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Eyes on Learning, Hearts on Teaching is a product by academics in Malaysia who conducted research on improving and enhancing Learning and Teaching practices in their own classrooms.

We would like to thank everyone who helped and contributed in making UM-LiTeR project a great success.

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INTRODUCTION

As quoted from Albert Einstein, “I never teach my pupils, I only attempt to provide the conditions in which they can learn”. There is no “one size fits all” teaching method, as it needs to be modified based on the students’ requirements. Even though technology is becoming more advanced nowadays, the core of teaching still depends on the passion of the educator, while the technology itself acts as an assistive tool where necessary.

This book is a product of University of Malaya Learning Improvement and Teaching Enhancement Research (UM-LiTeR) by academics in Malaysia who conducted research on improving and enhancing Learning and Teaching practices in their own classrooms, courses, and even at program level. The UM-LiTeR grant provides an opportunity for the lecturers to try new approaches or methods in their classroom and be awarded for it. It is not often that such efforts by our lecturers receive acknowledgement and appreciation, thus this culture should be further encouraged to promote better learning experience among students and higher level of reflection among lecturers upon their methods and principles of knowledge dissemination in class.

This book is a compilation of twenty-nine chapters related to teaching practices among lecturers in Malaysia. It is aimed at sharing and disseminating their Scholarship of Teaching and Learning (SoTL) and Action Research findings among academicians across Malaysia. It provides an overview of three major themes, namely (i) Learning and Teaching Enhancement; (ii) Assessment and Technology; and (iii) Student Support.

It is hoped that the compilation of ideas and experiences in this book would be able to shed some light and spark ideas for educators to improve their teaching and learning practices, including assessment, technology use, as well as student support. Readers who are interested or would like to know more about any of the chapters in greater detail may contact the corresponding authors of the chapters. You are all most welcome to adopt and adapt their approaches in your own practice, even if it cuts across different fields. Try it out! -- as the ones who should eventually benefit from what we do as educators are the students. Let them internalize the wisdom you can share, and enjoy the process of learning.

Dr Nur Azah Hamzaid

Editor
Section 1:

LEARNING AND TEACHING ENHANCEMENT
The iDEeA Project: Exploring Design Mindset and Toolset of Biomedical Engineering Undergraduates

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The iDEeA project: An effort to improve design learning

The ability to design a particular solution, including the application of design thinking process as well as to perform and justify the design, is a core competency sought after in undergraduate biomedical engineering students that sets them apart from technicians and lab technologists. This will empower the graduates to have an innovative value creation mindset and toolset; as it is about thinking, doing and feeling. Design-based projects set students in design thinking activities including the investigation and understanding the scope and context of the problem on hand, exploring and discovering various solution methods, listing and selecting appropriate criteria, identifying and anticipating problems, and conducting validity testing. Therefore, the efficiency of improving students’ learning experience on design-based problems is important; hence the iDEeA project was proposed with the aim of discovering the learning effects of implementing an innovation in strategic planning of design component in a few identified courses of Biomedical Engineering students across all years.

How did the iDEeA project work?

Following the need to help the Biomedical Engineering students on how to design, the Integrated Design in Engineering Education Approach (iDEaA) project was implemented in an effort to help the students address the design know-how with the guidance of the lecturers involved by implementing the iDEaA elements in each of their classes by incorporating integrated planning, teaching and assessment by the lecturers.

At the beginning the semester, students were introduced to the design concept during a workshop and throughout the classes, which is part of the integrated planning aspect, following which the knowledge gained was then implemented in their design-based assignments or projects toward the end of the semester. Within the continuous assessment, 20% of the component was dedicated to the design-based assignment or project with the assessment carried out by evaluation of all the lecturers involved in this project.

Methodologically, the project is divided into 2 stages: 1) Pre-stages activities and 2) Design thinking, teaching and learning activities. Within the first stage, the lecturers attended the trainers’ workshop to familiarize themselves with design assessment methods and self-reflection portfolio guidelines. This was followed by a 1-day design thinking workshop for the students which was conducted to expose them to the criteria and process (Figure 1) of designing a project. After the introductory session at the beginning of the workshop, the students were expected to incorporate elements of design and critical thinking skills
and justification in their selected projects. One prominent example of the project chosen was food waste management. This exercise has helped the students to understand what is expected in a design thinking project and assist in empowering them with the ability to use this knowledge to instill innovative value in their subsequent design project. The project assigned was carried out in groups.

