Contribution of Space Education in Deep Technological Development of Middle-income Countries: A Case Study of MOOC in Thailand

Siyada Witoon [1], Prapanpong Damsongsaeng [2] and Potiwat Ngamkajornwiwat [2,3,*]

1 Finland Futures Research Center, Turku university; Siyada.s.witoon@utu.fi
2 Space Zab Company Limited, 333/158 Soi Pracha Chuen10, Garden City Lagoon Village, Thung Song Hong, Lak Si, Bangkok 10210 Thailand; prapanpong@spacezab.com
3 Institute of Bio-inspired Structure and Surface Engineering, College of Mechanical and Electrical Engineering, Nanjing University of Aeronautics and Astronautics, Nanjing, 210016 China; potiwat.n@gmail.com
* Correspondence: potiwat.n@gmail.com; Tel.: +66935832946;
† Presented at the 2nd Innovation Aviation Aerospace Industry - International Conference 2021, 28-30 June 2021; Available online: https://iaai-2021.sciforum.net, https://iaai.asia/

Published: 1 July 2021

Abstract: Innovation enhancement strategies in middle-income countries are usually limited by several challenges including knowledge attainment, business opportunities, and information infrastructure. These limitations seem to explain the situation in Thai space technological development as well. The country has not been able to concretize any space-oriented innovation, regardless of the fact that the national astronomical research institute has a vision to be a world-renowned organization in astronomy, technology, and innovation. This research investigated the struggles of Thailand in the space economy as a case study of deep technological development in middle-income states. With the rise of telecommunication that facilitates distance learning, the study utilized online-class as a method to eliminate the limitation of insufficient knowledge and further investigate other constraints. The findings indicate that online lessons effectively respond to the lack of space-related knowledge. Additionally, financial concern of having hand-on experiences in deep technology is diminished by the curricular design that is built from the understanding of local context. However, the online learning addresses a new communication issue. The absence of a communication platform that leads to a low rate of peer discussion, especially after lessons, becomes the main obstacle to nourish R&D. The study suggests that communication infrastructure is a key element to instigate inspiration and implementation of knowledge in practice. This can be mutually supported by course-content providers and state authorities.

Keywords: Innovation enhancement in developing countries, space economy, space education, MOOC

---

1. Introduction

Innovation is recognized as one of the state tools to enhance national development and its international power. This idea of technology-driven society has been a widely visible trend correspondingly with the knowledge-based economy brought by the Organization for Economic Co-operation and Development (OECD). In 1996, OECD published the report stating below.

The aforementioned statement illustrates two viewpoints. One, advanced technological development requires a network of collaborations and scientific practices as the core. Second, professional practitioners who are scientifically knowledgeable are key players of knowledge production, transmission, and transfer. However, these implications are seen differently in Thailand.

Thai government seems to believe that the development of new scientific knowledge and innovation is at the boon of higher educational institutions. Many aspirational projects in technological enhancement were invested through the existing universities and scientists. Evidently, the country launched its first national development plan in 1961 to establish regional higher educational institutions.Since that time, education and innovation research funding has been primarily connected [1] with the universities and their researchers. The action leads to the phenomenon that science and innovation development are exclusive to those who are in the tertiary educational system and environment until nowadays. Additionally, since most of innovation know-how were mainly owned by the developed world, the Thai policy-makers perceived that a pioneer scientific project in an emerging country could rarely happen without the support of the originators in technological transfer. Consequently,Foreign direct investment was strongly encouraged as a main strategy to acquire the transfer of technological know-how and financial gains [2]. The initiation was successful and brought many international corporates from different regions around the world such as Toyota, Honda, Samsung, Google, Apple, Valmet to relocate. In 2020, The country was ranked 21^{st} of global scale in business-friendly environment [3] and the 5^{th} FDI attractive place in the Asia-pacific region [4].

