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Technology and Values-Driven Transformation in Education



**Southeast Asian
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Organization**



筑波大学
University of Tsukuba

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Foreword



Datuk Dr Habibah Abdul Rahim

Since its inception as an Affiliate Member of the Southeast Asian Ministers of Education Organization (SEAMEO) in 2009, the University of Tsukuba (UT) of Japan has been one of the most active SEAMEO Affiliate Members. Through the collaboration with the Center for Research on International Cooperation in Educational Development (CRICED) and the Faculty of Education of the UT, SEAMEO and UT have developed various teacher development programmes.

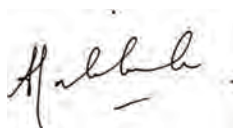
SEAMEO-University of Tsukuba Symposium has been organised annually with a different theme according to the needs and emerging issues in teacher education shared by Japan and Southeast Asia. The 11th SEAMEO-University of Tsukuba Symposium under the theme Technology and Values Driven Transformation in Education held on 20-22 February 2023 successfully engaged over 19,860 participants from 45 countries. With 30 speakers from 10 countries, the symposium provided the platform to share and exchange best practices carried out by schools and universities apart from identifying the challenges encountered by teachers, students and academicians.

In our effort to ensure the integration of technology and core values into the educational system to create a more equitable and inclusive learning environment for all the teachers, students and academicians in Southeast Asia, SEAMEO and UT have selected quality articles emerging from the symposium and put them together in the Journal of Southeast Asian Education.

The contributions presented in this journal delve into various aspects of digital transformation and values in technology for education. From exploring teachers' and students' experiences using technology in classrooms to examining the impact of teaching programming and computational thinking, the articles offer valuable insights into the challenges and opportunities presented by the digital age.

Some of the articles also generally discussed on the impact of technological outcome which arises out of a social context is influenced by the values of the day and influencing the values of the future. The technological learning provides authentic context for the teachers and students to understand how to make meaningful choices on responsible values when it comes to emerging technologies. The educational institutions will be able to respond more effectively in line with the right digital transformation and values in technology for education.

I express my sincere gratitude to UT for their support and dedication as this journal will certainly form a valuable addition to the existing body of knowledge on education and training. I hope that this journal will inspire policymakers, teachers, and learners to act towards consolidating the policy changes moving forward as well as improving practices responsive to the demands of the future needs and challenges especially in teacher education and training.



Datuk Dr Habibah Abdul Rahim

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Lifelong Learning in the Digital Age

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ABSTRACT

Learning through life has been practiced by human beings since ancient times, but it is the accelerating rate of the development of science and technologies that has made it an integral part of people's lives. Digital technologies are an enabler and facilitator of lifelong learning. Online teaching and learning platforms and open education resources are providing multiple opportunities for anyone with a need to learn to acquire knowledge and skills in convenient ways. However, the application of digital technologies is not without obstacles. This article reviews the concept of lifelong learning, and discusses the element of flexibility that is inherent in all aspects of lifelong learning. It proceeds with how digital technologies can support lifelong learning in this sense (flexibility of entry and exit points, age, modality, subject matter and so on) and what the obstacles are in applying technologies to lifelong learning (potential isolation, decreased social interaction and others, and it finally makes recommendations on how to make the best use of web-based learning for all for a balance in its use.

Keywords: Lifelong learning, digital technologies, flexibility, face-to-face communication

Introduction

Definition of Lifelong Learning

Learning is 'a process that leads to change, which occurs as a result of experience and increases the potential for improved performance and future learning' (Ambrose et al., 2010, p. 3). Living things are characterised by their ability to learn. As static as trees appear to be, they also adapt to the environment. An Indian rubber tree will curtail its growth and

preserve all its leaves to maintain its level of photosynthesis in low-light conditions; if it is abruptly exposed to a sunny environment, the tree may wither due to its adaptation to a low-light setting.

Human beings, the most intellectually advanced form of life, have been learning from their surroundings and from one another since



ancient times. It is this learning from older generations while in their shelters, or working in the open that has led to the development of human understanding and maintained the 'social continuity of life', that is, the 'continued existence of a society' (Dewey, 1915). The practice of learning through life can thus be traced back to ancient times, but it began to become a prominent one after World War II (Ouane, 2011) when adult education was recognised as 'a permanent national necessity, an inseparable aspect of citizenship (that) should be both universal and lifelong' (MOR 1919 cited in ILO, 2019, p. 3).

According to UNESCO, lifelong learning is 'rooted in the integration of learning and living, covering learning activities for people of all ages, in all life-wide contexts and through a variety of modalities that, together, meet a range of learning needs and demands' (UIL, 2022, p. 1).

The International Labour Organisation defines lifelong learning as 'all learning activities undertaken throughout life for the development of competencies and qualifications' (ILO, 2006, cited in ILO, 2019, p. 7).

Lifelong learning comprises all the phases of learning from pre-school to postretirement, including all spectrums of learning (Laal, 2011 cited in Akther, 2020).

Though a universally accepted definition of lifelong learning is still evasive, practically put, it is learning that takes place with 'any'—learning anything that one needs, at any time, in any place or context, with anybody, at any rate, in any mode and using any means. An umbrella characteristic of lifelong learning is flexibility as it is not restricted by any physical constraints.

Need for Lifelong Learning in the Digital Age

The concept of lifelong learning encompasses three primary phases of learning activities: basic formal education, higher education and continuing education. While basic and higher education lay the foundation for personal growth and development, continuing education, predominantly undertaken by adults, enables them to remain functional in the world of work and social life and to pursue personal interests and hobbies by adapting to new technologies.

Lifelong learning is an integral part of personal growth and development, as it not only enhances social connections and community engagement but also promotes a sense of fulfillment and well-being. With the rapid pace of technological change, mass population movement, demographic shifts and climate change, among several other issues, there is a growing need for more lifelong learning (UIL, 2019, p. 7).

The rate of development in science and technology is accelerating, creating new jobs and rendering knowledge obsolete in shorter cycles. According to the World Economic Forum (WEF, 2020), by 2025, advances in automation and technology may displace 85 million jobs while simultaneously creating 97 million new jobs. Furthermore, the half-life of knowledge, a concept introduced by Fritz Machlup in 1962 to describe the time taken for half of the knowledge in a particular field to become outdated or superseded, is decreasing. A century ago, it took 35 years for half of what an engineer learned when earning their degree to become obsolete. By the 1960s, this time span had reduced to a decade. Today, it is likely even shorter (FS, 2023).

This shrinking half-life of knowledge, coupled with the rapidly changing world, makes it imperative for individuals to engage in lifelong learning to thrive in society. The emerging work culture demands an increasing number of skills, with a 10 percent annual increase in skill requirements for one job. Workplaces are emphasising more remote or hybrid work, digital skills, and managerial functions and support (Muro et al., 2017 cited in Goger et al., 2022).

The Concept of Flexibility in Lifelong Learning

Definition of Flexibility in the Context of Lifelong Learning

Flexibility is defined by Merriam-Webster as the quality ‘characterised by a ready capability to adapt to new, different or changing requirements’ (Merriam-Webster, 2023). In the field of education, flexibility refers to the ability to adapt learning contents, modes and forms to meet the learning needs of a particular learner. The Open and Distance Learning (ODL) Association of Australia describes flexible

learning as a state in which learning and teaching are freed from the limitations of time, place and pace of study (ODL Association of Australia, 2017).

Flexible learning implies a departure from traditional education requirements, where there is no minimum or maximum age for a level of education, no need for regular physical attendance in classrooms, no mandatory three-month term of in-class study to obtain a certificate or accumulate credits towards a degree and no rigid mode of lesson delivery. Instead, learners have the freedom to choose their own learning activities, assessment tasks and educational resources in exchange for different types of credit and costs (ODL Association of Australia, 2017).

The International Federation for Information Processing (IFIP), an organisation affiliated with UNESCO, has identified four elements of flexibility in lifelong learning. These elements include flexibility in time and place, ease of use for both teachers and students, reusability of content, and the ability to add new modules and

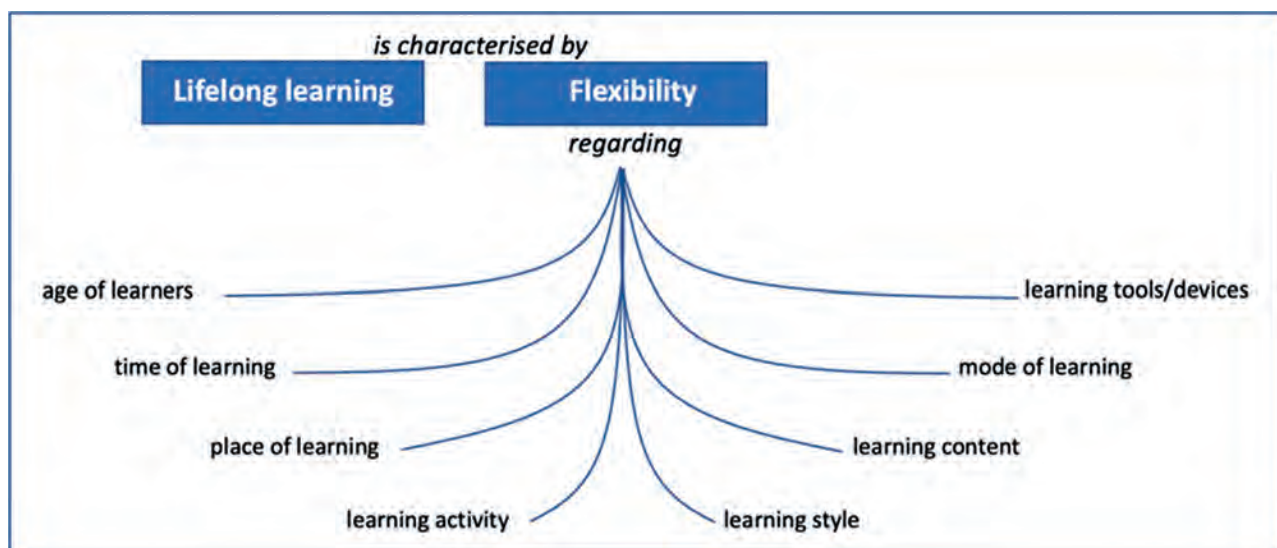


Figure 1. Characteristics of Lifelong Learning Seen Through the Lens of Flexibility.

materials. These elements align with UNESCO's concept of lifelong learning and can be utilised to create a practical model for lifelong learning provision (IFIP, 2004).

Figure 1 summarises the aspect of flexibility of lifelong learning from the above discussion.

In the realm of education, modularisation of learning programmes has been employed to enhance flexibility by enabling learners to have entry and exit points that are tailored to their specific needs. Micro-credentials serve as a solution to time constraints experienced by learners when their employers require only specific skills and knowledge relevant to their work, as opposed to an extensive learning programme. However, flexibility is not solely restricted to learning programmes; learners themselves should be able to adapt to novel methods of acquiring knowledge and skills. As the world continues to evolve rapidly with the emergence of new technologies, it is crucial for learners to stay abreast of the changes. Flexibility allows learners to embrace new technologies and integrate them into their learning process. Moreover, lifelong learning is not exclusively limited to professional or career-oriented skills and knowledge; it also encompasses the pursuit of new interests and passions. Flexibility provides learners with the freedom to explore new areas of study and pursue novel hobbies or interests.

Importance of Flexibility in Lifelong Learning

In contemporary times, humans are experiencing an enhanced quality of life. There are extensive social connections, an exponential increase in knowledge that can be accessed

from anywhere, and the ability to improve hobbies by learning from diverse sources. Additionally, health conditions are more stable than in the past. These advancements are a result of learning. However, this modern age brings forth more pressure on individuals who work. They have to complete more tasks, often of higher complexity and unfamiliar nature, and spend longer periods of time commuting due to heavy traffic. This creates a paradox: the growing need to acquire new knowledge and skills, and the shrinking time available for attending classes. Therefore, flexibility in learning is crucial, and all stakeholders in education must provide it. In recent years, flexibility and lifelong learning have become key aspects of education policy in nation-states and bodies such as the European Union and Organisation of Economic Cooperation and Development (Nicoll, 2006).

Edwards (1997, p. 110) has argued for the requirement of flexibility in most aspects of society, including in building a learning society, in the practice of adult education. 'Trends are towards flexibility through such practices as the accreditation (recognition) of prior learning, credit accumulation and transfer, workplace learning, criterion-referenced assessment and student-centred learning. Flexibility is an effective supporter for the realisation of lifelong learning'.

Digital Technologies and Lifelong Learning

Advantages of Digital Technologies in Lifelong Learning

The integration of digital technologies into distance learning has been instrumental in optimising educational practices. In fact, the

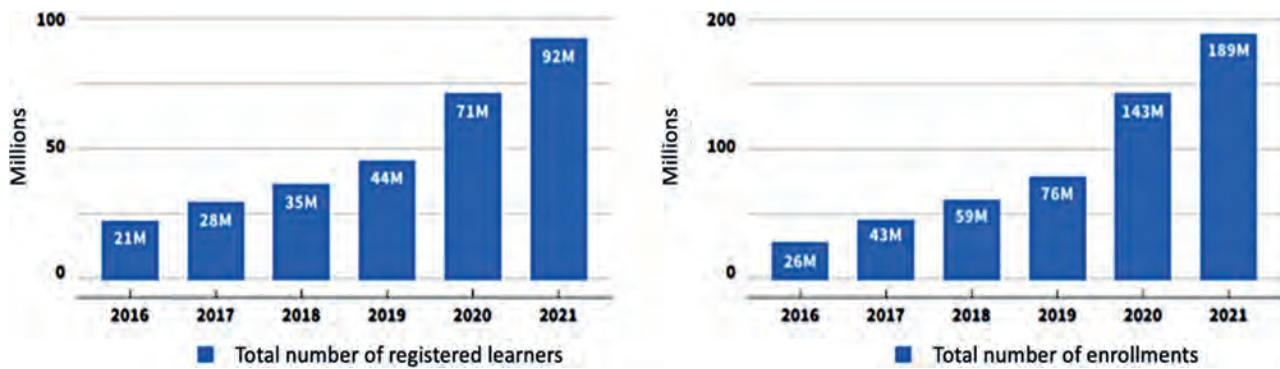


Figure 2. More Learners are Accessing Online Learning.

Source: WEF (2022).

Learning Economy Foundation has referred to current educational practices as the ‘Internet of Education’, highlighting the extent to which online platforms and technologies have transformed traditional learning environments. In contrast to traditional classroom-based education, online learning features greater flexibility and choice, with asynchronous lectures enabling students to view recorded lessons at their own convenience. Furthermore, a wide range of platforms, such as Coursera, Google Classroom, Khan Academy, LinkedIn Learning (formerly Lynda.com), Skillshare, Udacity and Udemy offer both free and paid courses to millions of learners worldwide. Online meeting platforms, such as Zoom, Microsoft Team and Google Meet, also provide a range of functions to facilitate both teaching and learning. Personalised learning becomes a reality when learners can select the content and tools of learning that suit their individual learning style. The numbers of online learners are increasing steadily. Figure 2 provides an illustrative example of the growth in the number of online learners registered on Coursera from 2016 to 2021, with a sharp increase from 2019

to 2020 due to the COVID-19 pandemic. The World Economic Forum (WEF, 2022) reported that the Asia Pacific region had the largest student presence on learning platforms, with 28 million new online learners enrolling for 68 million courses. This was followed by North America, Europe and Latin America (WEF, 2022).

Overall, the integration of digital technologies into distance learning has significantly transformed traditional education, offering students greater flexibility and access to educational resources. Traditional education resources—books, journals, encyclopedias, handouts and printed materials, and audio video recordings—are to be accessed in the localities where they are kept. These can be libraries, reading rooms, clubs and bookshops. On the contrary, digital technologies provide access to a wealth of information and resources that can be used for self-directed learning (UNESCO IITE and Open Shanghai University, 2022). Open education resources (OERs) allow access from virtually anywhere as long as there is an internet connection. These are experiencing exponential growth. MERLOT Content Builder,

OER Commons, Curriki and Wikibooks, and Open Culture are among the free OERs. This enables learners to research any topic of interest and access educational content in a variety of formats, including text, video and audio.

Datareportal reports that 42.3% of individuals aged 16–64 utilise the internet for education- and study-related purposes (Figure 3). Nevertheless, this statistic does not account for non-formal and informal learning, as a significant proportion of internet usage for activities such as seeking information (61.0%); watching videos, TV shows and movies (51.5%); and researching how to do things (51.3%) can also contribute to personal learning and social development.

Numerous websites have been developed by individuals, organisations, agencies and educational institutions to disseminate information, knowledge and skills. One such example is YouTube, which offers a plethora of learning opportunities, ranging from

household management, gardening and musical instrument lessons to more academic topics such as research methodology and statistics. These online resources are accessible around the clock from any location with an internet connection, thereby elevating informal learning to new heights.

With the world changing at an accelerating pace and knowledge expanding rapidly, new skills and jobs are emerging. This necessitates constant revision and updating of learning programmes. Printed textbooks are static, and digital materials offer a solution to this rapid change. E-learning courses can be quickly and easily updated to provide learners with access to the latest information and knowledge in their field. In addition, subject matter experts who are actively engaged in the industry or field of study can create and deliver e-learning content, ensuring that the content is up-to-date and relevant.

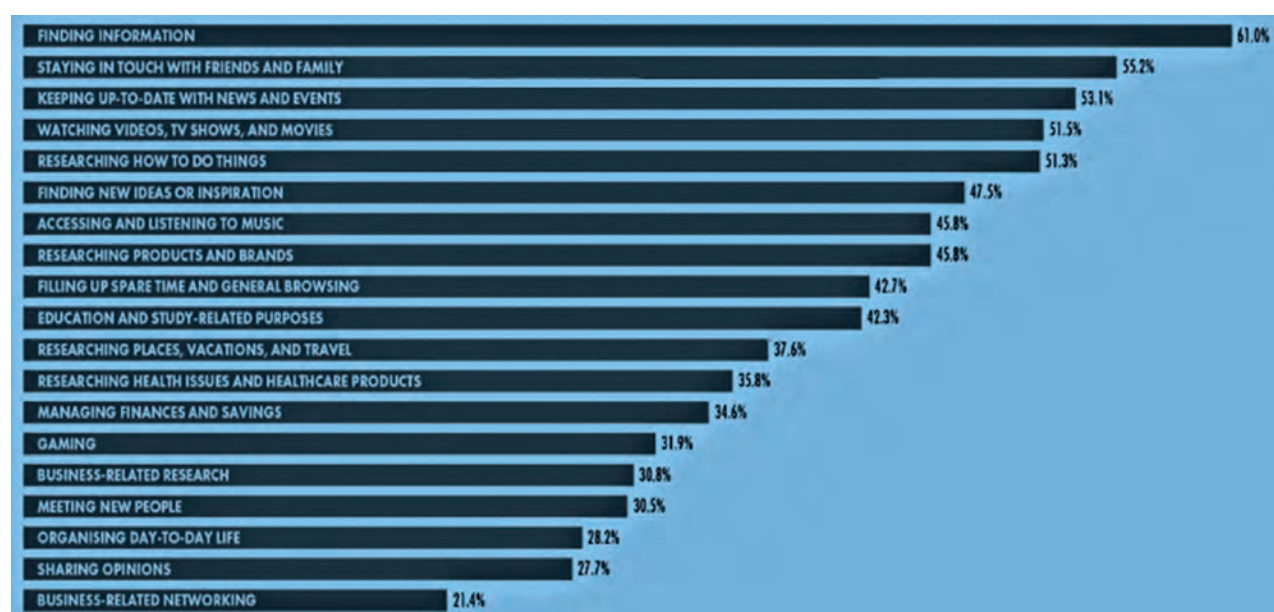


Figure 3. Main Reasons for Using the Internet.

Source: Hootsuite cited in DataPortal (2022).

The acquisition of knowledge, skills, integration of social and cultural values and ethics by learners occurs through a layer of constructs, with digital media emerging as an impactful element in the interaction (Figure 4).

In order to promote individual empowerment and lifelong learning, flexible learning strategies and various pathways of learning are required, encompassing both formal, non-formal education and informal learning and academic and vocational skills. This is particularly crucial for those who are marginalised or disadvantaged, as highlighted by the ASEAN in 2016 (ASEAN, 2016). Lifelong learning serves as a means for individuals to enhance their self-awareness and to adapt to changes in culture and technology within society.

The recent COVID-19 pandemic has further institutionalised the applications of digital technologies in education, beyond its function as a mere knowledge provider, to that of a co-

creator of information, mentor and assessor, as stated by Haleema et al. (2022). It has become increasingly important to prepare for a future that is unpredictable and constantly evolving, where technology is expected to play a critical role.

Drawbacks of Using Digital Technologies for Lifelong Learning

There is no arguing about the application of digital technologies to lifelong learning. However, from the learners' perspective, utilising these is not without obstacles.

The advent of the internet has further facilitated distant communication, but this presents only one aspect of the issue. 'Humans are social creatures' (Cacioppo & Patrick, 2008, p. X). As social beings, humans are more effectively able to exchange information through direct or face-to-face communication, which incorporates body language, facial expressions, movement and body posture in addition to verbal content expressed through a common language (Pease & Pease, 2006). The renowned authors of the best-selling book *The Definitive Book of Body Language* quote Albert Mehrabian's 7-38-55 formula, which asserts that 55% of the total impact of a message is through non-verbal presentation. However, in online classes or recorded videos, students may miss out on subtle cues conveyed through gestures, body posture and eye contact due to the absence of face-to-face interaction. This can be experienced in work where poor digital communication is a frequent barrier to work, leading to around four hours of wasted time each week (Dhawan, 2022).

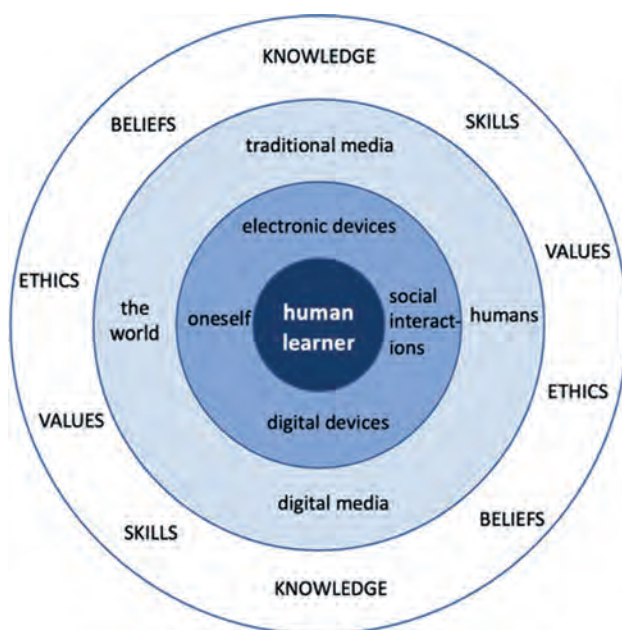


Figure 4. The Means Through Which Learners Access and Learn About the World and Society.