In the second stage of the iDEeA project, the students were expected to apply these sub-stages in their design assignment or project beginning from 1) Observation, 2) Brainstorming, 3) Ideation, 4) Prototyping, 5) Testing and 6) Presentation. Courses involved in this project were Human Anatomy & Physiology (First year), Biomechanics of Human Motion (Second Year), Biomechanics (Third Year), Medical Instrumentation (Fourth Year) and Artificial Intelligence in Medicine (Fourth Year) and a total of approximately 100 undergraduate students of the Biomedical Engineering department participated in the iDEeA project. The following is the list of the design assignment or projects for each of the courses:

1) Human Anatomy & Physiology
   ‘As a Biomedical engineer, how might you help in regenerating/reengineering human body parts?’

2) Biomechanics of Human Motion
   Human Movement Measurement System Design Project

3) Biomechanics
   Special Chair for people with Dwarfism

4) Medical Instrumentation
   Design an instrumentation system to acquire physical signal (it can be pressure, temperature, bio-potential signals)

5) Artificial Intelligence in Medicine
   Design decision-making software to assist with real problems and daily activities around the campus
Figure 1 shows the design thinking process that the students had to undergo in completing their assignment. In conducting the Anatomy and Physiology assignment, the first year students need to feel the empathy for someone without a complete body part with question on “How do these people feel and why is it important to help them?”. For the Biomechanics project, the third year students needed to define the criteria of the chair for people with Dwarfism. Second year students taking the Biomechanics of Human Motion course were requested to think about a new idea for measuring human movement. The fourth year students had undergone the experience in developing prototype for various types of signal acquisition hardware. The final year students had also involved in testing their self-made decision making software on the real problems encountered in their daily lives.

**In the Context of Engineering Education**

The project started as an effort to make design thinking appear more natural in students’ theoretical classroom subjects. Over the past few years, in order to deliver the knowledge and skill to enable design thinking among students, theoretical subjects were taught separately with laboratory-based or design-based courses. Students were expected to gather the attributes intended through learning the different courses and integrate the learnt concepts, knowledge and skills, and apply them into useful solutions themselves. Until more recently, the approach shifted into merging their laboratory or design projects and assignments with the theoretical classes. In this approach, however, the two types of courses were still treated as separate subjects with independent course codes, marking schemes, and assessments, making them still less efficient. In the iDEeA project, these two types of attributes were woven into a single course, making the design assignment a pivotal part of the theoretical knowledge understanding (Figure 2). This allowed students to inherently practice the design thinking skills with the subject content
knowledge in mind. This was deemed to be a more effective way of delivering both design thinking knowledge and the theoretical concept and content knowledge.

![Diagram showing the evolution of design skills incorporation with core subject knowledge.](image)

**Figure 2. The evolution of design skills incorporation with core subject knowledge.**

This integrated approach was highlighted by Nathan Scott (2004) who claimed that the Mixed-mode approach, referring to traditionally taught courses plus project-based components, seemed to be the best way to fulfil industrial needs. Interdisciplinary courses are usually more demanding and can help students prepare themselves in the industrial field with both engineering design knowledge and soft skills (Penny et al., 2001). In the case of the iDEeA project, the project-based component is an integral part of the taught course component and major assessment (20% to 30% of overall mark) comes purely from the design project assignment.

The design project requires skills that may be unfamiliar to the students outside the classroom. For example, it requires the use of microcontroller programming skills in a biomechanics course among second year students. This challenge-based feature may have been a ‘sweating’ reason among the students, and some even felt panic about the assignment. However, this ‘challenge’ made them learn the topic more meaningfully and enabled them to see the bigger picture of the course more effectively than traditional classroom-based learning (Martin et al., 2007). The real problems encountered during the design solution made them aware of the engineering field and practice and this had increased their understanding in engineering design by itself (Vieira et al., 2006).

Even back in 1988, Richard and Linda (1988) had mentioned that current and future engineers need both technical knowledge and innovation skills. If the courses were not designed to inculcate such attributes from their early years, it is doubtful that the graduates would be able to achieve those systematically. One of the methods reported to be useful in linking content knowledge and design application is to have a central project theme in the course, coupled with a good course structure and
appropriate pedagogical method; in this way the knowledge concept instruction is much improved (Kyle et al., 2016).