Thai government has been attempting to cultivate and leverage technological know-how. The fact that innovations can help advance and overcome middle-income traps has long been recognized. Yet, the country still encounters the same challenge to develop its technological know-hows from many decades ago. Thailand remains a middle-income country with 57^{th} in ICT capability, 91^{st} in labor skills, and 40^{th} in R&D qualities in the world ranking [2], albeit its same cohorts during 1960s, i.e. South Korea, Hong Kong, Singapore, and Taiwan have moved beyond the line [5]. Perhaps its existing strategies are only moderately effective in innovation enhancement. This is particularly visible in the area of space technological development. The country has not been able to materialize any space-oriented innovation, regardless the National Astronomical Research Institute of Thailand (NARIT) was founded in 2004 and has been publishing many researches each year (NARIT 2021). Although the clear vision: to be a world-renowned organization in astronomy, technology, and innovation, is highlighted; the government funding as well as astronomic experts and knowledge are already available in the country, space innovation growth remains a distant and ambitious plan.

Aubert World Bank (2005) point out that the keys lie in knowledge attainment, business opportunities, and information infrastructure [6]. This indicates that science and its practice should not be monopolized and centralized by public institutions. In other words, the participation of citizens and private sectors should be encouraged along with the governmental support of infrastructures. More diverse actors are needed if the tangible and profitable transformation of the space industry are expected,.

2. Methods for Course Design

Space*Lab, an interactive online space education with a set of experiments to do at home, launched its first Thai version in May to August 2020. The platform aimed to popularize space education as well as to overcome an inspirational shortage and lack of accessibility of space-related knowledge in Thailand. The lab consisted of 6 learning modules: (1) Talk like astronauts, (2) Space plant, (3) A little house in the universe, (4) Home space food, (5) Space toilet, and (6) Cultivating lunar civilization. The space science and technological contents incorporated daily life topics and the STEAM educational approach, [7] a combination of five disciplines namely Science, Technology, Engineering, the Arts, and Mathematics, in each lesson. The learning process followed Experiential Learning Cycle [8] which helped learners to earn the Concrete Experience (CE) and formulate Reflective Observation (RO) through inspirational talks, contents, and lectures. This pattern was developed to enhance the Abstract Conceptualization (AC). Hence, space-knowledge information such as a space technological application were shared and discussed before the mission ideation tasks were introduced. The learners were assisted to transform their experience to the Active Experimentation (AE) through several activities and experiments at home. As a result, the learning via experiencing, reflecting, thinking, and acting would be arisen.

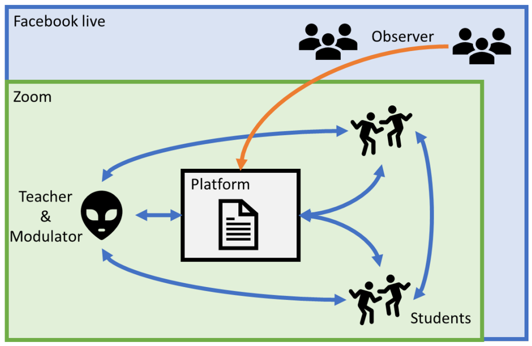

Figure 1. The platform of Space∗Lab

3. Results and Discussion

3.1. Participant demographics

The platform was publicly opened to all participants who were interested in space technology regardless of their space-related educational background. 165 participants registered to attend real-time online sessions. 29 attendees who participated in more than three live sessions were selected to be the focused group of this study.