Motivation is an important aspect of effective learning. Adult learners, who voluntarily engage themselves in a learning session due to their need for knowledge and skills that enhance their work efficiency, desire to know more about a topic of their interest or the joy of learning about a hobby they enjoy have strong motivations. Younger individuals may not have a similar level of motivation and may be more prone to distraction.

Online learning also comes with another obstacle: the feeling of isolation or, in other words, the feeling of not being present there, in the learning environment, as the learners are facing a computer screen sitting in their places. According to Lehman and Conceição (2010), two aspects of online presence are required for individuals to cross the threshold of the virtual classroom: telepresence, which is the sense of ‘being there’ in the context of the classroom, and social presence, which is the sense of ‘being together with others’.

The internet hosts a vast array of information and knowledge, but not all of it is of high quality, as misinformation and disinformation are

common. Therefore, it is necessary to critically evaluate and verify sources before using them for research or other purposes. Digital literacy, which involves the effective and responsible use of digital technologies, is crucial for finding, evaluating, creating and communicating information, as well as protecting personal information and privacy.

The digital divide—the unequal distribution of access to technology and digital infrastructure among different populations—in Southeast Asia is another obstruction. Disparities in access to the internet, mobile phones and other digital devices can be caused by various factors, including disabilities, illiteracy, age, wealth, concentration of economic activity in urban areas and enterprise access to capital. According to a study by Roland Berger, approximately 31% of the adult population in Southeast Asia, or around 150 million individuals, are digitally excluded due to a lack of access to communication technologies or low levels of digital literacy (Accountants Today, 2021). Although digital devices are increasingly present

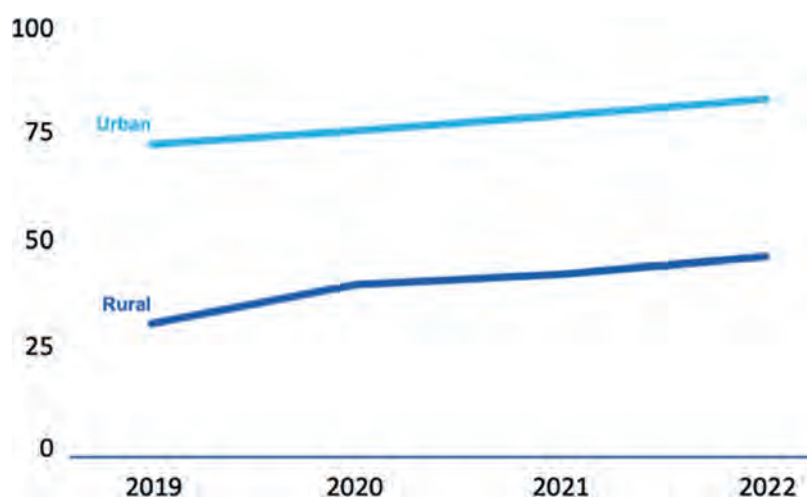
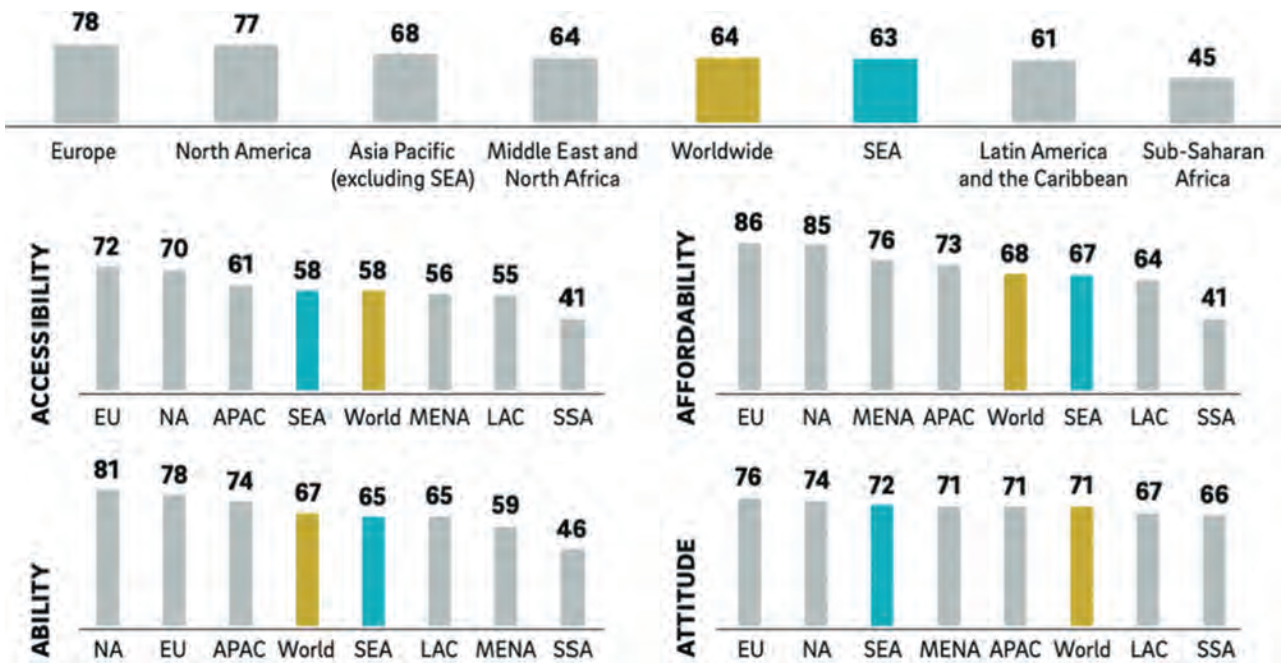


Figure 5. Percentage of Individuals Using the Internet in Urban and Rural Areas, 2019–2022.

Source: ITU (2022).



Source: RB index on GSMA, ITU, World Bank, UNESCO, UNDP, Euromonitor, Ookla

Figure 6. Southeast Asian Country Rankings in Term of Internet Accessibility, Affordability, Ability and Attitude Towards Using It (Max Score = 100).

Source: Low et al. (2021).

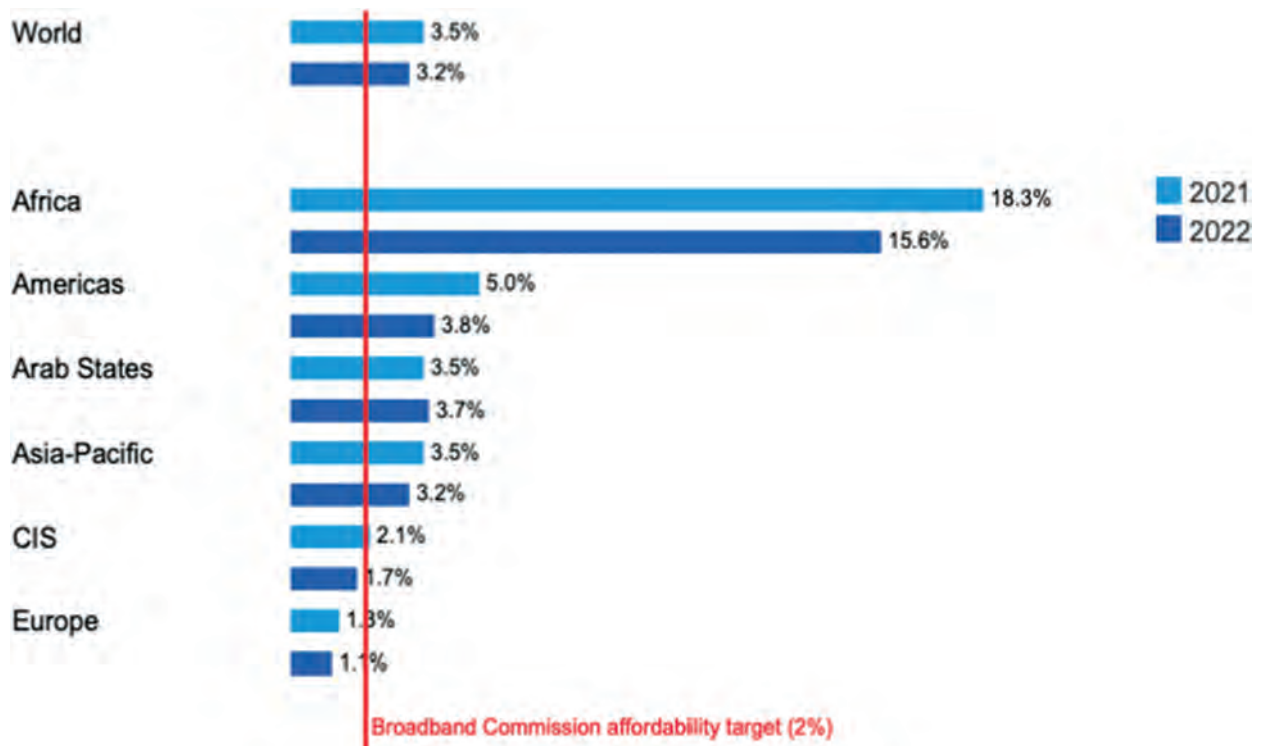


Figure 7. Fixed Broadband Basket Prices as Percentage of Gross National Income per Capita, 2021–2022.

Source: ITU (2022, p. 12).

in all walks of life, there remains—as seen in Figure 5—a significant gap of around 40% in internet use between urban and rural areas throughout 2019 – 2022.

Southeast Asia ranked fifth out of seven global regions (Figure 6) in a study of digital inclusion by Roland Berger, a leading global consultancy, due to low scores in the categories of affordability and ability (Low et al., 2021). This is confirmed in a report by the International Telecommunication Union (ITU) which shows that in Asia-Pacific the cost of fixed broadband prices is 3.5% and 3.2% higher than the national income per capita in 2021 and 2022, respectively (Figure 7) (ITU, 2022).

A crucial issue in the implementation of online education is the adequacy of teachers' skills in conducting digital instruction. In response to the COVID-19 pandemic, many educational institutions have been forced to shift towards the use of online teaching modalities in compliance with governmental mandates. As a result, many teachers have been compelled to develop their digital teaching abilities while implementing online teaching, which they had not been trained for.

Recommendations for Successful Lifelong Learning in the Digital Age

Governments, educational stakeholders and the business sector should strengthen collaborative efforts to:

1. Establish governance frameworks that harmonise micro-credentials issued by various educational institutions to enable the transferability of these certifications. This would enable the

attainment of digital credentials in a manner that is similar to conventional paper certificates. Additionally, these digital credentials could be accumulated in digital wallets, thereby allowing individual learners to showcase all they have learned throughout their lives.

2. Expand internet infrastructure to cover all regions and areas of a country, with priority given to remote and islandic areas.
3. Provide free opportunities for digital literacy skill acquisition, with a focus on marginalised individuals and those residing in remote areas. Digital competency encompasses not only the ability to use digital devices for information acquisition, but also the capacity to sift through information for valid and reliable facts and data.
4. Develop online teaching methodologies and provide training/retraining for educators in using digital tools, including online platforms that promote collaborative learning opportunities for programme development and course delivery. While digital technologies are emphasised, learning environments should balance online and face-to-face learning opportunities.
5. Create new platforms and software, and improve existing ones so that they facilitate student-student and student-teacher interactions better. Educational institutions of all levels and modalities should invest to develop their digital maturity.

Conclusion

The convergence of living, working and learning has blurred the boundaries between

these areas, resulting in a seamless integration of daily life activities. Digital technologies, particularly the internet, have made it possible for people to access learning opportunities anytime, anywhere, and through various modes and means that suit their individual needs. The proliferation of educational platforms and tools, as well as the increasing recognition, validation and accreditation of learning outcomes, has opened up new avenues for learners of all backgrounds. This paradigm shift is evident in the growing importance and relevance of non-formal and informal education, which is gaining momentum in Asia and other parts of the world. For instance, iTrain Asia, a private company in Asia, has established a digital learning platform that offers various options for learners across the region. As of this writing, artificial intelligence is emerging as a promising technology that can further enhance self-directed learning among both adults and young learners, enabling them to achieve self-improvement, self-actualisation and contribute to a sustainable world.

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Arising Significance of the SEA-Teacher Pilot Programme 2 on Japan-Related Participants: Challenges and Collaborations Among Multicultural Peers

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ABSTRACT

With the rising necessity of fostering global human resources in Japan, this study tries to investigate the significance of the SEA-Teacher programme pilot batch-2 with a special focus on the Japan-related participants. The challenges, collaborations and 'best episodes' of the participants dispatched from Japan, as well as the Japan-inbound Thai, Indonesian and Philippino, participants were analysed through a narrative approach. Findings suggest that the challenges arose from the gap between their norm in their home country and that of the dispatched country, and by reconsidering what they had always taken for granted, participants had overcome those challenges through collaborations with peers. The mixture of three different nationalities enriched their collaboration. A closer look into the participants' 'best episode' suggests that the programme had a holistic impact on the participants, fostering their openmindedness and flexibility. In conclusion, multicultural collaborations during the SEA-Teacher pilot programme have played an important role in fostering the global competency of the Japan-related participants.

Keywords: Challenges, collaborations, global competency, Japan, SEA-teacher pilot programme

Introduction

'Revitalising Teacher Education' has been one of the seven priority areas in order to improve the quality of education in Southeast Asia. The Southeast Asia Teacher Competency Framework (SEA-TCF) sets the standards of performance

among teachers across Southeast Asia (The Teacher's Council of Thailand, 2018; SEAMEO INNOTECH. 2010). Pre-Service Student Teacher Exchange in Southeast Asia (SEA-Teacher Project), which aims to provide opportunities for



pre-service student teachers from universities in Southeast Asia to gain teaching experiences in other Southeast Asian schools, has been implemented since 2016. Eight batches had already been implemented by 2023, and the University of Tsukuba in Japan, an affiliate member of SEAMEO, participated in the pilot batch of this programme in 2019, followed by the second batch in 2023. The pilot batch is unique in the sense that it is a multi-lateral programme, not bi-lateral, involving four different countries simultaneously. It is also unique in the sense that it includes a country from outside the SEAMEO region. The results of the pilot batch in the Japanese context need to be analysed in order to assess the possibility of expanding the SEA-Teacher programme in Japan. This study will focus on the second batch and investigate the impact of the pilot programme. Following is the basic information about the pilot batch-2 implemented in 2023:

1. Participating Universities (multi-lateral programme): Universitas Pendidikan Indonesia (UPI), Indonesia; Central Luzon State University (CLSU), Philippines; Khon Kaen University (KKU), Thailand; The University of Tsukuba (UT), Japan
2. Duration: One month (from 2 February 2023 to 6 March 2023)
3. Number of Students and Subject Allocation

Ensuring teacher quality is one of the global issues, and Japan is not an exception. The Ministry of Education, Culture, Sports, Science and Technology (MEXT) advocates the necessity of fostering teachers with global perspectives. Under such a context, this study aims to investigate the significance of the SEA-Teacher pilot programme in the context of Japan as a host country as well as the home country. Thus, the following literature review will first focus on finding out the common challenges and impacts

to from	Central Luzon State University	Universitas Pendidikan Indonesia	Khon Kaen University	The University of Tsukuba
Central Luzon State University		4 Eng2, maths1, TLE1	2 Eng2	3 CA2, PE1
Universitas Pendidikan Indonesia	4 Eng2, sci1, art1		3 sci1, maths1, ss1	3 sci1, math1, ss1
Khon Kaen University	2 ss2	3 Eng3		3 Eng3
The University of Tsukuba	2 Eng2	4 maths1, ss1	2 maths1, ss1	

Eng: English maths: mathematics CA: Culture and Arts PE: Physical Education sci: science ss: social science

Figure 1. Number of Students and Subject Allocation for SEA-Teacher Pilot Batch-2 in 2023.

Source: Author

that the SEA-Teacher participants face within the SEAMEO region. The second point of view is to search the teacher training policies in Japan to find out the teacher qualities and abilities that will be particularly demanded in the global world.

Literature Review

Challenges and Impacts of the SEA-Teacher Programme in the SEAMEO Region

Various research has explored the challenges and impacts of the SEA-Teacher programme within the SEAMEO region. According to Urai Musa and Ariyanti (2020), Hendra et al. (2019) and Ima and Kewwalee (2019), language barriers, religious sensitivity and differences in their life styles in the host country are found to be the most prominent challenges for the SEA-Teacher participants. In addition, Sujadi (2019) points out that teaching-related issues were the main challenges in implementing a lesson in a different country. Other studies have focused on what students have obtained through the programme. Lalu et al. (2020) observed the self-reflection of the Indonesian pre-service teachers and concluded that cultural understanding, English as an international communication tool, mutual respect and self-confidence were the values that the participants obtained through their experiences. Moreover, Venna and Achmad (2021) pointed out that intercultural awareness is critical for communication and that acknowledging and comprehending their own culture and identity is essential in terms of understanding those of others.

As for the pilot programme in 2019, which included Japan as a participant country for the

first time, Tatemoto (2020), as a host school of this pilot batch, points out that the SEA-Teacher programme would not only be an educational practice training programme but also an international experience for both the host and the home school, and that possibilities for further collaborations among Japanese universities need to be explored.

Although previous research has revealed the common challenges and impacts of the SEA-Teacher Programme in the SEAMEO region, there has been no study regarding these aspects focusing on the Japanese pilot batch. Thus, focusing on the Japan-related participants in the pilot batch would play an important role in seeking out the possibility of further expansion of the SEA-Teacher programme in the context of Japan.

The Necessity of Fostering Global Human Resource in Japan

The necessity of fostering a global citizen has been one of the most common issues all over the world, and Japan is not an exception. MEXT defines three elements of global human resources as follows: language and communication skills; initiative, positivity, challenging spirit, cooperativeness, flexibility and sense of responsibility and mission; and the understanding of other cultures and Japanese identity (MEXT, 2012). These are in line with the idea of global competency proposed by the OECD. Fostering effective communicators who are open to people from different cultural backgrounds through developing cultural awareness and respectful interactions in increasingly diverse societies is necessary in the

global world (OECD, 2018). The idea of student agency, which is defined as the capacity to set a goal, reflect and act responsibly to effect change, is supported by MEXT, and currently, teacher agency is one of the global issues. According to MEXT, the basic principles and perspectives of international education include ‘understanding what is different’, ‘acceptance of diversity’ and ‘coexistence’ and that deepening teachers’ awareness of these issues at the teacher training stage is necessary (MEXT, 2018).

In 2023, the Cabinet Secretariat has set the national vision for the mobility of international students as well as Japanese students’ going abroad. In their policy J-MIRAI, it is noted that by 2033, they aim to almost double the number of dispatched Japanese students and the accepted and retained foreign students. Moreover, in addition to the quantity-oriented perspective, Japan will also focus on improving the quality of such programmes (Cabinet Secretariat, 2023). Promoting the internationalisation of education through the creation of an educational and research environment where people with diverse cultural backgrounds and values can come together and understand each other is necessary. Taking into account fact that SEA-Teacher programme is a multi-lateral programme, with the educational purpose of conducting teaching practice in the dispatched country, this study aims to assess the significance of the SEA-Teacher pilot programme in the Japanese context.

Research Questions and Methodology

Based on the previous research, this study will investigate the four research questions as follows:

1. Were language barriers, religion-related issues, differences in lifestyle and teaching practice-related issues also faced by the Japan-related participants of the SEA-Teacher 2023 pilot batch-2?
2. What were the objects of collaborations made by the Japan-related participants of the SEA-Teacher 2023 pilot batch-2? What impact did such collaborations have on the participants?
3. What are the best episodes of the Japan-related participants in the SEA-Teacher 2023 pilot batch-2?
4. What were the impacts of the programme in terms of fostering the global competency of the participants?

As for the methodology, MonkeyLearn, which is an AI platform that incorporates machine learning to automate text analysis, will be used to first view the overall tendency for all the participants through keyword extraction of the 38 participants’ self-reflection report. In addition, the narrative approach, which emphasises wholeness in understanding the participant, including their subjectivity, is used for the answers of the nine Japan-bound participants and six participants who were dispatched from Japan.

Findings from Data: Challenges

In relation to the first research question, the participants were asked the question: ‘What were the challenges you have faced during your stay and how did you try to solve them?’ As shown in Figure 2, among the 38 participants, the most frequently mentioned keyword regarding this question was ‘student teacher’, followed by ‘language’ and ‘culture’. The word ‘student

keyword	student teacher	language	culture	lesson	commu- nication	student	food	teaching
count	18	16	14	14	10	9	7	5

Figure 2. Frequently Used Words of 38 Participants Regarding Their Challenges.



Figure 3. Japan-Bound Thai Participant Using Visual Information to Support Her Explanation in English.

teacher’ was used by the participants in the context of gaining solutions to their challenges. They had asked for advice from the peer student teachers when they faced challenges.

The literature showed that language barriers, religion-related issues, differences in lifestyle and teaching practice-related issues were the prominent challenges faced by the participants in the SEAMEO region. Were challenges also faced by the Japan-related participants?

Language Barrier

In line with the previous findings, one of the biggest challenges mentioned by the Japan-bound participants was the language barrier. Japan-bound Indonesian student A notes that ‘one of the biggest challenges I faced

was language’, and this was pointed out by six out of nine Japan-bound participants. As student A points out that ‘many students and teachers need help understanding English’, communication using English was not easy between students and teachers in the Japanese classrooms. Without sufficient language use, A notes, ‘it was pretty difficult for us to build bonds and communicate’.

However, in many cases, participants have tried to find a way to overcome the language barrier through their ingenuity. According to Indonesian student A, ‘I tried to learn easy Japanese vocabulary, and we often used Google Translate to communicate’. In another case, the Thai-bound Japanese student B ‘was hesitant to communicate with them because of the difference in language’ at first. However, B learned from the peer participant from Japan, as she notes

I saw my friend who went to Khon Kaen University from the University of Tsukuba with me enjoying conversation with Thai people by repeating their words and asking their meanings and by using the atmosphere of the language, even though she did not understand their language.

and adopted the method for better communication by trying to ‘memorize frequently used words and phrases in class so that I could at least understand the content of the class’.

Effective use of non-verbal materials was another solution to their language barrier issue. Figure 3 shows that the student teacher in the middle, holding the PC, is explaining using English with the support of visual material.

Religion-Related Issues

Religion-related challenges were found, especially among the Japan-bound Indonesian students. Japan-bound Indonesian student C notes that 'it was hard to find food that does not contain alcohol and pork'. She has overcome this issue of food by cooking by herself in the kitchen of the dormitory and asking the Japanese staff about the ingredients, but still, she notes that even if she 'tried to cook by myself, many ingredients still contain alcohol and pork, like sauces, noodles, frozen foods, jams and breads. The safest food I could eat is eggs and vegetables'. All three Japan-bound Indonesian students have pointed out this issue.

One Japanese participant D, who stayed in the Philippines and had four Indonesian students and two Thai students as peers, reflects on her encounter with the difference of religion as an acquisition of a new perspective rather than as a challenge. She notes, 'It was the first time I thought about the religious difference. I learned about cultural and religious differences and the importance of being considerate', which shows that this incident was a first cross-cultural experience related to religion for her.

