, interest and appreciation of the course. This is because, OSPE serves as a tool for assessing multiple dimensions of the student’s performance as well as the cumulative knowledge and skills acquired during the course (Tables 1 and 2).

Table 1: Session of OSPE conducted.

Session	OSPE 1	OSPE 2	OSPE 3
Session Details	Define various functions and uses, and demonstrate the correct way of handling stereo microscope.	Define various functions and uses, and demonstrate the correct way of handling compound microscope.	Define various functions and uses, and demonstrate the correct way of handling micropipette.
Domain Assessed	Cognitive, affective, and psychomotor.		

Phase 1: Prepare the Students

In Week 1 of academic session, the students were taught the theory of instrumentation via two hours lecture (PPTx slides).

Phase 2: Guide the Students

In Week 2 to 3, students were involved in three hours practical or laboratory session. Students will demonstrate (hands-on) the correct way of handling the instruments; assisted by the lecturers. They must submit the laboratory report right after the session. The laboratory report includes several post-laboratory questions related to the practical session.

Phase 3: Assess the Students through OSPE

In Week 3 to 6, the formative assessment for practical skills will be conducted. There are three sessions, namely, OSPE 1: Stereo microscope, OSPE 2: Compound microscope, and OSPE 3: Micropipette. Each session will be conducted at a different week of study (between week 3 to 6). Only one session per week. The formative assessment will be conducted individually. The details of assessment/evaluation methodology are as follows:

Table 2: Example of formative assessment of OSPE conducted.

Assessment	OSPE 1: Stereo Microscope	
Student's group	Group 1 (+/-120 students): Date 1 Group 2 (+/-120 students): Date 2 Group 3 (+/-120 students): Date 3 (Will be held in the same week for all groups)	
Venue	Quarantine room	Station
	Students are required to be in the quarantine room 15 minutes before the session start. There are several facilitators that will monitor the students in the quarantine room and in the hallway.	In total, there are 9 stations with one lecturer at each station. One lecturer will assess/ evaluate approximately 15 students.
Time allocation	5 minutes per person.	
Attire	Formal/Semi-casual and laboratory coat.	
Assessment/Evaluation	Part 1	Part 2
	Student will be assessed/ evaluated on the knowledge (theory), including verbal question related to the instrument/ apparatus tested. There are at least three variants for the verbal question. Different students will be asked randomly between the three questions.	Students will be assessed/ evaluated on the practical skills (hands on). Students must demonstrate the correct technique on how to use the instrument/ apparatus. Students will be assessed/evaluated on the steps/procedure used based on the rubrics provided.

Phase 5: Intervention Plan and Learning Extension

Once student(s) needs are determined, a plan of action is developed to overcome the weakness(es) of students such as allocating more attention to those students in the next practical session.

Students' Engagement/Involvement

The OSPE is a comprehensive tool for individual assessment as it is a competence-based assessment. It provides meaningful learning experience to the students because it assesses knowledge and practical competencies in an objective and structured manner with direct observation of the students' performance (Jabeen et al., 2016). On top, it is also a comprehensive tool to assess psychomotor skills.

In this study, N=96 (70.6%) students strongly agree that OSPE should be an assessment component in Biology (Figure 1). The students acknowledge, recognize and admit about what they have been taught, read, and activities conducted relating to the lesson as well as the assessment. The students can materialize the lesson learned based on the assessment to improve and make progress in their learning. In this study, N=76 (55.9%) students strongly agree that there are new skills or knowledge that they have acquired during OSPE (Figure 1). Based on this assessment, the students have engaged in active learning activities by talking to each other in small or large group discussions and develop their skills as compared to only memorizing information. They even move beyond just reading, listening, or watching to improve and progress their learning by connecting with the materials.

Impact on Students' Learning

A total of N=99 (72.8%) students strongly agree that OSPE has increased their knowledge and understanding in terms of skills relevant to the topic assessed/evaluated (Figure 1). Therefore, the know-what and know-how can be implemented in appropriate areas such as respiration,

cell division in plant and animal cells, DNA extraction, DNA amplification, plant identification, and water quality observation which was consistent with the learning objectives of the course.

The assessment is valid, unbiased, objective and trustworthy tool (Wade et al., 2013). About N=76 (55.9%) students strongly agree that OSPE has enabled them to identify the area of weakness in procedural steps (Figure 1). Students' weaknesses can be identified easily, and corrective (improvisation) measures can be taken accordingly.

A total of N=68 (50%) students strongly agree that OSPE triggers their interest and N=69 (50.7%) students strongly agree that OSPE motivates their learning (Figure 1). This is because, the instructor encourages the students to derive various biological principles, theories, concepts, and methods by personal involvement in the practical work.

Finally, the assessment is found to be an effective teaching and learning of biology which involve a perpetual state of show (demonstrate/hands on) and tell (discussion). The assessment has helped and encouraged the students to better understand, retain the knowledge and skills longer as they have conducted the experiments on their own. Other than that, the students were able to demonstrate engagement, care, safety, and responsibility towards the work. Lastly, N=78 (57.4%) students strongly agree that OSPE has increased their knowledge and N=52 (38.2%) students strongly agree that OSPE has helped them to developed problem-solving skills (Figure 1).

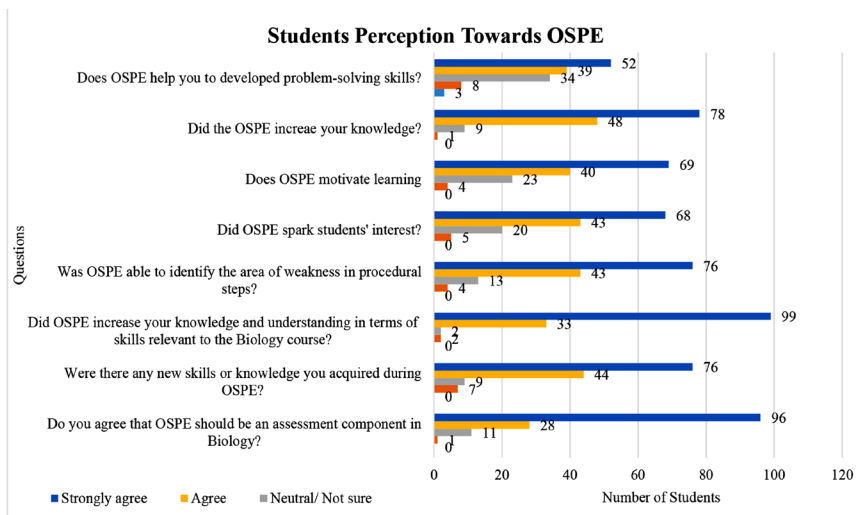


Figure 1: Student’s perception towards OSPE.

Improvement Project/Initiative in Future

This study will be more meaningful and provide a higher degree of confidence by increasing the sample size and questionnaire. Involving trans-university can improve the output relevancy by broadening the scale of participants, topics, and feedback input.

Related Learning Outcome Clusters MQF 2.0

Cluster 2/3A/3B/3C/5

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Keywords

Formative assessment, OSPE, pre-university, tool of assessment.

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