In this nature of courses, skills such as teamwork, leadership, communication, are evaluated apart from engineering skills and the students were required to present their project by poster, formal report and their designed product demonstration (Jassemnejad et al., 2013). Similar to the iDEeA project, students presented their final prototype and explained the outcome of their design with respect to the core theoretical knowledge at the end of the semester, before the final examinations. Their overall final examination grades were improved overall for all 5 courses throughout for those participating in this project.

![Figure 3. Design thinking workshop in the beginning of the semester.](image)

**Challenges of the project**

From the instructor point of view the major challenge is mainly to equip ourselves with the appropriate knowledge and skill of “Design thinking process towards specification and development of a project“ so that we can impart skills and the knowledge to the students. To overcome this issue all of us have to learn and train ourselves; we even got together and took up training on the design thinking process.

Although all students participating in this project have successfully completed their design assignments, nevertheless, when enquired deeper about their innate ability to design and their confidence in their own design skills, multi-factor relationship was detected in several aspects. In essence, students would ‘feel’ that they are able to design a solution if they had the opportunity to either complete the prototype or have a physical ‘hands-on’ encounter with the design subject. Their greatest challenge in realizing the design is the technical skill required to complete the project. The final year students especially realized that the most challenging design step was to impart commercial usability of the designed solution. Guidance, encouragement and appropriate feedback they received from the lecturers have significantly helped them to address some of these challenges and issues leading to completion of the given tasks.
Applicability of iDEeA Project in Other Academic Disciplines

*Design Mindset* can be fostered as early as non-formal education days. The imaginative problem-solving can take place on the playground when papers momentarily disappeared and educators are only observers. There, knowledge transpired through exploration and play. The iDEeA approach is to migrate the creative problem-solving into the classroom using the design thinking approach.

Design thinking is a well-known style that creates a creative and innovative mind set. The background of the intended audience is not limited to people with technical and sciences background. The iDEeA model can be integrated into other disciplines and curriculum and is not limited to higher education.

The iDEeA approach is very simple and easy to understand. If the model to be implemented in the field of law, it will introduce an inspired, new, and user-centered method on how future lawyers provide legal services. The module will require the law students to look at issues through a very diverse perspective—focused on legal as well as customer problem solving. And IF the iDEeA model is applied to history students, they can look for answers to challenges that were created in the past that are still having influence in the present.

More value can be added if design thinking is to be embedded in the performing arts and music curriculum. The students can use empathy in designing their masterpiece to connect with the audience. The element of empathy can be discovered via interviews, communication and even engagement with their environment.

The iDEeA approach is of upmost importance in Business and Economy field of study. Present days presented multilateral problems that are part of progressively complex business models. These challenges mandate innovative solutions requiring more than just basic applications of Economy and Business theory and concepts. This is where design thinking fits in the puzzle. These examples prove that design thinking is a universal approach in teaching. Not only can it educate, it has given insight into the true meaning of one’s chosen field.
Acknowledgement
The authors thank all the students for their keen participation in class and their valuable feedback. The project was financially supported by UM-LiTeR grant number RU002G-2016.

References

CONCLUSION

This book makes its mark as a platform for academics to share their teaching and learning evidence-based best practices in three main domains, namely Learning and Teaching Enhancement; Assessment and Technology; and Student Support.

Twenty-nine (29) authors and fifty-nine (59) co-authors involved in the making of this book. They are all from different background, which include Faculty of Education; Medicine; Language and Linguistics; Science; Arts and Social Sciences; Built Environment; Engineering; Economics and Administration; Computer Science and Information Technology; and Business and Law. The presence of studies from multidisciplinary field should provide our readers with an overview of how innovations in classrooms can be applied.

All twenty-nine (29) case studies presented herein illustrated a mix of action research, education research, and Scholarship of Teaching and Learning (SoTL) studies of university lecturers using different teaching and learning methods in the classroom; alternative assessments used in their lessons, the technology applied and how academicians provide students support.

It is hoped that this book would also act as a guidance and strength provider to those who are still hesitant in trying out new ways of delivering, assessing and supporting their students with the skills and knowledge they deserve.