Differences in Lifestyle

Changes in daily life situations were also seen among the Japan-related participants. One of the unique challenges only seen among



Figure 4. First Experience of Snow for the Participants from Southeast Asia.

the Japan-bound students was the difference in climate. Japan-bound Indonesian student C notes: 'The weather in Japan is different from that in my home country, so even when we used a heater, I often trembled in class. I already wore some layers of clothes, but still, it was not easy to adapt to the cold weather'. Figure 4 shows that the participants from Southeast Asia are excited about their first experience of snow. They are wearing thick down coats, which they usually don't need in their country. It shows that the participants have experienced a huge gap of climate compared to their own country.

As for the Japanese participants, although climate was not mentioned as a challenge, the difference in food and the sanitation system was a challenge. Indonesia-bound Japanese student E notes: 'The meals were limited to few vegetables and salads, and as I cannot eat spicy food, I was naturally limited in what I could eat. There were many delicious dishes, but I felt that my intestinal condition was not so good throughout my stay', showing that student E went through a cross-cultural experience in

terms of food, which is one of the basics in daily life.

In the case of Thai-bound Japanese student B, her challenge was related to the toilet. She notes that

the most shocking thing to me as soon as I arrived in Thailand was the differences in toilets and showers. No toilet paper is commonplace, and in some places you have to fetch your own water to flush the toilet, and showers with no hot water. When I saw these two things, I felt like I couldn't do it. However, thanks to the students who came with me from Japan, we were able to share the hardship and get through it by laughing and covering it up.

The comment of student B clearly shows the process of encountering the difference, struggling and overcoming it through adaptation of her way of thinking.

Teaching Practice-Related Issues

An outstanding factor that was commonly found among the Japanese participants was the teaching practice, which could be caused by the differences in the curriculum of the teaching subject. Indonesia-bound Japanese student F notes that 'it was difficult to teach what I had never studied before because the contents of social studies in Indonesia and Japan were different'. Student F was dispatched to Indonesia to conduct his teaching practice in social studies class and had to teach about the mechanism, advantages and disadvantages of fire. However, such an aspect of 'fire' is taught in Japan in science subjects, not social studies

subjects. Thus, he 'had to start by learning about the volcano before making a lesson plan', and he 'struggled with this'. Interestingly, after facing this challenge, he had revised the teaching plan drastically.

I decided to utilize the video clips and images. We switched to a style in which students watch videos and images together and learn together. We discussed the similarities and differences with the students. The students and teachers were able to think together about similarities and differences, and the whole class was able to discuss them.

Here, student F has adopted a new teaching method where he can learn together with the students. A similar comment was found among all the Japanese participants, and many of them had overcome this challenge through collaboration with the other participants from different countries.

As for the Japan-bound students, five out of nine participants mentioned issues regarding their teaching practice. Japan-bound Phillipino student G's challenge was the difference in the class schedule. She notes that

the UTSS class timetable differs significantly from the class schedule in the Philippines. I distinguished between the two schedules, stated that classes in the Philippines last one hour per subject, 15 minutes for a health break, and one hour for lunch, but classes in Japan lasted 45 minutes per subject and 45 minutes for a lunch break. I had a hard time to adapt the class schedules in UTSS, because I was used to the Filipino class timetable.

Her comment shows that that what she had taken for granted about the timetable in her home country was the cause of the challenge.

Interestingly, many of the participants reflected their challenges as positive opportunities and adapted themselves to the local situation through their ingenuity. For example, Japan-bound Indonesian student C reflected that ‘adaptive skill is the most important skill that needs to be developed’ in order to overcome the challenges. They ‘got to adapt quickly to the school system, the basic norm in daily life, and the different weather’. Phillipine-bound Japanese student I first points out that ‘it was very difficult to learn in a short period of one month and to research and create teaching plans, teaching materials, and teaching tools’. However, he concludes that ‘although it was very difficult, it was a good experience that was very fresh and gave me a lot to learn’.

As shown in their comments, challenges were not regarded as a negative event but as a chance to widen the participants’ way of thinking.

Findings from Data: Collaborations

In relation to the second research question to find out the object of collaboration, participants were asked to describe their experience of collaboration.

As shown in Figure 5, concrete ways to illustrate the way of collaboration, such as

‘activity’, ‘idea’, ‘knowledge’ and ‘suggestion’ are frequently used to describe their collaboration. As we focus on the Japan-related participants, the object of the collaborations can be categorised into two perspectives: collaborations related to their teaching practice and collaborations related to their daily lives.

Collaboration About the Teaching Practice

A Phillipine-bound Japanese student I notes that he ‘had many opportunities to collaborate not only with fellow trainees from Japan but also with trainees from Indonesia and Thailand in practical training at USHS (University Science High School) and in our daily lives’. He was assigned to teach a 9th grade English class with an Indonesian trainee. student I reflects this experience as follows:

We shared our different educational experiences and backgrounds, and in deciding on teaching plans and practices. We shared what kind of English classes we had taken and what kind of teaching materials and equipment we had used in our classes. We were able to have in-depth discussions about how we can improve our classes and how we can develop instruction that is more in line with our students. Through this experience, even trainees with different backgrounds could share the same goal of ‘providing a better education’, ‘deepening students’ learning’

keyword	teacher	experi- ence	educati- on	activity	culture	idea	knowl- edge	sugges- tion
count	19	16	16	11	9	9	7	5

Figure 5. Frequently Used Words of 38 Participants Regarding Their Challenges.



Figure 6. Team Teaching Class in UTSS, Japan.

and ‘developing a better teaching style. ‘I want to deepen students’ learning. This experience taught us that even though we have different backgrounds, we can practice better teaching by sharing the same goals, such as ‘to provide better education’ and ‘to deepen students’ learning’, and by learning from each other.

As student I notes, the first step was to exchange ‘what I know’ based on his educational experience in their home country. The next step was to know the peer participant’s ‘what he knows’, based on the different educational experiences in the peer participant’s country. Such an encounter with the difference turned out to be an eye-opening experience for both of the participants. In the case of student I, the fact that they had to conduct team teaching together inevitably created opportunities for both participants to discuss their teaching practice-related issues.

Collaboration through team teaching was also found in the school in Japan. In Figure 6, two participants from the Philippines are conducting a science team teaching class. After this lesson, they first reflected on how the lesson went between themselves and their mentor,

then shared ideas with the Thai and Indonesian participants for further improvement at dinner time. Such feedback took place daily. Japan-bound Thai student H notes that it became a habit to ‘share the plans in a day and have discussion when someone finished the class’ and that she ‘collaborated with them through the preparation, like writing a lesson plan and practicing the plan’. First, she discussed with her Indonesian colleague the personalities of the HR class students. Then, she compared their characteristics with those of her own HR class students in order to write an appropriate lesson plan. She then ‘used a board in her dormitory to practice in front of her Filipino friend. Next, student S (Phillipino) came to me and saw my practice; after that, he gave me some advice on what to concern and what to adapt’. Here, we can observe multicultural collaboration among the participants. Student H concludes that ‘knowing each other’s styles of teaching and preparation had pushed up’ her to put more effort into her students, and also to create a better lesson plan. In addition, student H’s reflection shows that collaboration occurred in various phases, including preparation, actual practice, and post-class feedback.

Figure 7 shows a similar situation in the Philippines. A Japanese participant had just finished her class, and the Indonesian participant and Thai participant are giving feedback to her class. Such collaborations could be found among all of the Japan-related participants.

In the case of Japanese student F, who stayed in Indonesia, he encountered a difference in teaching method as follows:

(In Indonesia,) the teachers themselves created their own teaching materials



Figure 7. Feedback from the Peer Participants After the Class.

(specifically, they made videos) and thought of their own games that suited the contents of the classes, without relying on the contents of the textbooks. This is a method of teaching that cannot be found in Japanese schools.

The encounter with a different methodology was experienced more or less by all six Japanese participants. The language used for communication was English, which was one of the challenges found among the Japanese participants, but the fact that they were in a situation where they *had to* communicate in English, which is not the case in daily Japanese life, has pushed them to discuss educational matters in English.

Collaboration in Daily Lives

As Japan-bound Indonesian student A notes, ‘collaboration is not a collaboration that results

in an official project. However, our collaboration is how we can survive, strengthen and support each other while in Japan’. This comment shows that collaboration took place not only in official contexts but also in a private context or during unofficial settings such as dinner time or in the kitchen of the dormitory. Also, as student A continues to say that she ‘exchanged stories and learned about the culture of our respective countries’, the object of collaboration was not limited to teaching-related issues. Such collaboration is reflected by student A as ‘collaboration like that can strengthen our relationship’. Student A concludes that she ‘learned a lot from other SEA-Teacher friends about respecting other people with different backgrounds and cultures’. Her comment shows that spending time with the peers led to mutual understanding and respect for the different cultures.

Similarly, Japan-bound Thai student H notes that they had ‘spent time together both day and night, including free times and holidays’ and that she had ‘learned how to be more responsible and respectful with people who live in the same place, especially, they were from different countries with different cultures and lifestyle’. To support her idea, she gives the episode of religious difference as follows:

For example, people from Indonesia are Muslim, they must pray 5 times a day and they don’t eat pork, so when we cooked together or hung out, we must concern about their pray time and their diet conditions as normal even we don’t have to.

Again, the encounter with the difference has made them realise something new and has

keyword	SEA-teachers	chance	student	country	experience	family	class
count	18	16	16	10	7	7	5

Figure 8. Frequently Used Words of 38 Participants Regarding Their Best Episodes.

made them reconsider their own norm and culture.

Findings from Data: ‘My Best Episode’

In relation to the third research question, participants were asked to choose their best episode.

As Figure 8 shows, among the 38 participants, the most frequently used keyword was ‘SEA-Teachers’, and a closer look into the usage of this word showed that the word refers to the collaboration between the peer participants in official or unofficial settings. Also, the keyword ‘family’ in their answers referred to the SEA-Teacher colleagues to describe the relationship among them.

When we focus on the Japan-bound and the Japanese participants, seven out of nine Japan-bound participants have pointed out that their view of the world has changed through the programme, not only in terms of education but also in terms of understanding other cultures and ways of thinking.

Japan-bound Thai student J notes:

to see the world in a wider perspective was life-changing for me. I was able to see education in a different setting and realized that indeed, the world is big and diverse. I was exposed to a different classroom setting, with students of different culture.



Figure 9. First Experience of Japanese Kotatsu.

As a result, I learned other teaching strategies, methods and concepts that can all be utilized in my future teachings.

Her comment indicates that her view of education has broadened through the programme. Moreover, not only in terms of teaching-related matters, J notes:

meeting friends with different nationalities and cultures and discovering and learning things together allowed me to grow and build relationships that bear respect and understanding. Socializing with fellow SEA-Teachers through random gatherings such as dinners, vacant class hours, and going to and going home from school has been beneficial in building a team of aspirants, regardless of diverse cultural backgrounds.

Similarly, in the case of Phillipine-bound Japanese student I, he emphasises the value of his experience since ‘in a country where education and educational systems are very different from those in your own country, you will learn, discover and realise things that you can only obtain by actually experiencing and practicing the differences firsthand’. Student I further notes that the programme was a ‘great opportunity to broaden our perspective not only as a teacher but also as a person, as you interact with many people at the training school and in your daily life’. The comments of Students J and I show that the programme had a holistic impact on the participants.

Japan-bound Indonesian student K chose the Ume Matsuri Festival as her best episode. Figure 9 shows the first experience of *kotatsu* in cold weather. Since it was a cold day, the encounter with this Japanese *kotatsu* was a memorable event for her.

Interestingly, all Japan-related participants included ‘bond’ or ‘friendship’ as keywords to describe their best episodes. One Japanese student who got sick in the destination notes that the peers acted in a troublesome situation as heartwarming and that he could overcome the sickness with the support of the peers. This Indonesia-bound Japanese student E wrote about his experience as follows:

One of the most memorable moments for me was when I got a little sick. I had a slight fever and had a chronic earache, which forced me to miss the class and to rest. Then, a *Sea-Teacher* member who had finished class came all the way to my room and asked me if I was okay, if I

needed any medicine, and if I needed to get something to eat or drink. Even though we had only been together for a few weeks, I have great respect for the members who can say such kind words to me. I also thought that having such an experience in a foreign country is something I would like to cherish in my life.

Although sickness was a negative experience for him, the heartfelt relationship among the other participants has changed this to his best memory.

In the case of Japan-bound Phillipino student G, she describes that ‘CLSU, KKU, and UPI participants are truly like family. The SEA teachers in UTSS during this batch are supportive, sweet, compassionate, helpful, competent, and easy to get along’. Similarly, half of the Japan-bound participants have used the term ‘family’ to express their relationship between the peer participants, showing the close bond among them. In the case of Japan-bound Thai student J, her best memory was related to ‘people’, as she notes that ‘what impact me the most is the relationship bonding with everyone in the program. My best episode was the memory whether it was play time or work time. The programme wouldn’t be as good as it is without the people behind it’. These comments show that the positive relationships among peers were the basis of their best episodes.

Discussion and Conclusion

In the findings, we have analysed the answers to each of the research questions. In the discussion session, we will focus on the significant findings in the context of Japan.

As defined as the first element of global human resources by MEXT, this programme had impacted the participants to reconsider their language and communication skills to be able to cope with people with different nationalities and backgrounds. A closer look into their reflection revealed that the challenges derived from the encounter were the difference between 'what they already know' and 'what they take for granted'. By encountering the gap, participants were forced to reconsider what has become normal in their own country and how they are unique compared to other countries. Especially in the case of basic daily issues or habits such as food or sanitation, since it had become part of their norm without doubt, some participants had a shocking experience. This encounter is the first step in cross-cultural understanding and has played a role in expanding the participant's view. This was seen both regarding their daily habits as well as in their teaching practice. Such experiences have played a significant role in terms of the third element of global human resource mentioned by MEXT, which is the understanding of other cultures and Japanese identity. Through encounters with the unknown, the participants came to reconsider and how their country is unique to others. Such cultural awareness is an important factor in fostering global citizenship.

Secondly, findings show that various collaborations took place during the programme. In the case of teaching-related collaborations, many of them shared their own national education system as well as the teaching methodology used in their country. Here again, by facing the gap between 'what is normal in their own educational situation'

and 'how it is different in the peer participant's educational situation back in their country', participants were forced to reconsider their own educational culture and to adjust it. We can say that such 'encounter to the difference' was inevitable in the process of multi-national collaboration. In addition, since the host school is located in a different country from any of the participants, they further needed to take into account the local situation and adapt what they could to the limited situation. Here, flexibility to adopt the original plan in an unfamiliar situation was needed. Such ability is close to one of the elements mentioned in MEXT's definition of global human resources. Moreover, the pilot programme had holistical impact on the participants, fostering their openmindedness and flexibility to different ideas through communication with their multi-cultural peers. We can conclude that participants in the pilot batch have acquired the elements mentioned in the definition of global human resources, such as initiative, positivity, a challenging spirit, cooperativeness, flexibility, a sense of responsibility and a sense of mission.

As we reflect our findings on the current Japanese teacher training context, which aims to foster teachers who can play an active role in the global world, the pilot programme has played a role in promoting the internationalisation of education through the creation of an educational and research environment where people with diverse cultural backgrounds and values can come together and understand each other is necessary. In addition, as the Japanese government is focusing more on improving the quality of the programme, SEA-Teacher programme, which has clear objectives to

conduct teaching practice in the local schools, can make participants learn in depth about the educational topic, which cannot be gained only through short cultural exchange programmes. We can conclude that Japanese participants in the SEA-Teacher pilot programme have faced challenges in unfamiliar settings, and their process to overcome them through multi-cultural collaboration had a positive impact on developing their cultural awareness, which is one of the important factors that a global human resource defined by MEXT possesses.

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SEAMOLEC's Initiatives on Technology and Values-Driven Transformation in K-12 Education

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ABSTRACT

This article explores the intersection of technology and values-driven transformation, especially in K–12 education. It discusses the need for values-driven transformation in education, the connection between technology and values-driven transformation, and the role that technology can play in facilitating this transformation. Good values are instilled in schools as early as possible and through habituation among students. This has become part of the teacher's obligation to integrate these good values through classroom learning. Values-driven transformation in education can be referred to explicit or implicit. Explicit values education refers to schools' official curriculum of what and how to teach values and morality, including teachers' explicit intentions and practices of values education. Implicit values education is associated with a hidden curriculum and implicit values influence, embedded in school and classroom practices. Teaching is inevitably a moral activity in which teachers have to consider the ethical complexity of teaching and the moral impact they have on their students. The article highlights two initiatives of the SEAMEO Regional Open Learning Centre that aim to integrate technology into the educational landscape while also staying true to the core values of education. The centre believes that one of the many ways to reach this objective is through the socialisation of digital literacy skills. The two initiatives include assisting the SEAMEO Secretariat in developing the Global Digital Literacy Online Course using Massive Open Online Course (MOOC) in 2019 and providing assistance in the conduct of ASEAN Teachers' Online Media and Information Literacy Bootcamp in 2023. Both initiatives are targeted at teachers because they are the drivers of education, and equipping them with the necessary skills and knowledge is crucial for providing students with a quality education that prepares them for the challenges of the future. This article also analyses the impact and future directions of technology and value-driven transformation in educational contexts that are both far-reaching and evolving. Overall, the paper argues that by embracing technology in a values-driven way, educators can better prepare students



for the challenges of the future and equip them with the skills to be responsible and ethical citizens. The skills they need to thrive in a rapidly changing world.

Keywords: Education, technology, digital literacy, media information literacy

Introduction

The rise of Industry 4.0 and globalisation has affected and even transformed things in almost every area of the digital age (Alpaydin, 2016). These rapid changes and transformations in the world affect education both as a structure and as a learning environment. One of these values has been the digital transformation (Brynjolfsson & McAfee, 2014). With the increasing use of technology in everyday and learning environments, most students are now born into a digital world.

In many ways, technology has profoundly changed education; it has greatly helped expand access to education (OECD, 2015). In the past, students had to travel to centres of learning to get an education. Nowadays, a massive amount of information through books, videos, audios and images is at their fingertips through technology.

Technology has also begun to change the roles of teachers and students (Johnson et al., 2015). In the past, the teacher was the primary source of information, and the learners passively received it. However, because of the access to information and educational opportunities that technology has enabled, in many classrooms today, we see the teacher's role shifting to being the learning facilitator as students take more responsibility for their own learning using technology to gather relevant information.

Technology can play a significant role in transforming K–12 education by providing new and innovative ways for students to learn and for teachers to teach (Voogt & Knezek, 2018). For example, online resources and educational software can provide students with personalised learning experiences and allow them to work at their own pace. Additionally, technology can facilitate collaboration and communication between students and teachers, regardless of geographic location.

However, while technology can be a powerful tool for education, it is important to ensure that it is used in a way that aligns with the values and goals of the education system (National Education Association, 2020). This may include considerations such as equity and accessibility, as well as the protection of student data privacy. Additionally, it is important to ensure that technology is not used as a replacement for human interaction and connection in the classroom.

Quoting from Ledbury Primary School (n.d.), 'Values-based Education' is an approach to teaching that works with values. It creates a strong learning environment that enhances academic achievement and develops students' social and relationship skills that last throughout their lives. Linking it with the use of technology in education, we have the term digital literacy, which can be one of the most effective ways to promote values-based education.

Digital literacy is the awareness, attitudes and abilities of individuals to identify, access and use digital tools and resources appropriately. It also encompasses the entire process of managing, integrating, evaluating and analysing digital resources, creating new knowledge, creating media expressions, enabling constructive social action and communicating with others (Gilster, 1997; Martin, 2008; Rheingold, 2010). In this technological era, the transfer of education to digital environments and distance education across the world have revealed the necessity of digital literacy.

In ASEAN, the use of technology in K–12 education is growing rapidly. A recent survey by the SEAMEO Secretariat (2022) found that 90% of respondents said that they were using technology in their classrooms, and 70% said that they were using it to a significant extent. The most common uses of technology in K–12 education in ASEAN include providing access to information and resources, facilitating communication and collaboration, personalising learning, assessment and gamification.

The use of technology in K–12 education in ASEAN also has the potential to transform the values that students learn. By providing access to information and resources, technology can help students develop a critical thinking and problem-solving mindset (TechNavio, 2016). By facilitating communication and collaboration, technology can help students to develop a sense of community and cooperation (Greenhow & Lewin, 2015). By personalising learning, technology can help students develop a sense of self-efficacy and agency (Hashim et al., 2022). By using assessment, technology can help students develop a growth mindset and a love

of learning. By using gamification, technology can help students develop a sense of resilience and perseverance (Mekler et al., 2017).

In short, the use of technology in K–12 education in ASEAN has the potential to transform the way that students learn and the values that they learn. By using technology wisely, educators can help students become lifelong learners who are prepared to succeed in the 21st century.

Overview of SEAMEO SEAMOLEC

SEAMEO Regional Open Learning Centre (SEAMOLEC) is one of the 26 centres under the auspices of the Southeast Asian Ministers of Education Organization (SEAMEO), focusing on the field of open and distance learning (ODL). It envisions being the centre of expertise in ODL, with a mission to assist SEAMEO member countries in identifying educational problems and finding alternative solutions for sustainable human resource development through the dissemination and effective use of ODL.

Owing to various programmes that become its core tasks, like trainings, consultancies, research and development and information dissemination, SEAMOLEC is assisting the SEAMEO Member Countries to find alternative solutions to enhance the quality of their people through ODL. As cited from its official website, www.seamolec.org/seamolec, the goal of SEAMOLEC is to undertake relevant programmes that are responsive to current national and regional needs through the utilisation of the ODL system.

SEAMOLEC has made efforts through national and regional programmes to support teachers

and educators in Southeast Asia and beyond. In the year 2022 alone, SEAMOLEC has trained more than 6,000 teachers in the Southeast Asia region through more than 70 training sessions. The most wanted topic of the training is the focus on the current technology to be integrated into learning activities, such as augmented reality (AR), virtual reality (VR), extended reality (XR), the Internet of Things (IoT), artificial intelligence (AI), robotics and many more. The centre has also developed six ODL models within the year and established cooperation with 20 new partner institutions (SEAMOLEC, 2022). Through collaboration with its partners and network, the centre wishes to expand the positive impacts of its programmes.

SEAMOLEC's Initiatives on Technology and Values-Driven Transformation

SEAMOLEC, in collaboration with its potential partners and networks, develop initiatives to build the digital literacy of teachers in Southeast Asia. Why teachers? We believe that before motivating students to use technology, teachers should learn and practice using it with full responsibility. This is also in line with SEAMEO 7 Priority Areas no. 5: Revitalising Teachers' Education.

While both teachers and students play important roles in the education process, targeting teachers is essential because they are the ones who facilitate learning and guide students in their academic journey (Darling-Hammond & Rothman, 2011). Teachers are responsible for designing and implementing educational programmes, creating classroom environments that support learning and assessing student progress. Therefore, they have

a significant impact on the quality of education that students receive.