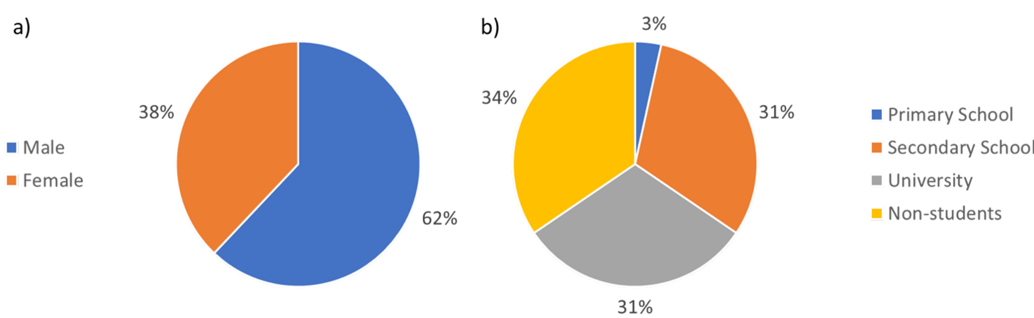

Figure 2. (a) shows percentage of participant, (b) chart of the level of educations

The gender distributions of participants were males 62% and females 38% (Figure.2a). Additionally, the majority of participants were non-students and secondary school students.

3.2. Program evaluation

Outcomes of the program are evaluated concerning five factors, including inspiration enhancement, accessibility of space-related knowledge, lesson difficulty, affordability of designated activities, and platform satisfaction. The assessment was conducted by interview of participants focusing on their perspectives prior to and after taking the course.

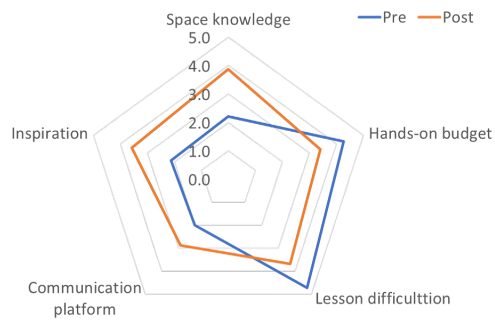

Figure 3. The score of the trainee compare before and after learned the Space∗Lab

It can be seen that learners have greater motivation toward space technology after taking the course as shown in Figure 3. Furthermore, the platform also increases the accessibility of knowledge of space science and technology by approximately 75%. However, the difficulty of a space-related lesson remains challenging.

4. Conclusions

The space education leads to an enhancement of inspiration and increased knowledge accessibility which play important roles in space-related technological development. The program allows not only the knowledge and skills, but also the challenger attitude to grow in participants. This may contribute to the shift of new-knowledge absorptive capacity, especially in an emerging space country. With the appropriation of lesson difficulty, there is a positive sign to popularize and well-deliver the complex and expensive astronomical know-how in the future.

Acknowledgments: This work is supported by Space Zab Company Limited and partially supported by the NUAA Research Fund (P.N.). We would like to gratefully thank Spaceth.co for their contribution on Space∗Lab.

References

1. Sanguanruang, S. *Development Planning in Thailand: The Role of the University*, Regional Institute of Higher Education and Development:Singapore, 1973.
2. UNCTAD, Catching technological waves: Innovation with equity., *Technology and Innovation Report 2021*; United Nations Publications:USA, 2021.
3. World Bank., *Doing Business 2020*. Washington, DC: World Bank, DOI:10.1596/978-1-4648-1440-2, 2020.
4. Riadh, B.L. Country Profile Thailand 2020, *A Global Foreign Direct Investment Country Attractiveness Index*, http://www.fdiattractiveness.com/thailand/ (accessed on 30 April 2021).
5. Sarel, M., Growth in East Asia: What We Can and What We Cannot Infer., In *Economic Issues*, 1996.
6. Aubert, J.E., Promoting Innovation in Developing Countries: A Conceptual Framework, *Policy Research Working Paper*, 2005, Vol.3554, World Bank, Washington, DC., DOI: 10.1596/1813-9450-3554.
7. Sousa, D.A. & Pilecki, T. *From STEM to STEAM: Using brain-compatible strategies to integrate the arts*, Thousand Oaks, Corwin:California, 2013.
8. Kolb, D. The Process of Experiential Learning, *Strategic Learning in a Knowledge Economy*; Robert L. Cross, Sam B. Israelit, Butterworth-Heinemann, 2000, pp. 313-331.