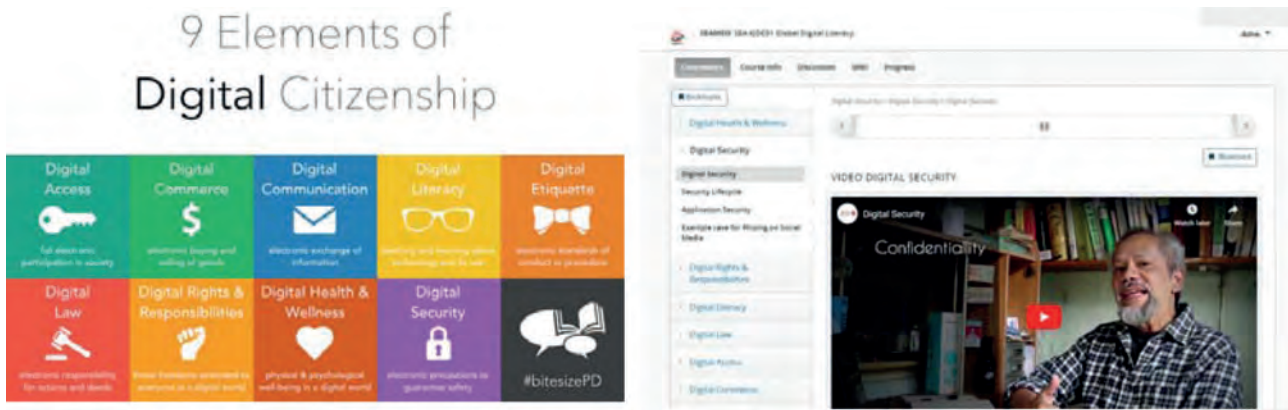
Targeting teachers with digital literacy is crucial because it enables them to effectively integrate technology into their teaching methods and create a learning environment that aligns with the core values of education (Harris & Hofer, 2011). Teachers need to understand the impact of technology on education, the challenges and opportunities it presents, and how to use it effectively to enhance student learning outcomes (Koehler & Mishra, 2009). Additionally, teachers also play a critical role in modelling values such as empathy, collaboration and ethical behaviour, which are important in a values-driven education system (UNESCO, 2013).

Students are proficient in using the internet, but teachers need to inform them of the appropriate digital knowledge to ensure they are using technology in a proper manner and safely for their positive character building. Therefore, SEAMOLEC decided to take part in two initiatives aimed at developing teachers' digital literacy:

1. Assisting SEAMEO Secretariat in developing 'Global Digital Literacy Online Course' using Massive Open Online Course (MOOC) in 2019 and
2. Assisting the conduct of the 'ASEAN Teachers' Online Media and Information Literacy (MIL) Bootcamp' in 2023.

Global Digital Literacy Online Course

This is the SEAMEO Secretariat's project in 2019, supported by UNESCO Headquarters and the Weidong Cloud Education Group in China.



Picture 1. SEAMOLEC in Charge of Developing Module About Digital Security.

It is committed to leveraging the capacity of Southeast Asian human resources to understand the norms of appropriate, responsible behaviour with regards to technology use. The project was developed in collaboration with various partners and SEAMEO Centres, including SEAMOLEC. SEAMOLEC provided the development of the MOOC platform.

This course is aligned with the SEAMEO Priority Areas particularly No. 7: Adopting a 21st Century Curriculum. This online course is also a comprehension of the nine elements of digital citizenship that will make technology safer and more helpful for everyone. The elements are (a) Digital Health and Wellness, (b) Digital Security, (c) Digital Rights and Responsibilities, (e) Digital Literacy, (f) Digital Law, (g) Digital Access, (h) Digital Commerce, (i) Digital Communication and (j) Digital Etiquette. SEAMOLEC was in charge for module 2: Digital Security.

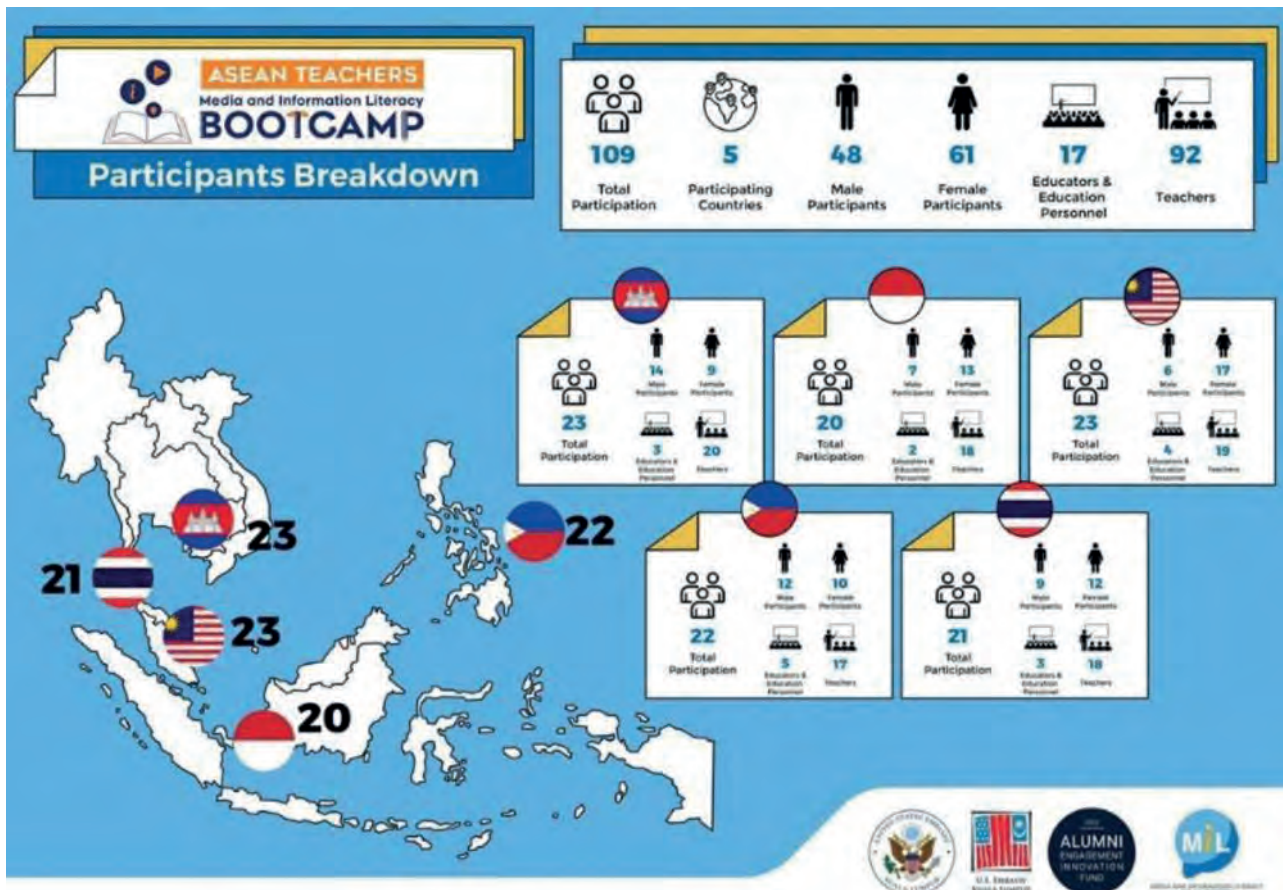
The course was attended by around 200 participants, who are mostly educators and came from Cambodia, Canada, Germany, India, Indonesia, Libya, Malaysia, Myanmar, the Philippines, Saudi Arabia, Thailand and Vietnam.

Visit this link, <http://seamooc.seameo.org>, to view the online course and all materials in more detail.

ASEAN Teachers' Online MIL Bootcamp

ASEAN Teachers' Online MIL Bootcamp supports UNESCO's goal to ensure that all citizens have access to media and information competencies. This programme aims to train and deepen the understanding of the importance of MIL in a fast-moving digital media landscape among teachers and teacher educators from five Southeast Asian countries: Cambodia, Indonesia, Malaysia, the Philippines and Thailand. As cited from UNESCO's website, MIL is a complex concept which covers all competencies related to information literacy and media literacy that also include digital or technological literacy. It focuses on different and intersecting competencies to transform people's interaction with information and learning environments online and offline.

MIL is considered the essential ability to access, analyse, evaluate and communicate information in a variety of formats and platforms,



Picture 2. Participants Breakdown of the Bootcamp.

including traditional and digital media. It involves understanding how information is produced, disseminated and consumed, as well as the potential biases and inaccuracies that may exist in various sources. It also includes the ability to critically evaluate and use the information to solve problems, make decisions and communicate effectively.

MIL is expected to empower individuals to be active and responsible in using global information effectively and ethically. This is important, especially for teachers across the world who will be the ones spreading knowledge to students.

Within this idea, the alumni of the U.S. Department of State—supported by the U.S. Department of State and the U.S. Embassy in Kuala Lumpur—initiated a three-day virtual bootcamp on February 8–10, 2023. The bootcamp aimed to train hundreds of teachers and teacher educators from Cambodia, Indonesia, Malaysia, the Philippines and Thailand about MIL. There were a total of 109 participants selected from all five Southeast Asian countries to participate in this exciting bootcamp.

SEAMOLEC was involved in the programme as a collaborative partner in recruiting teachers to apply to the bootcamp. Through the dissemination of social media postings,

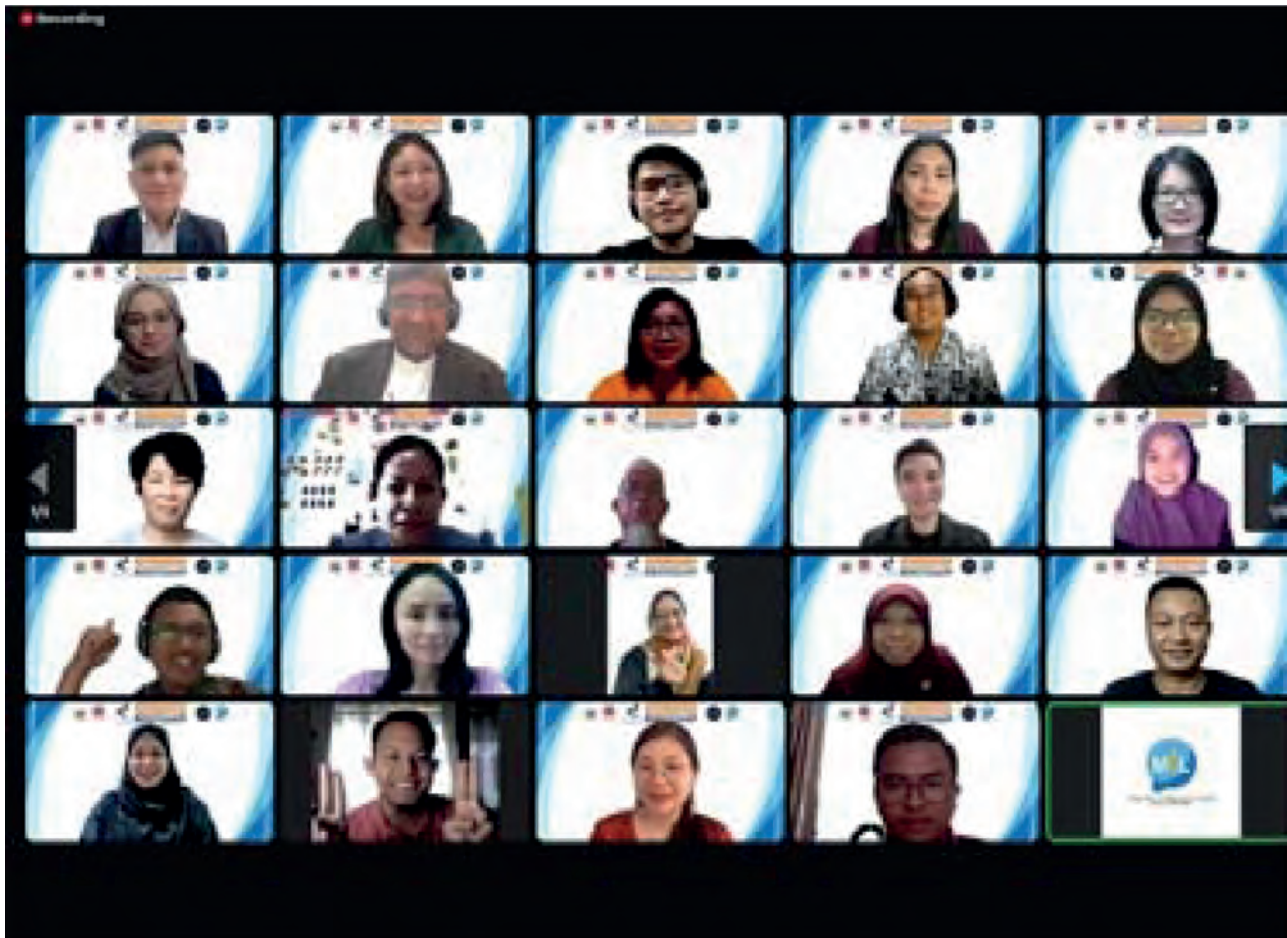


Figure 3. Happy Participants of the Bootcamp.



Figure 4. Indonesian Participant Joined the Bootcamp from School's Computer Lab.



Figure 5. Thai Teachers Participated in the Bootcamp Together.



Figure 6. Big Groups of Cambodian Teachers After Participating the Bootcamp.

SEAMOLEC invited teachers and education personnel to participate.

At the end of each day of bootcamp, participants were encouraged to do some tasks, including their opinions on the collaborative board called Insight Gallery using the Google Jamboard platform and developing their individual action plans based on the UNESCO competency in MIL. The action plans were expected to be implemented within three months after the bootcamp. However, participants are allowed to create action plans for beyond that time as well. Not only individual action plan, but participants were also grouped based on country on the last day. They were assigned to create action plans that are feasible and contextualised for implementation in their respective countries.

Visit this link <https://aseanmil.org/asean-teachers-virtual-bootcamp-2023/> to access more information related to the bootcamp.

Impact and Future Directions

The impact and future direction of technology and value-driven transformation in education are indeed extensive and continuously evolving. Here are some potential impacts and directions worth considering. Some potential impacts include:

1. Enhanced learning experiences: Technology can provide new and innovative ways for students to engage with course material and access resources, which can lead to more personalised and effective learning.
2. Improved student outcomes: Technology-driven transformation can help to close achievement gaps and provide more equitable educational opportunities for all students.
3. Increased access to education: With the help of technology, educational resources can be made available to more students in

more locations, regardless of their physical location or financial status.

4. **Development of 21st-century skills:** Technology can provide students with opportunities to develop critical skills such as problem-solving, communication and collaboration that are in high demand in the modern workforce.

To prepare for and take advantage of massive developments in technology, we propose some recommendations that aim to guide the future direction of technology and value-driven transformation in education within the ASEAN region as follows:

1. **Promote Digital Inclusion and Access.**

We need to prioritise efforts to ensure equitable access to technology and digital resources across ASEAN member countries. Investment in infrastructure development, internet connectivity and affordable devices is needed to bridge the digital divide and provide equal learning opportunities for all students.

2. **Foster Collaboration and Knowledge Exchange.**

To foster collaboration and facilitate knowledge exchange in the field of educational technology among ASEAN member countries, it is important to implement the following measures: (a) Actively encourage collaboration and knowledge exchange among ASEAN member countries, specifically in the realm of educational technology, (b) establish dedicated platforms and forums that bring together educators, researchers and policymakers from across ASEAN. These platforms should serve as spaces for sharing best practices, discussing

innovative approaches and exchanging valuable resources related to educational technology and (c) cultivate a collaborative culture that promotes innovation and cross-cultural understanding.

3. **Enhance Teacher Training and Professional Development.**

To drive the effective integration of technology into pedagogical practices, it is crucial to invest in comprehensive teacher training programmes that empower educators. By providing ongoing professional development opportunities, workshops and online courses, teachers can enhance their digital literacy and pedagogical skills, enabling them to fully leverage the potential of technology in the classroom.

4. **Embrace Innovative Pedagogies and Learning Approaches.**

To foster educational innovation, it is essential to embrace innovative pedagogies and learning approaches that harness the power of technology, encourage the adoption of student-centred, active learning methodologies that cultivate critical thinking, creativity, collaboration and problem-solving skills and place emphasis on leveraging technology as a tool to enhance student engagement, facilitate personalised learning experiences and establish meaningful connections to the real world.

By focusing on digital inclusion, collaboration, teacher professional development and innovative pedagogies, ASEAN member countries can harness the transformative power of technology to create inclusive, learner-centred educational environments. Nevertheless, it is important for

each country to adapt these recommendations to their specific contexts, needs and priorities while also considering regional collaboration and coordination.

In a nutshell, the integration of technology and values-driven transformation in education has the potential to revolutionise the way we learn and teach. By leveraging technology to create more personalised, engaging and inclusive learning experiences, educators can inspire a passion for learning in students and empower them with the skills they need to succeed in an ever-changing world.

However, to achieve this transformation, educators must place a renewed emphasis on values such as empathy, compassion and social responsibility and ensure that technology is used to enhance, rather than replace, human connection and interaction. With a collaborative and holistic approach, we can create a future of education that is truly transformational and that prepares students to lead fulfilling and purpose-driven lives. SEAMOLEC will continue to bring out initiatives that will emphasis not only the use of technology but also how to cultivate strong values and character traits that are essential for students. By doing so, we can foster a generation of learners who are not only proficient in technical skills but also possess the emotional intelligence, creativity and ethical integrity needed to thrive in a rapidly evolving global landscape.

Undoubtedly, the ongoing (r)evolution of technology and value-driven transformation in education is poised to have a profound impact on both student learning and teaching practices. As we move forward, it is clear that

these advancements will continue to shape and redefine the educational landscape, presenting new opportunities and challenges for students and teachers alike.

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A Breakthrough of Values-Driven Strategies in Using Multimedia-Based Instruction (MMBI): A Course Towards Sustainable Transformative Education

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ABSTRACT

Face-to-face learning has been the standard way of teaching and learning. However, during the pandemic, the educational sector was greatly affected since schools were forced to shut down as the country implemented plans and procedures on how to contain the virus infection. As the global setting suffered, so as with the local entities were distressed. In fact, a significant decrease in the number of enrollees had been recorded. To aid the challenges brought by the pandemic, last 11 September 2020, 'Salida La Filipina' was launched, which is a media-based programme of La Filipina National High School (LFNHS) that produces localised and contextualised media-related supplementary materials like Television-Based Instruction (TVBI), Radio-Based Instruction (RBI), TeleRadyo-Based Instruction (TBI), Salida Ads, Salida Talks and Salida Probe. Thus, making Salida La Filipina the centre of supplementary learning instruction. Furthermore, varied teaching and learning strategies were integrated into the programme, namely: (a) digital learning, where technical resources were used as learning tools; (b) effective lecturing, where teachers innovate materials showing digital lectures and seminars; (c) flipped classroom, where students can have actual learning experience on how to properly use the equipment, (d) group/collaborative work, where students can actively engage with others to improve public reasoning and team-based skills. To ensure the objectives were attained, the school with the Salida Crew conducted online training and seminars for teachers to capacitate them in studio-related tasks and to produce their contextualised videos at their own school levels. As the full implementation of face-to-face classes paved its way in LFNHS, teachers utilised the produced materials as supplementary learning resources for instruction. The programme helped the teachers minimise their time in discussion, thus deviating from the conventional way of teaching and encouraging students' interaction and self-exploration. In support of the different activities, Salida La Filipina produced Same-Day-Edit episodes for school, division, regional and



national events. Salida team served as the production team, highlighting the skills learned during the trainings and workshops, which in turn developed harmonious relationships among partners and stakeholders as the team engaged in reach-out programmes, benchmarking and community activities. Moreover, the programme also journeyed towards incorporating values-driven strategies. It promoted the authentic lives of indigenous people as integrated into the subjects broadcast in the programme. The episodes did not only highlight the cognitive aspects of the students but also the values and good morals. Salida La Filipina corroborates that learners embody respect and love for others, regardless of their skin colour, gender, religion and status. Lastly, to ensure the continuity and sustainability of the Salida La Filipina programme. It intends to pursue the following plans: (a) conduct media literacy trainings, seminars and camps to produce competent and media-skilled teachers and learners, (b) designate students as Salida Studio Crew to utilise the usage of Salida La Filipina Studio and create news broadcasts and content videos, (c) produce supplementary media-based instructional episodes to support the learning process and (d) strengthen partnerships through benchmarking and community immersions.

Keywords: Educational transformation, La Filipina National High School, multimedia-based, the Philippines, Salida La Filipina

Introduction

‘Salida La Filipina’, a media-based programme of La Filipina National High School (LFNHS) that produces localised and contextualised media-related supplementary materials like Television-Based Instruction (TVBI), Radio-Based Instruction (RBI), TeleRadyo-Based Instruction (TBI), Salida Ads, Salida Talks and Salida Probe. The programme aims to deliver quality learning resources to make teaching–learning fun, engaging and interesting.

Due to the COVID-19 pandemic, Universities were forced to fast transition from traditional classroom teaching to online learning, (Sousa, 2020). With this, LFNHS accepted the challenge by creating a programme to aid distance learning, thus making Salida La Filipina the centre of supplementary learning instruction.

From its humble beginning, the programme first produced episodes from scratch with no proper equipment and a classroom as the studio. By making Salida La Filipina anchored to Adopt-a-School Programme and Brigada Eskwela, the programme received positive responses from partners and stakeholders and was successfully launched on 11 September 2020.

Currently, the programme utilises all donated equipment to deliver quality instructional materials in over 417 already-produced videos to supplement students’ learning. With the programme as the centre, many activities were conducted, like *Salida Ads* as programme advocacy campaign, *Salida Eskwela* as supplementary media-based instruction for all subject areas, *Salida Talks* for community

engagement activities, Salida Probe for news and current events and Salida Snapshots to document every celebration and events.

Moreover, with all the support received by the programme, Salida La Filipina helped back the community by creating Salida Ads on the accomplishments of Barangay La Filipina and providing media-based learning instruction to preschool learners. In connection with the programme's advocacy, the school is already conducting trainings and seminars for teachers and students to capacitate them for studio-related tasks and to produce their own informational videos.

With this, Salida La Filipina continues to make supplementary learning materials, welcome benchmarking activities, conduct trainings and produce informational ads for the school and the community.

Strategies Integrated to Salida La Filipina

1. **Digital Learning** is the transformation from traditional classroom teaching to online teaching (Sousa, 2020). The multimedia-based instruction (MMBI) that is already produced by Salida La Filipina, like RBI, TVBI and TBI, can be easily retrieved by students and teachers and is open to be used during the teaching–learning process as a supplemental learning strategy.
2. **Contextualised Learning** explains how bringing learning into context can make the experience more meaningful to students (Osika, 2022). Further, it enables learners to apply knowledge and skills to real-life situations. Likewise, Salida La Filipina made sure that the examples presented

in the lesson are relatable to the student's life since students are engaged in various social media platforms, and this is also the target of contextualised learning. Meeting with students' experiences results in meaningful learning happens.

3. **Effective Lecturing** innovates the traditional method of lecturing as it introduces more active and participatory components, thereby enhancing higher-order thinking and learning during class (Abreu, 2021). Like showing digital lectures and seminars documented by Salida La Filipina. This helps the lecturer not to monopolise the whole duration of the lecture as materials are already provided to be used.
4. **Flipped Classroom** utilises Salida Studio to experience real-life production works like TV and Radio broadcasting, hosting and other live recorded works. As students learn the skills, they then assist other students, teachers and visitors who are interested in learning them. The outputs from the studio are all aired and uploaded to different platforms like YouTube and Facebook so that other students will also learn from them, thus ensuring the programme's efficiency.

Values-Driven Strategies Incorporated in the Programme

Globally, the education system is faced with many crises including drug addiction/peddling, indiscipline, school dropout, rape, abuse of various forms, smoking, drinking of alcohol, and other violent crimes (Khathi, 2022). Integrating values-driven contents, strategies and activities

in the teaching–learning process is an integral part of the holistic development of the students. The programme does not only focus on the cognitive side but also on the total well-being of the students. According to Mercer et al. as cited by Zheng (2022), well-being is the center of positive educational practices along with educational content. Teachers want to inculcate in the students’ minds that emanating good values and good morals matter. Learners should embody respect and love for others, regardless of their skin colour, gender, religion, status, etc. That is why the school produced *Salida* episodes, documentaries and programmes, invited high-calibre speakers and conducted symposiums to integrate values in the delivery of education. For instance, in one of the programme’s produced episodes, it promoted the authentic and aesthetic lives of our indigenous people. It showcased their language, cooking recipes, culture and traditions. With these, students appreciated their history, origin and identity.

In addition, *Salida La Filipina* also broadcasted episodes like *My Wonder Juana Story*, which magnified the resilience of a woman during the pandemic. This episode was also integrated into some of the lessons in different subject areas, like *Edukasyon sa Pagpapakatao* and English. Moreover, during the school’s celebration of the 2020 National Reading Month, the programme produced eight episodes of virtual storytelling highlighting the good values and conduct of a person as embodied by the character from the story. It also prompted students to respond to different questions not only focusing on the cognitive aspects but also on affective domains. Furthermore, a teacher’s guidance boosts the students’ morale inculcating what is more

valuable in life (Sen, 2019). As we designed this programme, the teachers really put into account that *Salida La Filipina* would really be focused on developing not just the intellect of the learners but also boosting their morale and good conduct because these would help students to become more and more responsible and sensible citizens of society.

Interrelationship of *Salida La Filipina* with Other Sustainable Development Goals

1. Wash in School (WinS)—Sustainable Development Goal (SDG) 6: Clean water and sanitation: To educate the community on the critical importance of sanitation, hygiene and handwashing in containing diseases, especially during the pandemic, *Salida La Filipina* launches the WinS programme.
2. Pag-Indo aw Pagbabarawan Ng Kamonamonaan—SDG 10: Reduce inequality: *Salida La Filipina* also became a forum for spreading indigenous people’s culture and values, as shown in *Pag-Indo aw Pagbabarawan Ng Kamonamonaan* (Discussion on Educational Heritage). This is an essential topic since LFNHS was named Tagum City’s most sustained indigenous education implementing school and is in line with SGD on reduced inequality. Through the ‘18-day campaign VAW (violence against women)’ and ‘Juana in time of epidemic’, which talk about the resilience of women, the SGD on gender equality was demonstrated. These two initiatives were founded on the SDGs of promoting gender equality.

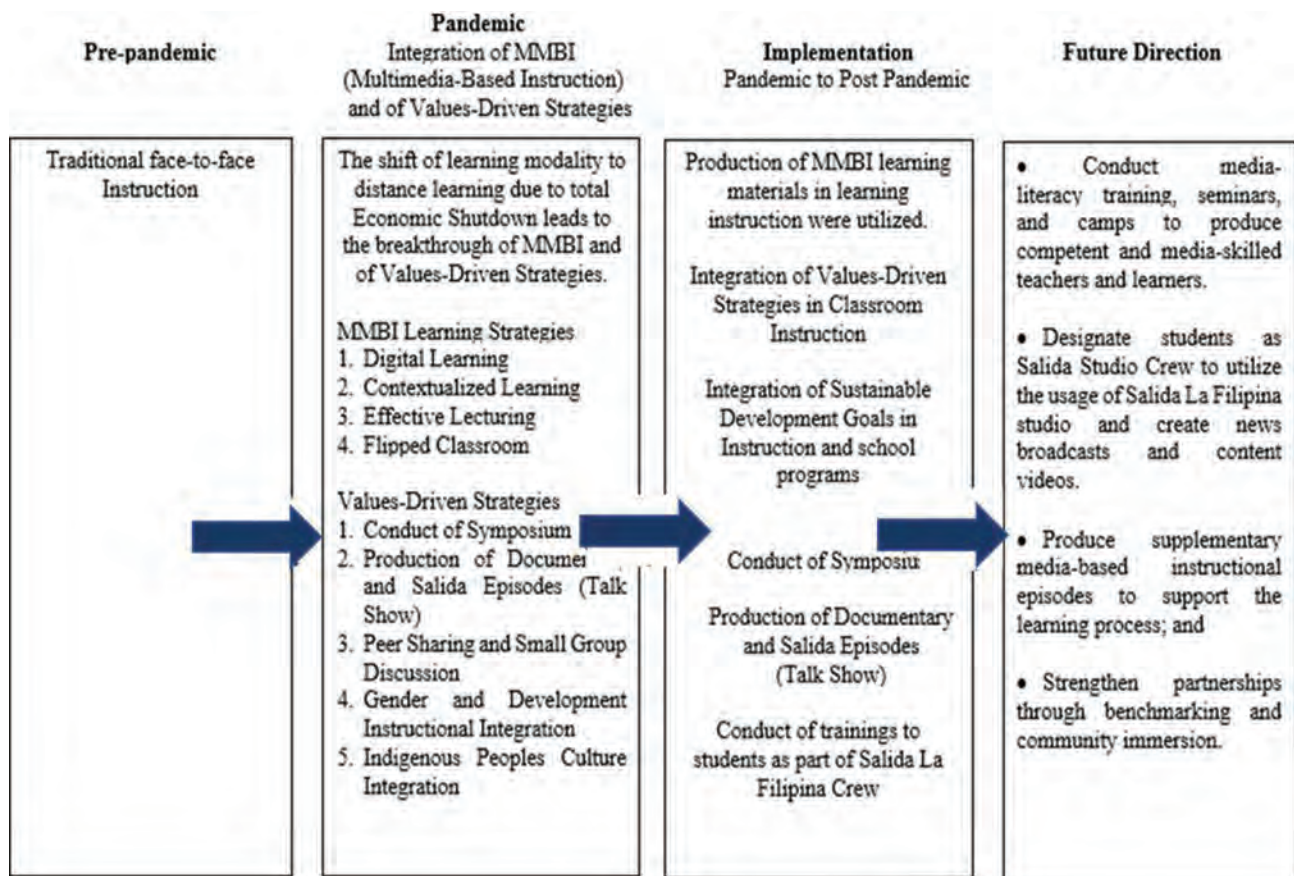


Diagram 1. The Conceptual Paradigm of the Implementation of Salida La Filipina Program

Salida La Filipina's Future Plans

The school targets continuity and sustainability of the Salida La Filipina programme. It intends to pursue the following future plans:

1. Conduct media literacy trainings, seminars and camps to produce competent and media-skilled teachers and learners;
2. Designate students as Salida Studio Crew to utilise the Salida La Filipina Studio for creating news broadcasts and content videos;
3. Produce supplementary media-based instructional episodes to support the learning process and
4. Strengthen partnerships through benchmarking and community immersions.

Concept Flow

Strategy: Talk show

Topic: A breakthrough of values-driven strategies in using MMBI: A course towards sustainable transformative education. The diagram is anchored on Csikszentmihalyi's Flow Theory

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Development of a Framework for Assessing the Readiness of TVET Institutions for IR 4.0

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ABSTRACT

The Industrial Revolution (IR) is coming and has impacted the way we live, learn and work. The adoption of digitalisation in preparation for IR 4.0 or even beyond is inevitable for technical and vocational education and training (TVET) institutions. Much has been introduced and discussed about TVET 4.0, but the scope, including the variables and indicators, is not clearly defined. For that reason, having a suitable framework that can be used to assess the readiness of TVET institutions to prepare for IR or future technological innovation is very much needed. This paper will explore, compare and discuss various frameworks, both related to those for assessing the readiness of industry and education institutions for IR 4.0 integration. Based on the workshops organised by SEAMEO VOCTECH in September and November 2022 and a pilot study of the instrument, a proposed framework will be shared and discussed in this paper, including the assessment tools for TVET institutions. This paper will also offer some recommendations on how to use the framework and the assessment tools for the development of institutional roadmaps based on the level of TVET 4.0/ technological adoption at the institution.

Keywords: Conceptual framework, digitalisation, readiness for industrial revolution 4.0, technical and vocational education and training (TVET)

Introduction

The Fourth Industrial Revolution (IR 4.0) presents wider opportunities for the implementation of fundamental concepts that have already been widely adopted in various countries, including Europe and the United States. The concept of IR 4.0 refers to a variety of developing technologies that have significant impacts on the workplace and that integrate the physical, digital and biological worlds (Asian Development Bank, 2021). Modernisation and technological advancements have indeed had a profound effect on today's society and job markets. Eventually, this will lead to the decline of the traditional employment market. The



anxiety of job loss is due to the possibility of labour substitution as a result of technological change, and it has always existed during periods characterised by radical technological shifts, such as witnessed in the previous IRs (Rajput, 2020). The benefits of IR 4.0 are considered to be greater than the potential drawbacks for German mechanical and plant engineers. According to a survey, 90% of companies deeply engaged in IR 4.0 perceive it as a prospect to distinguish themselves in the market. Furthermore, a significant majority of 76.2% believe that the discussion of this subject matter is an essential component of being a technology leader (Impuls, 2015).

Several research studies have demonstrated the advantages and prospects that accompany the latest technological advancements related to IR 4.0. As such, one study states that the implementation of Industry 4.0 technologies is expected to generate an additional potential added value of 23 billion euros and an annual growth rate of 2.1 percent in the sector by 2025 (Bitkom/Fraunhofer IAO, 2014 cited in Impuls, 2015). The realisation of this potential can be attained through the utilisation of optimised value-adding networks, improvements in business process efficiency, the introduction of innovative products and the implementation of novel services and business models (Impuls, 2015).

Technical and vocational education and training (TVET) is a critical component in preparing today's youth for future employment opportunities in the era of IR 4.0. The study of IR 4.0 and its impact on the world of work to foster innovation in TVET education is of paramount importance. As countries move towards

adopting the IR 4.0, they are likely to face several hurdles related to the competency level of their workforce (BRICS Skill Development Working Group, 2016). Consequently, many nations have begun to equip their workforce with the necessary knowledge and skills for IR 4.0 (Tun et al., 2021).

The impact of the IR 4.0 on TVET has been recognised by several governments worldwide, leading them to take appropriate measures in response to this trend (Rajput, 2020). Most Asian countries prioritise policy initiatives such as altering the demand for skills, restructuring the implementation of TVET and creating innovative curricula to facilitate their transition towards the IR 4.0. A skilled workforce is the cornerstone of industries and crucial for the economic growth of a nation. It is necessary not only for enhanced productivity, competitiveness and industrialisation but also for maintaining the progress already made (Rajput, 2020).

The degree of preparedness and readiness of nations for the IR 4.0 varies and is contingent upon several factors, including awareness, perception, current industrial demand and governmental policy (Tun et al., 2021). TVET and the industry need to offer a diverse range of skills to produce a workforce equipped with a broad spectrum of competencies that can effectively address the demands of future employment. In order to guarantee that forthcoming employees possess the necessary knowledge and skills, TVET institutions play an important role in the reorganisation of the labour force as a component of their workforce readiness efforts (UNESCO, 2013; Yusop et al., 2023).

According to a report published by the Institute of Labour Information and Analysis (ILMIA) in Malaysia, one of the key factors required to facilitate the implementation of IR 4.0 is the reinforcement of policies pertaining to skilled human resources and employment. The aforementioned opportunity has provided us with a broader outlook on the various perspectives regarding the significance of education in equipping skilled human capital (Rohanai et al., 2020).

Accordingly, TVET is included in the United Nations' objectives to enhance the number of young individuals and adults who possess proficiencies in areas such as technical and vocational skills, which are essential for the labour force, satisfactory employment and entrepreneurial pursuits (United Nations, 2020). The IR 4.0 necessitates modifications in the curriculum of not only technical education but also general education. This transformation plays a crucial part in preparing the workforce for the industry (Aulbur et al., 2016). Additionally, it is imperative to enhance action research methodologies at the community level to customise TVET offerings to meet requirements and circumstances in collaboration with all pertinent stakeholders. Collaboration with researchers and experts who prioritise solution development and possess the ability to work together on a pragmatic level is of utmost significance (Mahmood et al., 2018; Shabbir et al., 2020).

The existing body of research on work readiness within the field of global studies has yet to specifically address the preparedness of TVET institutions with regards to IR 4.0. Conducting this type of research is imperative

as it can furnish insights into the degree to which endeavours have been undertaken to enhance the preparedness of TVET for the IR 4.0 (Nurjanah & Ana, 2021). Furthermore, the results acquired may serve as a research foundation for the creation of a curriculum that aligns with the Industry 4.0 framework. The findings may also serve as a means to enhance the linkage and alignment between the domains of academia and industry. Correspondingly, this calls for the need to have a proper framework and tools to evaluate the preparedness of TVET institutions for the upcoming IR or future technological advancements.

Objectives of this paper are the following:

1. Explore, compare and discuss various frameworks, both related to those for assessing the readiness of industry and TVET institutions for IR 4.0 integration.
2. Propose a suitable framework for assessing the readiness of TVET institutions for IR 4.0 (TVET 4.0).
3. Recommend how to use the framework and the assessment tools for the development of institutional roadmaps based on the level of TVET 4.0/technological adoption at the institution.

Literature Review

The investigation of IR 4.0 readiness is a potential avenue for organisations to effectively address the challenges that may arise during the transition towards the new IR (Hofmann & Rüscher, 2017). Schumacher et al. (2016) conducted a study on various readiness and maturity models for the implementation of Industry 4.0. They assert that the distinction between a maturity

model and a readiness model lies in the fact that the readiness assessment takes place prior to the commencement of the maturation process. Nonetheless, a scarcity exists in the availability of readiness assessments that address the distinct demands and obstacles faced by TVET institutions within the context of Industry 4.0. It is necessary to conduct a readiness assessment in order to showcase the TVET institution's level of preparedness. This section will discuss several frameworks related to assessing the readiness of the industry and TVET institutions for IR 4.0 integration.

Review of IR 4.0 Readiness Models

1. Self-Assessment of Industry Readiness (Impuls, 2015)

The readiness model developed by Impuls (2015) serves as the basis for conducting a self-evaluation and comparative analysis. The developed Online Self-Check enables organisations to assess their IR 4.0 readiness across six dimensions, namely strategy and organisation, smart factory, smart operations, smart products, data-driven services and employees. The model was developed to explore the following aspects: structural attributes of the companies, general questions about Industry 4.0, the degree to which companies satisfy the dimensions of Industry 4.0 and motivators and obstacles on the road to Industry 4.0. The outcomes are utilised to categorise the corporations into groups of 'newcomers', 'learners' or 'leaders'. As shown in Figure 1, the readiness model consists of 6 main dimensions and 18 fields.

As illustrated in Figure 1, the inner circle of the model looks at six dimensions, and each



Figure 1. Readiness Model with 6 Dimensions and 18 Fields.

Source: Impuls (2015).

of these six dimensions is further delineated into fields, which in turn are operationalised with appropriate indicators. Meanwhile, the outer circle shows the fields associated with each of the six dimensions. A total of 18 fields are measured using the appropriate indicators: level 0 (outsider), level 1 (beginner), level 2 (intermediate), level 3 (experienced), level 4 (expert) and level 5 (top performer).

2. Singapore Smart Industry Readiness Index (SEDB, 2020)

The Smart Industry Readiness Index (SIRI) is a framework designed to assist manufacturers in initiating, expanding and maintaining their manufacturing transformation endeavours, regardless of their size or industry. The framework was developed through a collaborative effort with a multinational testing, inspection and certification corporation and subsequently reviewed and endorsed by a

group of professionals with expertise in both industry and academia. The SIRI framework and assessment matrix is based on the Reference Architectural Model for Industry 4.0 (RAMI 4.0), which was created by *Plattform Industrie 4.0*, a prominent Industry 4.0 network with global reach (SEDB, 2020).

The SIRI framework is composed of three distinct layers. The uppermost stratum comprises the three essential building blocks of Industry 4.0, namely process, technology and organisation. The fundamental components of the structure are supported by eight pillars that denote essential facets that corporations must prioritise to attain readiness for the future. The final layer encompasses a total of 16 dimensions that organisations ought to consider when assessing the present state of development of their establishments. The assessment matrix is a tool used to evaluate and measure the performance of individuals or groups based on predetermined criteria. The assessment

matrix is a self-diagnostic tool designed to aid companies globally in assessing the current state of their factories. Displayed in Figure 2 is the layers within SIRI Framework developed by SEDB.

3. Malaysia Industry4WRD

The Industry4WRD model consists of 3 shift factors, 8 thrusts and 21 dimensions. The Industry4WRD Readiness Assessment is an endeavour undertaken by the Ministry of International Trade and Industry in Malaysia, aimed at assisting companies in evaluating their competencies and preparedness to embrace IR 4.0 technologies and procedures. Enterprises operating within the manufacturing and IT-related services sectors in Malaysia are eligible to participate in this programme. The programme offers various benefits, such as the ability to identify areas for improvement in terms of IR 4.0 adoption and the opportunity to apply for financial incentives (MPC, n.d.).

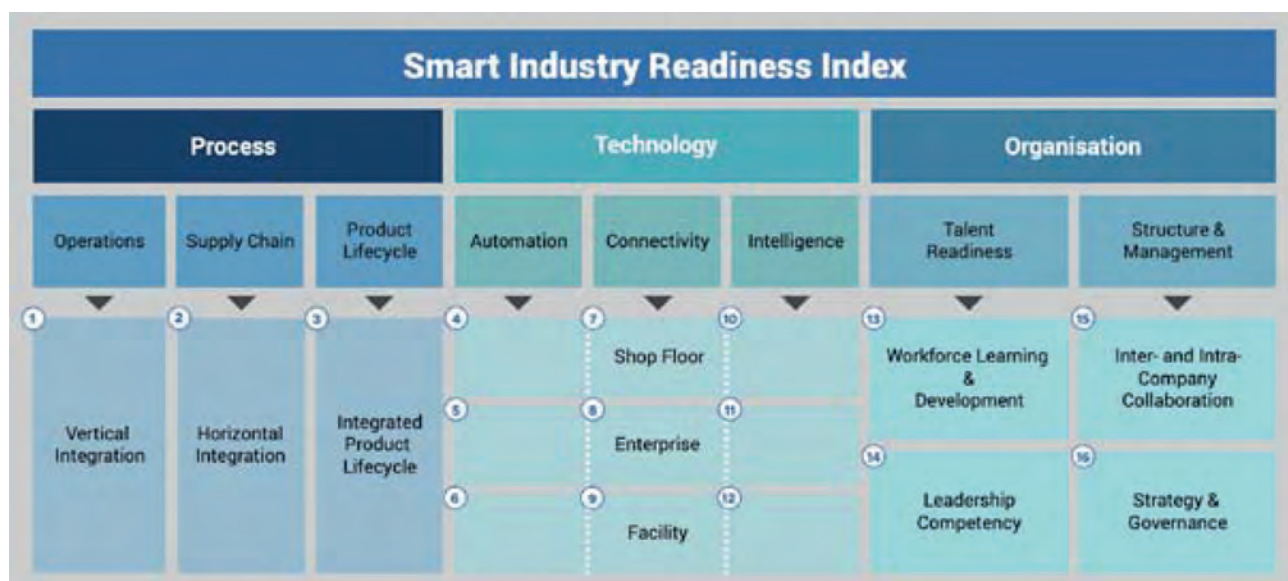


Figure 2. SIRI Framework.

Source: SEDB (2020).

The inner circle of the model includes three shift factors: people, process and technology. The first factor, *People*, centres on both individuals and the organisation as a whole, prioritising strategies aimed at cultivating an appropriate workforce. The second factor pertains to *Process*, which centres on the management system utilised in conducting business operations, supply chain and product lifecycle. This factor places emphasis on the implementation of intelligent and strategic public-private partnerships, security, sustainability and product co-creation. The third factor pertains to *Technology* and emphasises the utilisation of intelligent, interconnected and automated technologies (Saari, n.d.).

4. Labtech Digital TVET Framework

The Labtech Digital TVET framework was created by Labtech International. The framework underscores the importance of investing in teacher training, digital platforms, high-quality content and establishing networks that extend beyond institutional boundaries (McKee, n.d.). The framework comprises three outer layers, namely InfraStructure, InfoStructure and InfoCulture. Beneath each external layer are four internal dimensions that represent the sub-components. Components under InfraStructure contains hardware, integration and support, connection and bandwidth. As for InfoStructure, the components include software, platform, content and assessment. Meanwhile, the InfoCulture components consist of curriculum, policy, capacity building and change management.

5. TVET College Readiness (Makgato, 2019)

The study conducted by Makgato (2019) presents empirical findings from three TVET

colleges located in one province within South Africa. The empirical part focused on vocational pedagogic and didactic practices, workshop material and equipment for practical training, work-integrated learning and integration of theory and practice in vocational subjects. The study's results reveal both congruent patterns and conflicting outcomes with prior empirical investigations. Within the category of pedagogical and didactic practices, a significant majority of the students expressed agreement with the notion that the VET pedagogy is geared towards augmenting their ability to think independently. This finding is consistent with the research conducted by Reeson et al. (2016), which highlights the necessity for educators to adopt a distinct pedagogical approach and skill set in light of the emergence of Industry 4.0.

Furthermore, the results pertaining to the perspectives of students regarding the amalgamation of theoretical and practical aspects in academic disciplines indicate that a significant proportion (75%) of students concur that they encounter obstacles in acquiring the essential competencies and expertise requisite for social and economic development. Additionally, a majority of the students concurred on the significance of collaboration in vocational education and training. The aforementioned results offer a comprehensive analysis of students' perspectives regarding the preparedness of their institutions for IR 4.0. These outcomes may serve as a point of reference for universities and policymakers in devising suitable tactics to facilitate the production of TVET graduates who are equipped for the demands of the future.

6. Readiness of Public TVET for the IR 4.0 (Denhere & Moloi, 2021)

Denhere and Moloi (2021) conducted a study in South Africa to examine different indicators that can be used to evaluate the preparedness of TVET colleges for IR 4.0. The present investigation encompassed a total of 26 public TVET institutions situated in nine provinces of the Republic of South Africa. The study evaluated a total of 14 indicators that pertain to the readiness of public TVET institutions to function effectively in the context of IR 4.0, as depicted in Figure 3. Drawing upon the aforementioned findings, it was determined that public TVET institutions in South Africa have initiated efforts towards readiness for IR 4.0; however, they have not yet achieved full preparedness.

7. E-Learning Readiness (Chapnick, 2000)

Chapnick (2000) proposed the E-learning Readiness Model, which evaluates the preparedness of individuals to adopt e-learning in an institution or organisation. According to Chapnick, there exist multiple factors that necessitate consideration in order to evaluate preparedness. The author presents a comprehensive list of 66 factors, organised into 8 distinct categories (as depicted in Figure 4). Chapnick's approach diverges from previous research in that he presents a range of options for each query and requires managers to choose a single response that best reflects the circumstances of their organisations. According to Aydin and Tasci (2005), the model facilitates an evaluation of an organisation's readiness for e-learning while also identifying areas that

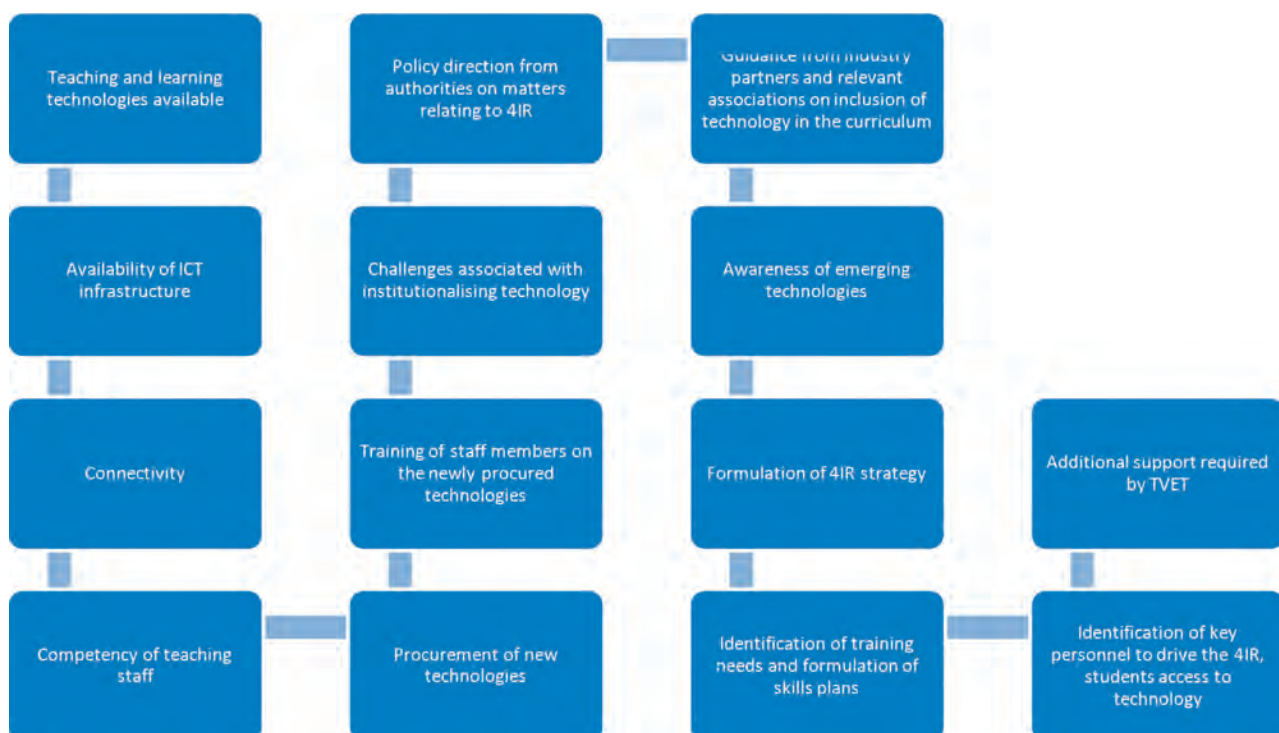


Figure 3. Indicators of IR 4.0 Readiness for Public TVET Colleges.

Source: Denhere and Moloi (2021).

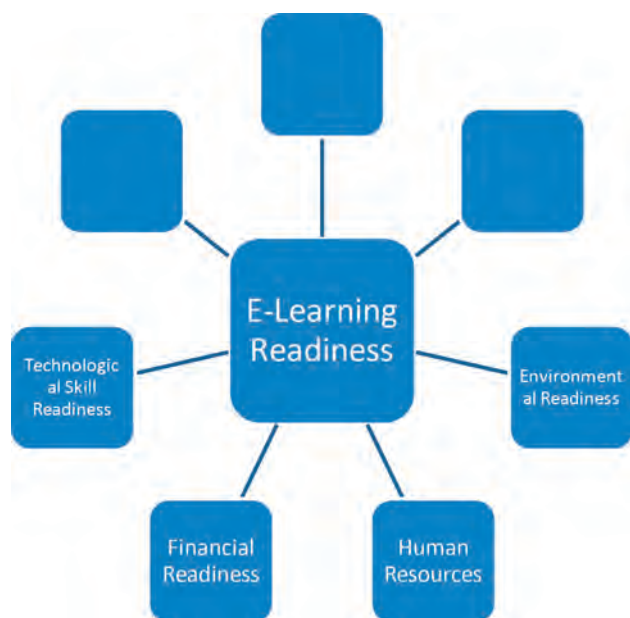


Figure 4. Components of E-Learning Readiness.

Source: Chapnick (2000).

require improvement and those that have been successful.

Methods

Approaches for constructing the framework:

1. The process of conducting desk reviews involves the identification, selection and analysis of pertinent frameworks that assess the readiness of industries and educational institutions. As previously stated and analysed in the preceding section, various extant frameworks pertaining to the IR 4.0 were evaluated; these encompass scholarly articles and professional publications.
2. Training and workshops were conducted with researchers from nine ASEAN countries and partners to create a framework and tools that are appropriate for evaluating the preparedness of TVET institutions for the IR 4.0. This research

project involves the participation of 24 researchers from various SEAMEO sister centres, universities, governmental agencies and entities. Two workshops were convened to discuss and develop a framework and assessment tool to measure the preparedness of TVET institutions for IR 4.0. The first workshop was conducted in a virtual format on 21–22 September 2022, with a focus on deliberations pertaining to the framework. The second workshop was held at SEAMEO VOTTECH from 8–10 November 2022. The subsequent workshop involves the completion of the research framework and the creation of an assessment tool for the survey questionnaire, as well as the formulation of questions for the focus group discussion (FDG).

3. Following the workshops, the framework and assessment tool were pilot tested in nine ASEAN countries by the corresponding researchers. The pilot study yielded 50 responses, and analysis indicates a high level of reliability in the measurements utilised. The feedback and suggestions offered by the researchers and participants from the country provide opportunities for enhancing the framework and assessment tool.
4. Before commencing data collection, the enhanced iteration of the survey was disseminated to industry experts for their final review. The Smart Education Readiness Index (SERI) framework and assessment matrix were finalised by taking into consideration the feedback received from industry experts.

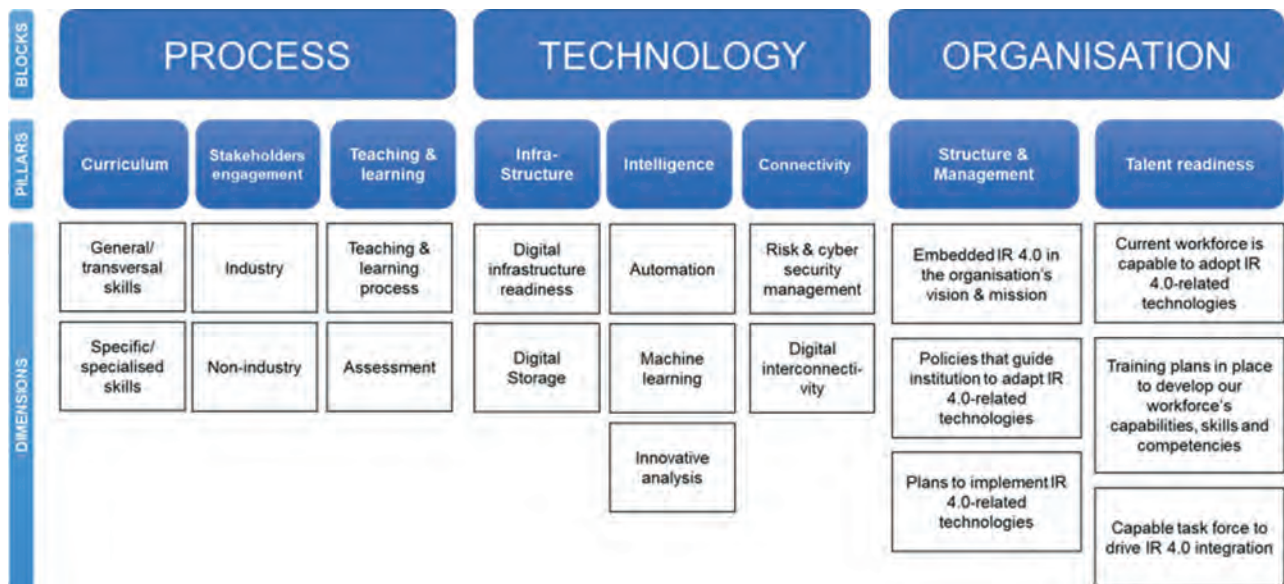


Figure 5. SERI Framework Developed by SEAMEO VOCTECH's Research Team.

Source: SEAMEO VOCTECH.

Following a comprehensive review of the relevant frameworks, extensive deliberation among the research team and consideration of feedback from partners, a framework has been established for evaluating the preparedness of TVET institutions for IR 4.0. The SERI framework is derived from the SIRI framework (SEDB, 2020). The SIRI framework has been designed to evaluate the preparedness of the industry, whereas the SERI framework has been adapted to suit the educational context, thereby enabling its application in assessing the readiness of diverse educational institutions.

Figure 5 illustrates the SERI Framework, comprising three blocks, eight pillars, and nineteen dimensions.

SERI framework consists of three building blocks: process, technology and organisation. Under these blocks, there are eight pillars contributing to the development of the TVET system in alignment with industrial

requirements. The pillars under *Process* are curriculum, stakeholder engagement and teaching and learning; the pillars under *Technology* are infrastructure, intelligence and connectivity and the pillars under *Organisation* are structure, management and talent readiness. Under each pillar, there are several dimensions that will be assessed using an assessment matrix developed by the research team from SEAMEO VOCTECH. Overall, there are 19 dimensions, as depicted in the SERI framework. Each of these dimensions is defined and described according to the level of adoption, ranging from the lowest level of adoption (band 0) to the highest level (band 4).

There are two assessment tools: a survey and an FGD. The survey will act as the main tool, while the FGD will be complementary to the survey. The survey consists of four sections: personal information, *Process*-related questions, *Technology*-related questions and *Organisation*-related questions. Institutions will be using the

Table 1. Assessment Matrix for Dimension *Transversal Skills*

BAND		DEFINITION	DESCRIPTION
0	Conventional	Use existing curriculum	Curriculum content without IR 4.0
1	Early adopter	Early stage adopting IR 4.0 curriculum	Curriculum content has a few components of IR 4.0
2	Learner	Moderate usage with IR 4.0 curriculum	Curriculum content adopts basic components of IR 4.0
3	Experienced	Almost every time expose/ use IR 4.0 curriculum	Curriculum content incorporates a majority of components of IR 4.0 in the context related to the area of specialisation
4	Exemplary	Transformative use of IR 4.0 curriculum	Curriculum content incorporates all components of IR 4.0 in the context related to the area of specialisation and the Referral Centre of IR 4.0 curriculum

Note: Block: Process; Pillar: Curriculum; Dimension: Transversal Skills.

Transversal skills are those typically considered as not specifically related to a particular job, task, academic discipline or area of knowledge but as skills that can be used in a wide variety of situations and work settings (IBE, 2013).

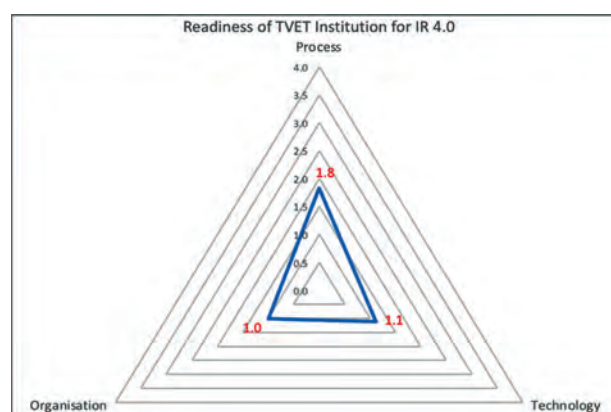
Source: Authors.

Table 2. Item Questions for Process–Curriculum–Transversal Skills. The Authors’ Institution Has Embedded the Following Transversal Skills in the IR 4.0 Curriculum

	CONVENTIONAL	EARLY ADOPTER	LEARNER	EXPERIENCED	EXEMPLARY
Complex problem solving	○	○	○	○	○
Social skills	○	○	○	○	○
Process skills	○	○	○	○	○
Cognitive abilities	○	○	○	○	○
People management	○	○	○	○	○
Content skills	○	○	○	○	○
Digital skills	○	○	○	○	○
Entrepreneurial skills	○	○	○	○	○

Source: Authors.

assessment matrix provided for each dimension as guidance to answer the questions. Sample of the assessment matrix for dimension *Transversal skills* can be seen in Table 1. Included in the assessment matrix are item questions that provide more detailed information that will help the respondents to complete the survey; see Table 2 as an example of an item question for Table 1. Meanwhile, the FGD in this research project is complementary to the survey, to supplement and provide alternative viewpoints from industry players and representatives of TVET institutions.

**Figure 6.** The Current Readiness of a TVET Institution for IR 4.0 in the Three Building Blocks.

Source: Authors.

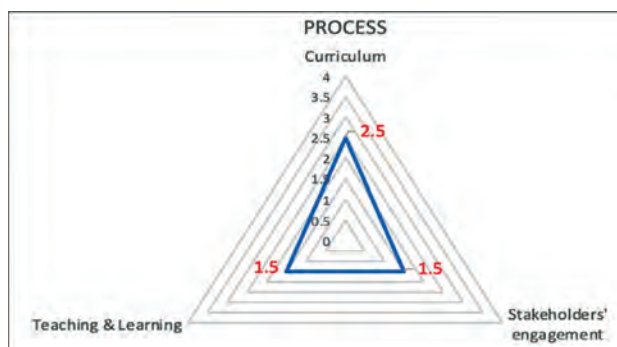


Figure 7. The Current Readiness of a TVET Institution for IR 4.0 in the Process Building Block.

Source: Authors.

Similarly, the rest of the dimensions under the building blocks of process, technology and organisation will have an assessment matrix like the ones presented in Tables 1 and 2. To complete the survey, it is recommended that an institution create a team or task force so that the responses will be accurate and comprehensive, as well as create awareness and understanding about the status or condition of the institution's readiness for IR 4.0. Once the survey is completed, the respondents can generate outputs in tables or charts to make the findings easy to understand and come up with an action plan. Just for illustration, the findings can be presented in web diagrams as follows:

Figure 6 shows that the institution has a low-level adoption of IR 4.0 in *Technology* and *Organisation* and a medium-low level in *Process*. To examine more details of each building block, the respondents can generate web diagram as illustrated in Figure 7.

Figure 7 illustrates the readiness of a TVET institution for IR 4.0 in the process building block covering curriculum, stakeholders' engagement and teaching and learning. The score represents

the readiness level from the lowest 0 to the highest 4. Please see the band description for interpretation.

Conclusions and Recommendations

Based on literature reviews, workshops with the researchers from nine SEAMEO member countries and the piloting of the questionnaire, we conclude that:

1. There is a need to develop a theoretical or conceptual framework that can be used as the basis for assessing the readiness of TVET institutions for IR 4.0. There are frameworks for assessing the readiness of industry for IR 4.0, but none for assessing TVET, not even for education institutions in general.
2. The conceptual framework developed here was inspired by the existing conceptual frameworks for assessing industry readiness, particularly SIRI by SEDB (2020). We name it the SERI framework, which covers 3 building blocks: process, technology and organisation; 8 pillars and 19 dimensions. The team of SEAMEO VOTTECH's researchers agreed that it is a useful tool to assess the current status of TVET institutions' readiness for IR 4.0.
3. The SERI framework is accompanied by the assessment matrix to guide the respondents from TVET institutions in assessing their institution's readiness for IR 4.0, referring to the definition and description of each dimension and the band or scale of its readiness.

To optimally use the SERI framework, we recommend the followings:

1. TVET institutions or higher education institutions are recommended to participate in this study so that they can assess their readiness for IR 4.0 and develop a roadmap for furthering IR 4.0 adoption. To participate in the study, we advise the institutions to create a team or task force so that they can complete the survey accurately and comprehensively.
2. The FGD may be used to complement the survey to offer different perspectives from industry players and TVET institutions' representatives.
3. Any TVET institution may treat the survey as a self-assessment that can be administered continually, every year or every other year, and the findings can be used as input for developing a roadmap that reflects a journey towards IR 4.0. The existing condition reflected in the survey is a starting point to move to the next level by referring to the definition and description of each dimension.
4. An action/improvement plan based on the roadmap should be developed, including the timeline (6 months and/or 1 year) and specific activities to improve the status to the next levels.
5. To the related ministries and TVET directorate at the national level, it is recommended that they encourage educational institutions under their jurisdiction to assess their readiness for IR 4.0 using this framework periodically. This process can be integrated as part of the accreditation process or monitoring and evaluation.

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Leave No One Behind: The Solution to an Inclusive Future

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ABSTRACT

As educational technologies excel towards achieving a better and more advanced future, it should be on the pillar of 'leave no one behind', a transformative promise sealed in the 2030 Agenda of Sustainable Development Goals. The 40th UNESCO General Assembly in its 2019 UNESCO Recommendation on Open Educational Resources (OER) called upon member states to 'encourage inclusive and equitable quality OER' in one of its mandates. Additionally, it includes leveraging open educational practices to make educational content more freely available, allowing for greater access to educational materials and resources. Inclusive open educational resources (iOER) has recently been an important discussed topic among stakeholders, especially with the implementation of a national-level policy statement by Malaysia on the development and use of iOER for its higher learning institutions nationwide (Ministry of Higher Education Malaysia.,2020). iOER is a form of educational resource that is designed to be accessible and usable for learners with disabilities, regardless of their specific needs or abilities. This type of environment can include materials and resources that are in accessible formats, such as Braille or audio, and also include features that make the resources easier to use and navigate, such as adjustable font sizes and contrast levels. There are many misconceptions and barriers to the adoption of iOER, and many are from within the community of OER advocates themselves. iOER, including a lack of awareness of the existence and availability of iOER, a lack of understanding of the value of iOER, a lack of technical skills and knowledge needed to find and use iOER and a lack of support from educational and policy makers. Additionally, issues of cost, copyright and quality can also be barriers to the adoption of iOER. Hence, iOER-enabled environments are designed to be flexible and adaptive, allowing learners to adjust their educational



experience as needed and sharing content in various formats and across multiple platforms. Through structured implementation approaches and strong support from stakeholders, this iOER initiative can be successfully implemented. SEAMEO SEN, being the regional centre for disability-inclusive education, expresses its commitment to be a referral centre for iOER among its eleven (11) SEAMEO Member Countries and beyond.

Keywords: iOER, educational technology, learners with disabilities, disability-inclusive education, OER

Introduction

In today's rapidly advancing digital age, ensuring the inclusivity and accessibility of education is a pressing issue. 'Leave No One Behind: The Solution to an Inclusive Future' embodies the importance of creating equal opportunities for all learners, regardless of their individual needs or challenges.

To achieve an inclusive future, we must address barriers such as connectivity, parental involvement, motivation and assessments, with a particular focus on the unique obstacles faced by students with disabilities. By examining the various strategies, resources and tools available to create an inclusive learning environment, there are several potential benefits of embracing OER for fostering equitable access to education. However, there are general barriers to adopting technology in education and exploring the specific challenges faced by students with disabilities before presenting potential solutions centred around OERs.

Therefore, it is important to ensure that education in the digital age is inclusive and accessible. Connectivity, parental involvement, reduced motivation and assessments are common barriers to the adoption of technology in education, but students with disabilities also have their own barriers.

Traditionally, learners with hearing impairments using sign language have relied heavily on teachers to provide context through examples. On the other hand, visually impaired learners, especially those who are born blind, need support to access learning materials (Agesa, L. 2014). They rely on braille materials that are not always available at home, especially for young learners who are new to assistive devices, such as screen-reading software. Learners with behavioural and cognitive problems often have short attention spans during learning and require a variety of instructional styles and approaches to capture their attention.

Thus, when adopting technology for learners with disabilities, we must consider the types of accessibility issues they face. To ensure equitable and inclusive quality education, educational content must be made more freely available, and access to teaching materials and resources must be improved.

Open Educational Resources

Teaching, learning and research materials in any format, including digital ones, that are in the public domain or have been published under an open licence that allows unrestricted use, adaptation and redistribution by others are referred to as OER (Atkins et al., 2007). The

public may access, use, repurpose, adapt and redistribute educational resources under an open licence that respects the copyright owner's intellectual property rights (Creative Commons., 2020).

OER can include full courses, course materials, modules, student guides, teaching notes, textbooks, research articles, videos, assessment tools and instruments, interactive materials such as simulations and role-plays, databases, software, apps and any other educationally useful materials. The term 'OER' is not synonymous with online learning, eLearning or mobile learning. Many OERs, while shareable in digital format, are also printable. An open license is a standardised way to grant permission and state restrictions for accessing, using, repurposing, reusing or redistributing creative work (UNESCO & Commonwealth of Learning, 2015).

Inclusive Open Educational Resources

Inclusive open educational resources (iOER) have recently attracted significant attention from stakeholders. An educational resource known as an iOER is made usable and accessible to everyone, including students with disabilities, regardless of their particular requirements or abilities.

iOER can include content and resources in braille or other accessible formats, as well as functions that make them simpler to use and explore. iOER supports the four OER Compliant Creative Commons licenses (CC BY, CC BY SA, CC BY NC, CC BY NC SA) and/or dedicating the work to be public domain (CC0) on all iOER it owns or co-owns (Ministry of Higher Education Malaysia., 2020)

It is helpful to consider web accessibility principles while creating platforms, tools and gadgets. An inclusive and accessible design may benefit from the principles of POUR. Perceivable, operable, understandable and robust are abbreviated as POUR (Government Digital Service., 2017). These guidelines have the fundamental aim of increasing content accessibility.

To ensure that learners could understand the information provided by sight, hearing or touch, the first principle, perceivable, was established. Designing strategies, for instance, so that visually challenged people can access visual content such as photos and charts. To increase accessibility, digital text can be transformed into various sensory modalities, such as braille and text-to-speech. The second principle, operable, attempts to create a variety of input devices, including a mouse or touchpad, keyboard, touchscreen and voice recognition software, capable of using input methods for online content functioning. The third principle, intelligible, focuses on providing information in a manner that is consistent and clear so that everyone can grasp it. It is crucial to support users by filling out forms, preventing mistakes and enabling their correction. The fourth principle, robustness, focuses on ensuring that content is compatible with all user agents, browsers and assistive technologies.

These principles are relevant to web access but are more broadly applicable to the development of both web-based and non-web-based OER. This principle helps instill a sound, holistic mindset when it comes to developing accessible content. Many OER accessibility checklists and guidelines have been developed primarily for practitioners

from academia, many of which are available online include the configuration of content, images, links, tables, multimedia, formulas and font sizes (Coolidge et al., 2018). Many of these areas are problematic for people with sensory or learning disabilities who rely on screen readers or assistive technologies to access OER content. Web accessibility assessment tools can be used to check the accessibility of web content by identifying the elements required to improve accessibility.

Conclusion

The potential to create an inclusive and fair environment for all through the widespread application of OER is limitless. Ultimately, it may be possible to design wholly individualised learning experiences that are accessible to students with disabilities throughout the world. The first step in this process is putting into action a multi-faceted, coordinated strategy that will enable OER and its principles of accessibility for web access.

We hope that educators around the world will consider embracing OER as a way to pave their paths to an inclusive future. In doing so, we will leave no one behind and move into the digital future with confidence and assurance that everyone is being included equally in the classroom environment.

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Does the SEA-Teacher Project Bring New Insights into Education in Japan?: Lessons Learned from ASEAN's Experience for Japan

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ABSTRACT

This article summarises the significance and challenges of implementing the SEA-Teacher Project in Japan from the perspective of the Japanese high schools that have hosted the pilot project. The Senior High School at Sakado, University of Tsukuba (UTSS), one of the laboratory schools of the University of Tsukuba(UT), has accepted the SEA-teacher pilot project on two occasions. In the first batch pilot project, the pre-service student teachers were accommodated in English, science and social studies classes, and in the second batch pilot project, the pre-service student teachers were accepted in mathematics, physical education and agricultural science classes. Practical training in the local community was conducted in the agricultural studies class, during which opportunities for integrating local learning and global education were identified. Although the SEA-Teacher Project is designed for pre-service student teachers, it has also proved to be a great learning experience for the host high school students and teachers in Japan. Japan's participation in the SEA-teacher project will be beneficial not only for teaching practice in Japan but also for ESD and global education in high schools. Currently, only the UT and its affiliated Sakado High School are participating, but more Japanese universities, as well as primary and secondary schools, are expected to join in the future.

Keywords: SEA-teacher, high school, global education, ESD, teaching practice

Introduction

With the acceleration of globalisation, an increasing number of Japanese high schools have begun to engage in global education and Education for Sustainable Development(ESD).

Japan's Ministry of Education, Culture, Sports, Science and Technology (MEXT) is promoting the development of global education and ESD in high schools through national projects such as



the Super Global High School Project (SGH) and the World Wide Learning (WWL) Consortium. (University of Tsukuba Education Bureau of the Laboratory Schools, 2023a, 2023b).

However, not all current teachers have extensive experience in global education and ESD practices, and they might struggle to cope with students from more diverse backgrounds as well as function in highly globalised classrooms. Teacher training programmes at Japanese universities focus on teaching academic subjects, and there are few opportunities for teachers to receive training in global education and ESD prior to them working in the school setting. There is an urgent need to train teachers who can effectively engage in global education and ESD, and to update training content for current teachers.

UTSS has been designated as a SGH, and WWL by MEXT and has been implementing collaborative projects with high schools, especially in Association of South East Asian Nations(ASEAN) countries (Tatemoto, 2020). In this context, UTSS was approached by the University of Tsukuba to be the host school for the SEA-teacher pilot project. After internal discussions, the school decided to accept the SEA-teacher pilot project, seeing it as a valuable opportunity for Japanese high school students to directly interact with university students from ASEAN countries, and for the high school to expand its global education and ESD. After the first acceptance in February 2020, the SEA-teacher pilot project was suspended for three years due to COVID-19, but it resumed in February 2023 with the second acceptance.

This report will first provide a detailed overview of the two pilot projects. This will be followed by a summary of the international network meeting between UTSS and high school teachers from ASEAN countries that was held during the implementation the second batch of the pilot project in Japan. Then, based on the results of the two pilot projects and meetings, a discussion of the advantages of continuing the SEA-teacher pilot project in Japan, as well as the challenges that can be anticipated during the implementation of the project. Finally, recommendations for the effective implementation of SEA-teacher in Japan are summarised.

Overview of SEA-Teacher Pilot Project Acceptance

On both occasions, the university students lived together in a dormitory in the school campus. The dormitory had a kitchen that the students could use, and they cooked their own meals.

In the first batch, the students were accepted in the chemistry, biology, civics and English departments and special classes on ESD and Sustainable Development Goals(SDGs) were held in the agriculture and home economics classes. In the second batch, there was a request from the Philippines for a subject on arts and culture. However, UTSS did not have a full-time teacher on arts and culture, and thus could not provide constant guidance. Therefore, following discussions, it was decided to accept the students in a class of the agriculture department, as the teachers of the agriculture department were

Table 1. Outline of SEA-Teacher Pilot Project at UTSS.

Period	First Batch	Second Batch
	6 February to 27 February 2020	6 February to 6 March 2023
Number of students	6 (Indonesia 2, Thailand 2, The Philippines 2)	9 (Indonesia 3, Thailand 3, The Philippines 3)
Accepted subjects	Biology, Chemistry, English and Social Studies	Agriculture, Chemistry, English, Mathematics, Physical Education and Social Studies

Note: Prepared by the author from records at UTSS



(a) Practice at Local Agricultural Festival



(b) Lampshade in a Plum Grove Photographs by the author.

Figure 1. Second Batch of Pre-Service Students at the Local Festival.

able to provide guidance on local culture and art (Table 1).

In this class, lessons were held in collaboration with local farmers, and a local festival was also held during the training period, where university students from ASEAN were also invited to participate in this festival. At the festival, high school students made decorative lampshades using bamboo (Figure 1). In the school lessons, university students from the Philippines received lessons about the bamboo plant, which is a common natural resource between Japan and the Philippines. The lessons provided opportunities to share the various cultural and artistic topics, and the uses related to bamboo in the Philippines. Although this was not a purely

artistic and cultural class exercise, it is believed to have led to a valuable opportunity for the university students to understand different cultures in Japan and their own country.

At the local festival, the interaction with locals was an occasion to share and exchange meaningful ideas, and the possibility of developing new classes that combine global education and local exchange was also identified.

Organisation of Meetings of High School Teachers from Seven Schools in Four Countries

With the support of MEXT and the Asia-Pacific Cultural Centre for UNESCO (APCCU), an international networking meeting for ASEAN-

Table 2. List of Participating Countries and Participating Schools.

Country	School Name	UIS	S-T H
Indonesia	SMA Kornita IPB	●	
	UPI Laboratory Senior High School		●
Thailand	Kasetsart University Laboratory School	●	
	Khon Kaen University demonstration School		●
The Philippines	University of the Philippines Rural High School	●	
	Central Luzon State University Science High School		●

Note: UIS, UTSS international partner schools; S-T H, SEA-teacher host school.



(a) Meetings for International Networking



(b) Classroom Observation Photographs by the author.

Figure 2. High School Teachers' Meeting and Workshop.

Japan high school teachers from the four countries was held simultaneously in Japan in February 2023, while the SEA-teacher pilot project was ongoing (Figure 2). High school teachers from each country observed the actual implementation of the SEA-teacher pilot project in Japan. The participating schools are shown in Table 2.

The three schools that have an international partnership agreement with UTSS did not participate in the SEA-teacher programme, but they shared their evaluation and expressed high expectations about the value of SEA-teacher and

its effect on global education. In addition, three schools that have already implemented SEA-teacher expressed their desire to participate in the network between UTSS and schools in Indonesia, Thailand and the Philippines (Table 3). In this way, we can expect to see an increase in the number of substantial direct exchanges between schools across national borders in the future. Global education that shares each country's educational resources and integrates on-site and online education will be promoted in ASEAN countries and Japan in the near future.

Table 3. Comments from Participating Teachers from Four Countries.

Country	Comments
Indonesia	T1: 'This partnership program is an excellent program that can be a model for other schools. We learn from each other. The activities of the program improve and inspire us. And also motivate us to do continuous improvements that benefit students and the education in general. In the future, some teachers expect that they can have joint classes with other schools of different countries, especially in the subject of English, Japanese or Indonesian language. I am quite sure that these joint classes will give great impacts not only to students but also to the school.'
	T2: 'We do really appreciate this program and opportunity to be invited in this honored country. Our school is glad to be part of the SEA Teacher program receiving pre-service student teacher in our school. Therefore, we also look forward to working and collaborating more and longer in this program. Hence, we also expect that our school could be a sister school of Sakado Senior High School, UTSS in the near future.'
Thailand	T1: 'It's a good program that provides opportunities for teachers from ASEAN countries and Japan to exchange knowledge with each other. Developing relationships and collaboration on student exchange. We hope that this relationship will expand further to ensure sustainability.'
	T2: 'We are proud to have the opportunity to participate and be a part of the school partnership program with UTSS that shows ideas and shares discussion with other schools in many countries. In the future, KKU would like to be a part of the project to develop the student teacher training and research together.'
The Philippines	T1: 'It is very wonderful to see the growth of the international exchange programs initiated by UTSS with its partner schools. With more partners this year, we are excited to see where it leads us in the future. In particular, we are excited to partake in the SEA Teachers program. We also like to empower our teachers through this program to cultivate a global mindset.'
	T2: 'The partnership program with partner schools is really inspiring and makes us want to experience and forge something the same so we could also be on the "race" of the global trend. The partnership does not only strengthen the bonds between institutions but also, they develop certain learnings/strategies they can use in the future.'
Japan	'In my class, "Muslim student-teacher from Indonesia teaches Islam by using English as a foreign language for the Non-Muslim Japanese students". This situation provided a valuable opportunity for Japanese high school students to live in a globalized society. We would like to continue to ensure such opportunities by accepting SEA-teacher students every year.'
	'This time, I assisted students living in the school's dormitory. I was very moved by the sight of students from different countries supporting each other and living together in harmony. I was very moved by this scene, and I am grateful to have been involved with SEA-teacher. I wish I had joined SEA-teacher when I was a university student.'

Note: T1, teachers from UTSS sister school; T2, teachers from SEA-teacher hosting school. Prepared by the author from a survey of participating teachers.

Significance and Future Challenges for Japanese High Schools to Participate in SEA-Teacher

Based on the experience of facilitating two pilot projects, the effects of Japan's participation in SEA-teacher will be examined from the perspective of the high schools that accepted the Pre-service student teachers. In particular, the

impact on high school students, the impact on teachers and the effect on regional cooperation, which is currently an issue for Japanese high schools, will be discussed.

1. Impacts on High School Students

University students from ASEAN were invited to participate in homeroom activities as well as in the classroom

for about one month, which helped the high school students gain a better understanding of the different cultures and, in turn, develop open-mindedness. In terms of English language learning, the students were able to take classes in English from university students who were close in age to the high school students. Moreover, the content and language integrated learning (CLIL)-like method of learning about global issues and cross-cultural content in English helped to motivate the high school students to learn English. Furthermore, the possibility of motivating high school students to travel and study abroad was also observed, as some high school students expressed a desire to travel to the country of origin of the university students.

2. Impacts on High School Teachers

Due to day-to-day work and budgetary problems, not all teachers are able to receive training abroad or training on global education, and hosting ASEAN students in schools is a training opportunity for in-service teachers. Simply coming into contact with ASEAN university students who support each other across borders and work hard during their practical training in Japan can be a great stimulus for teachers in Japan.

3. Impacts on Regional Cooperation

In Japan, the creation of schools that are open and connected to the local community is currently being promoted. The number of foreigners living in Japan is increasing, and it is necessary to form new communities with foreigners in the region

and create sustainable local communities. The participants in the second batch were able to attend a festival, which is part of the requirements in an agriculture class. On that occasion, the local people welcomed the participation of ASEAN students. In this way, we saw the potential for many people to deepen exchanges and mutual understanding, with the high school as a starting point.

As mentioned earlier, the programme has a lot of significance for Japan, but there are some issues that need to be resolved in order to continue the programme. Several reports on SEA-teachers have pointed out issues related to English, cross-cultural understanding and religion (Chrisie & Ariyanti, 2020; Ima & Kewwalee, 2019; Lalu et al., 2020; Sherly & Fitri, 2020; Venna & Achmad, 2021). The timing and preparation of the programme may also need to be considered. These two points are discussed further.

a. Reduced Psychological Barriers to English and Other Cultures

This is a particular problem for high school teachers. In Japanese high schools, there are many cases where the teachers themselves are not very confident in their English abilities and may not be comfortable in cross-cultural exchanges. This time, an agriculture teacher with no experience of teaching in English was able to teach ASEAN university students through collaboration with an English teacher and the use of an English translator. During the SEA-teacher pilot programme, this agriculture teacher

showed a more positive change in their attempts to communicate in English compared to before. This fact may serve as a good example for other schools in Japan when they host SEA-teachers.

b. Consideration of Timing of Acceptance and Prior Guidance

The month of February, when SEA-teacher is currently taking place, often coincides with the end of the school year and high school entrance exams in Japan. Also, in August, Japan is on summer holiday and cannot accommodate the programme. Other times of the year should be considered to ensure sufficient practical training time. If the participants are identified early enough, this will allow time for pre-orientation prior to their arrival in Japan. For the second batch of participants, an orientation on life in Japan was conducted via ZOOM. This helped to deepen mutual understanding and help in the preparation of the pre-service teachers. Next time, it would be a good idea to also conduct pre-orientation for each subject in advance, using ZOOM and other methods.

Suggestions for Promoting SEA-Teacher Project in Japan

In order to encourage more schools in Japan to participate in SEA-teacher programme in the future, we would like to propose three recommendations based on our two experiences of hosting SEA-teachers.

1. University-Affiliated Schools Act as Hubs to Promote SEA-Teacher Participation in Japan

A comparison of the content of instruction in SEA-teachers with Japanese teaching practice showed no significant differences in terms of instructional content. It was also found that the current teaching practice system in Japan is a sufficient base for implementing SEA-teacher in Japan. The process of creating a lesson plan, delivering the lesson in class, receiving feedback and reflecting was almost the same in each country. Most Japanese high schools do not have international networks with universities abroad. Therefore, it is expected that university-affiliated schools in each country will establish an international network and play the role of a hub, connecting universities and high schools across countries.

2. Hosting SEA-Teacher Students During the Regular Teaching Practice Period in Japan

Currently, the SEA-teacher programme is mainly implemented in January, February, August and September. In Japan, this mainly takes place in May, June or September. If the timing of the teaching practice can be set at the same time, both Japanese and ASEAN university students can undertake teaching practice at the same time. Not all students are able to undertake teaching practice abroad. Not all students are able to participate in teaching practice abroad so being able to undertake teaching practice in their own country with university students from abroad can be a valuable opportunity.

3. Conducting Evidence-Based Project Evaluations

Using the SEA-teacher programme as a model, the implementation of international teaching practice in Japan, with flexible policy development (system design and credit recognition) and financial support, could lead to the development of teachers who can also respond to the globalisation of Japanese society and help create a sustainable society. Medium- to long-term research is needed on (a) the impact of the SEA-teacher project on teachers and students at the high schools that hosted the training, (b) how students who joined the SEA-teacher project are actually making use of their experience in pre-service training in their professional teaching and (c) whether the international network gained through participation in the SEA-teachers is being maintained.

Conclusion

As a result of accepting two pilot projects, it can be concluded that although there are some issues regarding the timing of acceptance and prior guidance, the participation in the SEA-teacher programme has a variety of positive impacts to Japanese schools. The university students from ASEAN were generally enthusiastic about the practical training, and, in particular, the way they supported each other across national borders gave many suggestions to the students and teachers of the schools that hosted them. In the future, we would like to share the results of the two pilot projects with other Japanese schools and encourage them to participate in SEA-teachers in Japan. We would also like to conduct a follow-up survey of the students who participated in the pilot project in

Japan and study the effects of the project over the medium- to long term.

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Unplugged Computational Thinking with Colouring Books

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ABSTRACT

Large language models (LLMs) such as ChatGPT and Bard are generating a huge impact on the nature of work and education. LLMs are efficiently writing text and computer code. It is then necessary to focus education on the skills needed in this new scenario. One such key skill is computational thinking. It contains algorithmic thinking, computational modelling and machine learning. For elementary school students, we propose the Unplugged Computational Thinking Using Colouring books (UCTUC) strategy. UCTUC teaches three core skills. First, students learn to colour images following pseudocode instructions specified with first-order propositional logic, existential and universal quantifiers, recursion and probabilities. Second, students learn to write pseudocode instructions for colouring making sure their classmates understand the pseudocode. Third, they learn metacognitive skills to produce written argumentations explaining their pseudocode. Moreover, they also develop values, attitudes and habits such as beauty and simplicity of arguments, develop explanations and a genuine appreciation for the ideas of others. Based on preliminary experience using UCTUC with first to fourth graders, we sketch an implementation plan. Start producing localised mini videos showing students in classrooms using colouring books. Next, create guidelines for teachers and parents. Then, build a lesson study community to develop and scale the UCTUC strategy.

A first AI tsunami has Arrived

Critical predictions for the next 20 years include climate change, new pandemics and growing inequality. However, artificial intelligence (AI) is already having an even greater impact (Araya, 2021e; Araya, 2023a; Bostrom, 2014; MacAskill, 2022; Hinton, 2023). In November 2022, the

ChatGPT tsunami arrived. We are now in the middle of turbulent waters of a great cultural transformation provoked by AI.

A major challenge is how to navigate our way to such a smart society. Intelligent systems are rapidly starting to do intelligent tasks typical of



highly educated workers (Bubeck et al., 2023; Eloundou et al., 2023). For example, ChatGPT is already giving better and more empathetic medical diagnoses than doctors (Ayers et al., 2023). Another LLM, CancerGPT, is giving advice in drug combination therapy for cancer in rare conditions. In many cases, CancerGPT provides a combination of drugs that have better treatment outcomes than single-drug therapy.

Thus, we urgently need to understand the irruptive AI phenomenon, look for the opportunities it can offer us, and teach to think and learn with these new AI tools

Why Computational Thinking?

We are experiencing the explosive irruption of AI, and in particular, natural language processing (NLP) tools such as large language models (LLMs). These are apps like ChatGPT, GPT-4, You, Llama, Bard, etc. They are starting to generate a huge impact on the nature of work and education. With them, we can delegate to the AI the cognitive tasks of system 1. These are the fast and less conscious processes according to the dual cognitive process classification proposed by the Nobel prize Daniel Kahneman (Kahneman, 2011; Stanovich, 2016). Not only are these innate tasks. They include tasks that after training and practice, we do automatically without much conscious effort. For example, tasks like transcribing speech to text, detecting visual or audio patterns, writing paragraphs, summarising, translating between languages, translating ideas into images and translating ideas into computer code.

Computational models are at the base of these transformations. Therefore, the particular

mode of thinking of computational thinking (CT) is key. However, in addition to system 1 type of fast processing, there are more cognitively demanding tasks. These require slower and deeper system 2 processing skills. For example, CT skills with deeper connection to mathematical thinking. This means designing algorithms, devising computational models, and learning and discovering with machine learning methods (Isoda et al., 2021; Araya et al., 2020).

Even though CT is a radically different way to think about the world and solve problems, in the end, it is a form of mathematical thinking (Isoda et al., 2012; Araya et al., 2020; Inprasitha et al., 2023). This means that mathematics educators are primarily responsible for leading the required educational transformation.

On previous research, we proposed Figure 1 as for curriculum framework by APEC InMside Project (Araya & Isoda, 2021). In this proposal, the computational modelling is one of the three pillars of the curriculum. It is key for the development for CT.

Why Unplugged Computational Thinking?

One of the most affected professions by AI is that of the computer programmer. LLMs are already writing code. They can do it in any programming language. Moreover, they are programming with increasing efficiency (Eloundou et al., 2023; Naughton, 2023). LLMs are starting to do in seconds what it takes legions of human programmers to do in hours or days. This is a phenomenon similar to the use of computers in arithmetic. The computer sums, multiplies, subtracts and divides much faster than humans do it, and does it without errors.

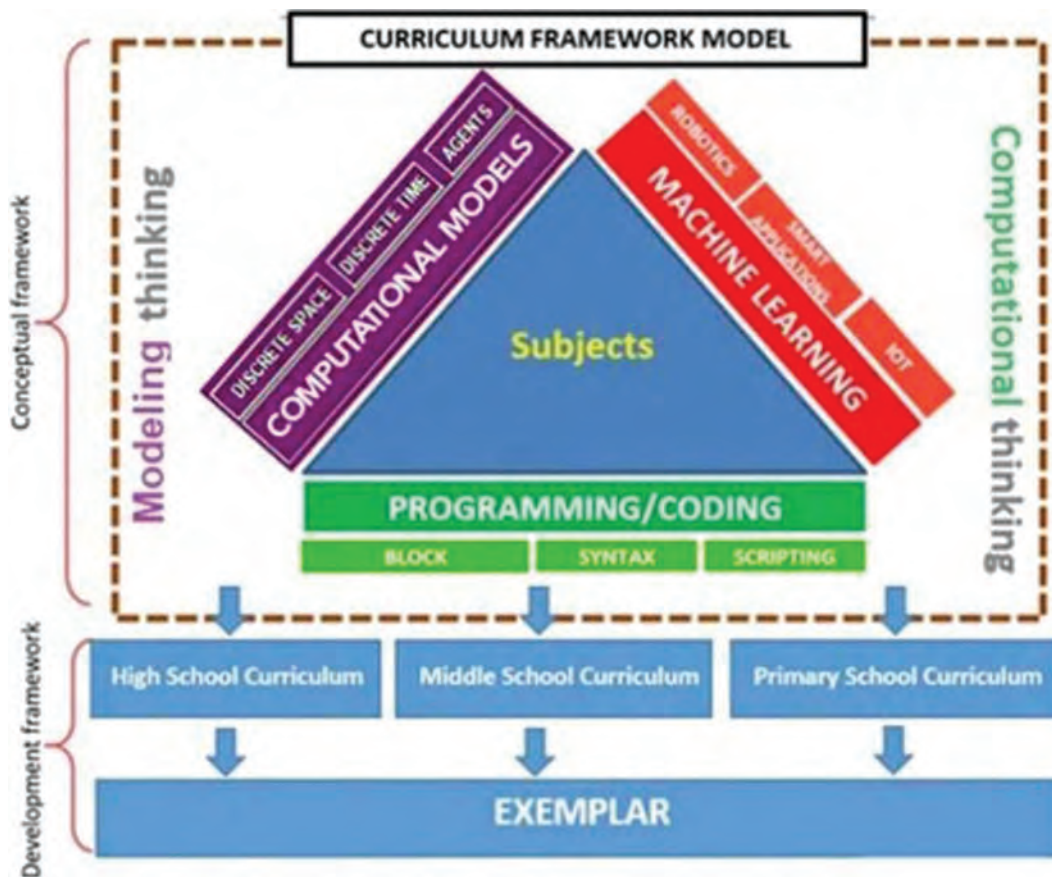


Figure 1. Curriculum framework for computational thinking

Similarly, the computer now programs much faster and with fewer error codes. In addition, it documents, explains and tests the programs.

What we must concentrate on is teaching how to create efficient instructions. These should be instructions directly expressed in the natural language of humans. For example, the instruction “colour the hat red”, or “add the numbers from 1 to 10”. Computer scientists call these types of instructions pseudocodes. After learning to program and with enough practice, translating from pseudocode to code corresponds to a cognitive system 1 task. It is similar to the translation that a bilingual individual does from one language to another. After some training and practice, the individual does it automatically without consciously

thinking about it. LLMs also do it. Nevertheless, LLMs write code much more efficiently. LLMs, in less than a second, can translate altogether thousands of different pseudocodes in precise computer codes. For example, after the instruction: “write the code in BASIC for the sum from 1 to 10”, Bard response is:

```
DIM sum AS INTEGER
sum = 0
FOR i = 1 TO 10
sum = sum + i
NEXT i
PRINT sum
```

Moreover, it can be done in any programming language. If you ask Bard to write the code in Python instead, then Bard responds:

```
def sum_of_numbers(n):
    sum = 0
    for i in range(1, n + 1):
        sum += i
    return sum
```

```
print(sum_of_numbers(10))
```

Translation is similar to the work done by the compiler of a programming language such as C, Java, or Python. The compiler translates the instructions into machine language. No one programs in machine language anymore. The compiler does the translation job.

In addition, LLMs can review code, fix it, improve it, rewrite it, explain it and write comments according to the level specified by the user. For example, in the previous example, if you ask Bard to explain the code, it writes:

The first line defines a function called sum_of_numbers(). This function takes an integer as input and returns the sum of the numbers from 1 to that integer.

The next few lines define the body of the function. The first line initialises a variable called sum to 0. This variable will be used to store the sum of the numbers. The next line uses a for loop to iterate from 1 to the input integer. In each iteration, the value of i is added to sum. Finally, the value of sum is returned.

The last line calls the sum_of_numbers() function with the number 10 as input. The output of the function is then printed to the console.

Here is a more detailed explanation of the code:

The def keyword is used to define a function.

The sum_of_numbers() is the name of the function.

The () after the function name indicates that the function takes an input.

The i is the name of the variable that will be used to iterate over the numbers.

The range() function is used to create a sequence of numbers. In this case, the sequence will go from 1 to the input integer.

The += operator is used to add the value of i to the variable sum.

The return statement is used to return the value of the function.

The print() function is used to print the value of the function to the console.

I hope this explanation is helpful. Let me know if you have any other questions.

It is then necessary to focus education on what society really needs for the next 10–20 years. These are more cognitively demanding and innovative tasks that use system 2. These are non-autonomous and distinctively human processing performed by our algorithmic and reflective mind. These processes include the initiation of mental simulation, decoupling them from the current processing triggered by information received by our perception systems, argumentation considering different points of views, devising deep explanations, avoiding overconfidence and *myside* biases and a profound and meticulous evaluation of arguments. This means an actively open-minded

thinking (Stanovich et al., 2023). One example of these innovative and demanding thinking skills is CT. This means, designing and testing algorithms, designing computational modes and building machine-learning solutions to solve a problem are complex tasks. These thinking skills are different to the traditional thinking skills needed in the traditional agricultural and industrial societies. They are the core skills of the curriculum framework for CT (Figure 1), and the heart of writing and testing pseudocode. They require conscious work and effort. They are system 2 cognitive processes.

Several researchers and practitioners have been proposing unplugged CT as a strategy to start developing CT. For example, they are a central strategy in the initiatives of some Universities (University of Canterbury, University of Waikato; Queen Mary University of London). They have been used in primary school (Olmo-Muñoz, 2020; Tsortanidou et al., 2022), and in integration with science and STEM (Araya, 2023b; Peel et al., 2021). However, since LLMs can write code, we should concentrate on teaching to write pseudocode. This is exactly unplugged CT.

What Exactly is Pseudocode?

Pseudocode is a plain language description of the steps in an algorithm. It focuses only on the CT part of the code development. It is a general way of describing algorithms that avoids getting mired in the details of a specific language (Compeau, 2023).

Today, the work of professional programmers is changing radically (Castelvecchi, 2022; Li et al., 2022). They must focus on the ideas and

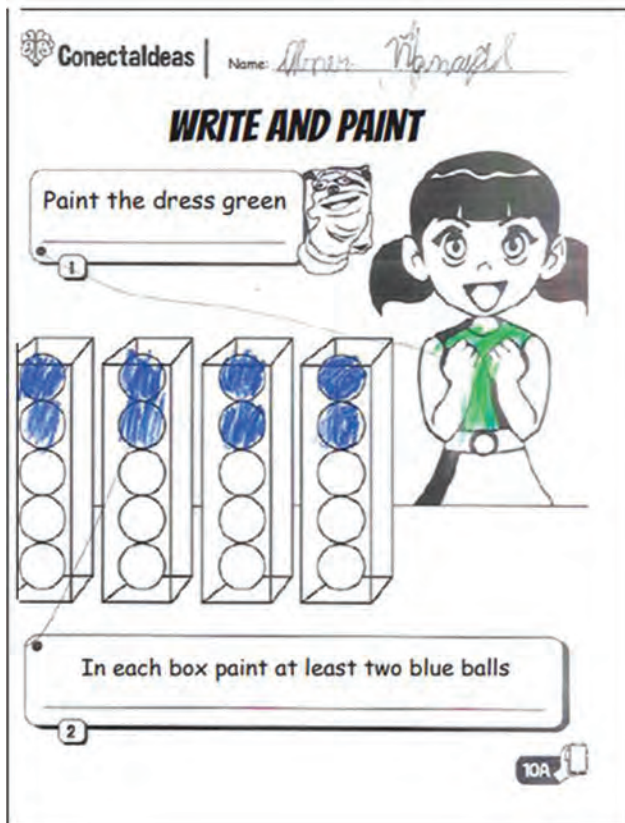
algorithms. Then, they have to describe these ideas and algorithms in natural language. This means precise instructions, but written in a language closer to the natural language with which we communicate between humans. This is the pseudocode. Later, the programmer specifies the particular programming language where the LLM has to translate the pseudocode into computer code.

In teaching CT, the impact of LLMs is enormous. LLMs, such as ChatGPT or Bard, can write code very efficiently. Thus, rather than writing code in a specific programming language, what is critical is specifying the core ideas and algorithms. That is, writing “pseudocode”. Therein lies now the value of a good programmer. The translation into code is a task automatically executed by LLMs.

Why Colouring Books?

We propose to implement Unplugged Computational Thinking (UCT) lessons using colouring books (Figure 2). Colouring activities can be easily adapted to teach CT (Araya, 2021a). They are a powerful strategy to teach, read, write and assess pseudocodes. In the left figure, the student is introduced to universal and existential quantifiers. In the right side, the student has to propose an instruction using these types of logic quantifiers.

The proposed UCTUC strategy is an extension and enhancement of a pilot plan started in 2019 (Araya, 2021a). There is initial evidence that they are a powerful teaching, learning and assessment tool (Inharjanto et al., 2019; Pinto et al., 2019). They are very attractive and engaging for students, and they are easy to include in classroom settings.



(a) In each box colour blue at least two balls



(b) Write your instructions

Figure 2. Page A with pseudocode colouring instructions. Page B, where students write a pseudocode.

Moreover, colouring books are very attractive to everyone. They also easily engage adults. A proof of this is that nine out of the twenty-bestseller books on Amazon's 2015 list were colouring books (NYPost, 2015). They connect with art, recreation and play. They highlight the beauty and simplicity of ideas and argumentation. In addition, they decrease stress and increase relaxation (Ashdown, 2018; Mantzios et al., 2018; Kaimal et al., 2017).

We propose three activities for teaching CT to elementary school students.

Page A: Read Pseudocode and Paint

First, students use page A of the colouring book (Figure 2a). In this page, they learn to

follow precise logical instructions to colour a picture. This means learning to understand and follow pseudo-code instructions. The instructions in the colouring book include four core CT competencies: first order propositional logic, existential and universal quantifiers, recursion, and probabilities (reasoning under uncertainty).

The instructions also include several core mathematical thinking ideas like well-known spatial algorithms (Araya, 2021b), mathematical contents according to the curriculum, mathematical modelling and problem solving (Inprasitha et al., 2023; Araya et al., 2021). They include activities with recursive figures, Turing machines, probabilistic machines, characters' dialogs in order to find and colour hidden objects

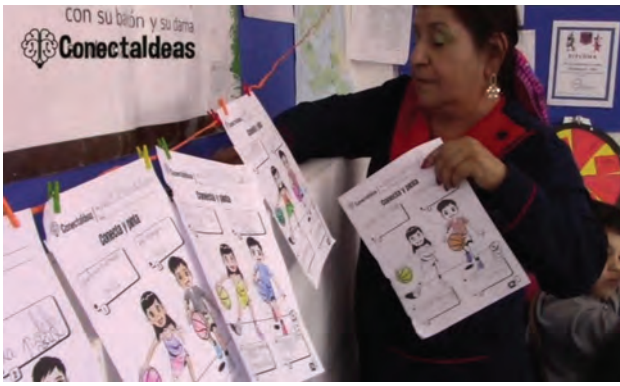


Figure 3. The teacher hangs up the students' colouring activity papers.

using logic implication from propositions, and agent-based computational models (Araya, 2021b; Araya, 2022).

Page B: Write Pseudocode

Second, students use page B of the colouring book (Figure 2b). In this page, they learn to write and test pseudo codes for colouring images. They write instructions using first order propositional logic, existential and universal quantifiers, recursion, and probabilities. They have to use this type of instructions and develop their creativity to write their pseudocode on how to colour images (Araya, 2021a).

Then classmates receive the pseudo code and use it to colour. Next, they both discuss and assess the instruction and the correctness of the colouring.

In a next step, the teacher promotes the discussion of the pseudocodes written and the corresponding colouring of the images. For this, we propose that the teacher shows, like in a museum, on the blackboard, all the pages with the pseudocodes and their corresponding coloured images (Figure 3).



Figure 4. A student reading the instruction and talking with his puppet before colouring and writing explanations

Metacognition

Third, the colouring book asks students to write explanations on how they interpreted the instructions and how they colour the images. The book also introduces the use of a hand puppet so that the student can talk with it and discuss before writing how they painted and how they solved the problem (Figure 4). The conversation with the puppet helps refine the instructions before writing them down. The strategy is to help the student develop argumentation and metacognitive skills, help with the internalization and internalization of dialogic processes and foster the dialog with their inner voice.

In this internalisation process, the hand puppet helps to auto-regulate, develop inner speech and write coherent argumentations (Figure 5). It supports the transition from social speech to a second stage of private speech, and finally to a third stage of inner speech (Vigotsky, 1978). This is the transformation of an interpersonal process into an intrapersonal process. According to Fox &



Figure 5. The internalisation process illustrated in four stages

Riconcente (2008), for Vygotsky, “metacognition and self-regulation are completely intertwined; the intentionality implied by self-regulation requires consciousness and the control required for consciousness implies self-regulation”. The puppet is a tool for cultivating this connection. Several scholars (Bråten, 1993; Fuhs et al., 2011; Zakin, 2007) see Vygotsky conception as a precursor to Metacognition theories.

Argumentation is one of the core skills in the curricula, and it is a key to metacognition. However, it is very difficult for students due to the complex thinking required when explaining their reasoning behind solving problems. In UCTUC, the hand puppet is a tool to develop this metacognitive skill. As discussed by (Graziano, 2019), we attribute consciousness to

ventriloquism with inanimate puppets. Similarly, the puppet that resides within us represents our consciousness. It is a model of the self that the brains construct and it is the base of our metacognition skills.

UCTUC Platform

The goal is to build and cultivate a community for the implementation of the Unplugged Computational Thinking Using Colouring-books (UCTUC) strategy. Colouring book can be an excellent resource for teachers (Araya, 2021c) and parents (Araya, 2021d) to help develop CT and problem-solving skills in their students.

However, it is critical to develop, build and cultivate a Lesson Study community actively

implementing, developing and innovating with colouring books for CT. The community should rigorously assess its effect and explore new opportunities with colouring books. For this purpose, it is very helpful to implement an online support platform (Araya, 2020a; Araya, 2020b; Urrutia et al., 2022; Urrutia et al., 2023). In our experience, such online platforms should report on real time the level of adoption, the type of colouring activity used, the coherence of the written argumentations of students, and the coverage of the national curriculum. This type of platform helps to disseminate better practices.

UCTUC Implementation Plan

Based on a couple of years of experience with UCTU with first to fourth-graders, we propose an implementation plan. Start producing localised mini videos showing students and classrooms using colouring books. Next, create guidelines for teachers and parents. Then, build a lesson study community to develop and scale the UCTUC strategy.

In more detail, the plan is the following:

1. Localised mini videos

- Translate the existing colouring books
- Write a plan and first draft of a guidebook for teachers, and another for parents.
- Pilot in two schools a lesson study. One for first graders and another for fourth graders. Record in video and produce 2-minute videos as shown in the corresponding videos.
- Produce 2-minute videos with kids at home and with parents as shown in the corresponding videos

2. UCTC guidebooks for teachers

- Produce new version of the guidebooks
- Produce a teacher development activity as shown in the corresponding video. Produce a 2-minute video
- Produce the final guidebooks

3. UCTUC Lesson Study community

- Develop a UCTUC platform
- Produce a massive open class event to launch the community with the participation of principals and teachers
- Record video and produce a 2-minute video of the launching event.
- Start scaling

Adaptation to Mathematical Thinking Developments

CT is indeed part of Mathematical thinking. From the perspective of Mathematical Thinking literacy and curriculum framework for mathematics education, such as SEA-BES: CCRLS for Mathematics on Figure 6 (Isoda et al., 2023), CT can be seen as a part of mathematics education.

As Figure 6 shows, students learn and develop mathematical thinking through reflective processes, and cultivate mathematical values through appreciation of the reflective process. In the strict sense of mathematics education, the learning contents up to the secondary school level are fixed on the content threads of the Key Stages 1 to 3. However, the meaning of mathematics in ancient Greece is any content learning that promotes logical and philosophical thinking. From this perspective, the task of colouring the A page is a way of thinking, and the task of the Bs pages provides an opportunity to explore ways of thinking and

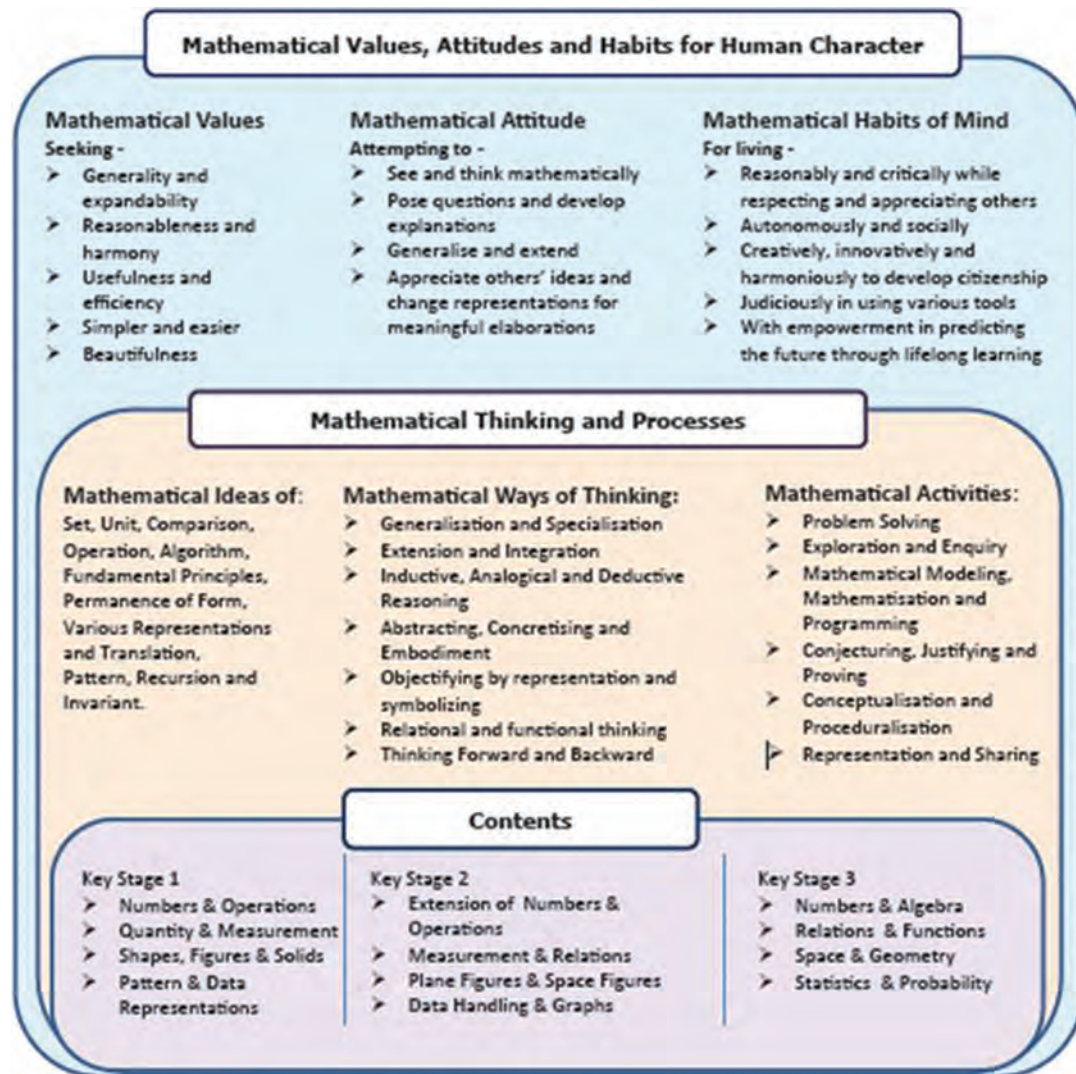


Figure 6. Revised Edition of SEABES: CCRLS Mathematics Framework (Isoda et al 2023)

to promote reflection and appreciation of the way of thinking and values.

One value that colouring books genuinely promote is the idea of simplicity. This type of book, which combines art and the playful activity of painting with coloured pencils, highlights the great value in describing and communicating the central ideas of mathematics and computation in a simple way. It reinforces the value that simple and easy is better and more powerful.

Colouring books develop an aesthetic sense, typical of the visual arts. In the colouring

activities, the student combines this perceptual sense with the simplicity and attractiveness of the ideas. It helps promote values such as beauty and harmony into computational and mathematical thinking. As Hardy (1940) highlights, 'The mathematician's patterns, like the painter's or the poet's, must be beautiful; the ideas, like the colours or the words, must fit together in a harmonious way'.

In addition, attitudes like *Pose Questions and Develop Explanations* are central in the SEABES: CCRLS Mathematics Framework (Figure 6).

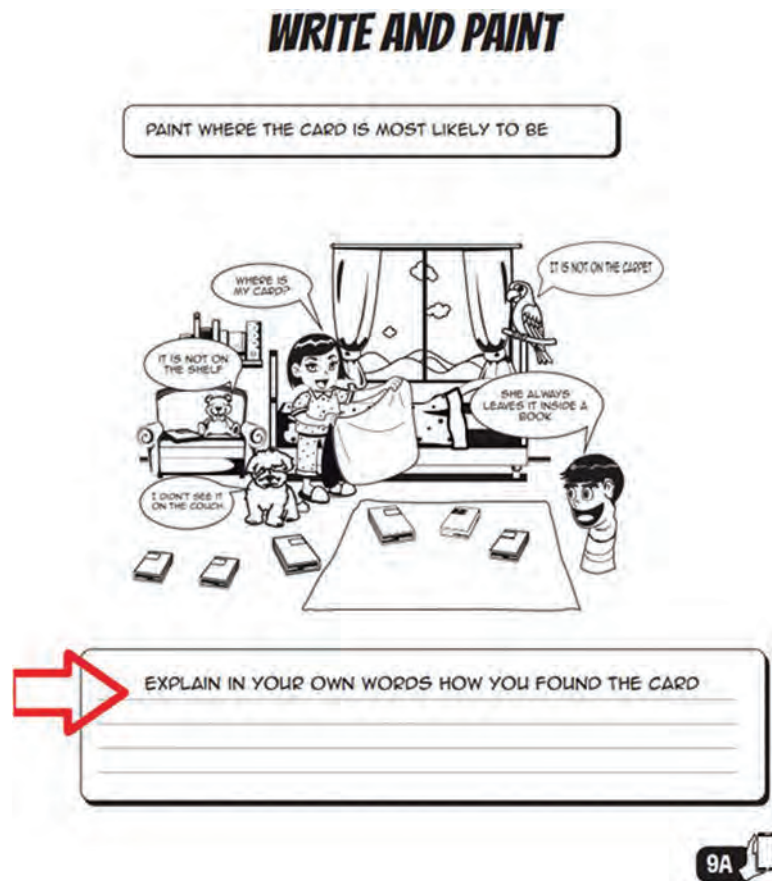


Figure 7. Students have to find the hidden object using propositional logic of first order, and then write explaining their thinking process to solve the problem.

These attitudes play a key role in the colouring activities. In the book for fourth graders, students have to explain their solutions and write their explanation in their own words, as indicated in the arrow in Figure 7.

Page Bs of the colouring book promotes the attitude of *Appreciate the Other's Ideas and Change Representations for Meaningful Elaborations*. On pages B, which has the same images as on page A, students imagine and propose a new problematic situation. Then, classmates must read them, interpret them, colour them and write their own explanations. On page B, students have to connect with their classmates, understand them, and try some mind reading. These B pages promote reflection

and appreciation of the way of thinking of others.

Extension for Learning Traditional Content in School Mathematics

The task sequence of Colouring book starts with learning the way of thinking at task A. Then continues with task B. This second task asks students to pose similar questions by and for themselves. This is the same strategy proposed by Isoda and Katagiri (2012). Figure 8 is an example on its Spanish edition by Araya (2016). The example teaches the notion of mathematical value as a component of mathematical thinking as described on SEA-BES: CCRLS (Isoda, 2019,

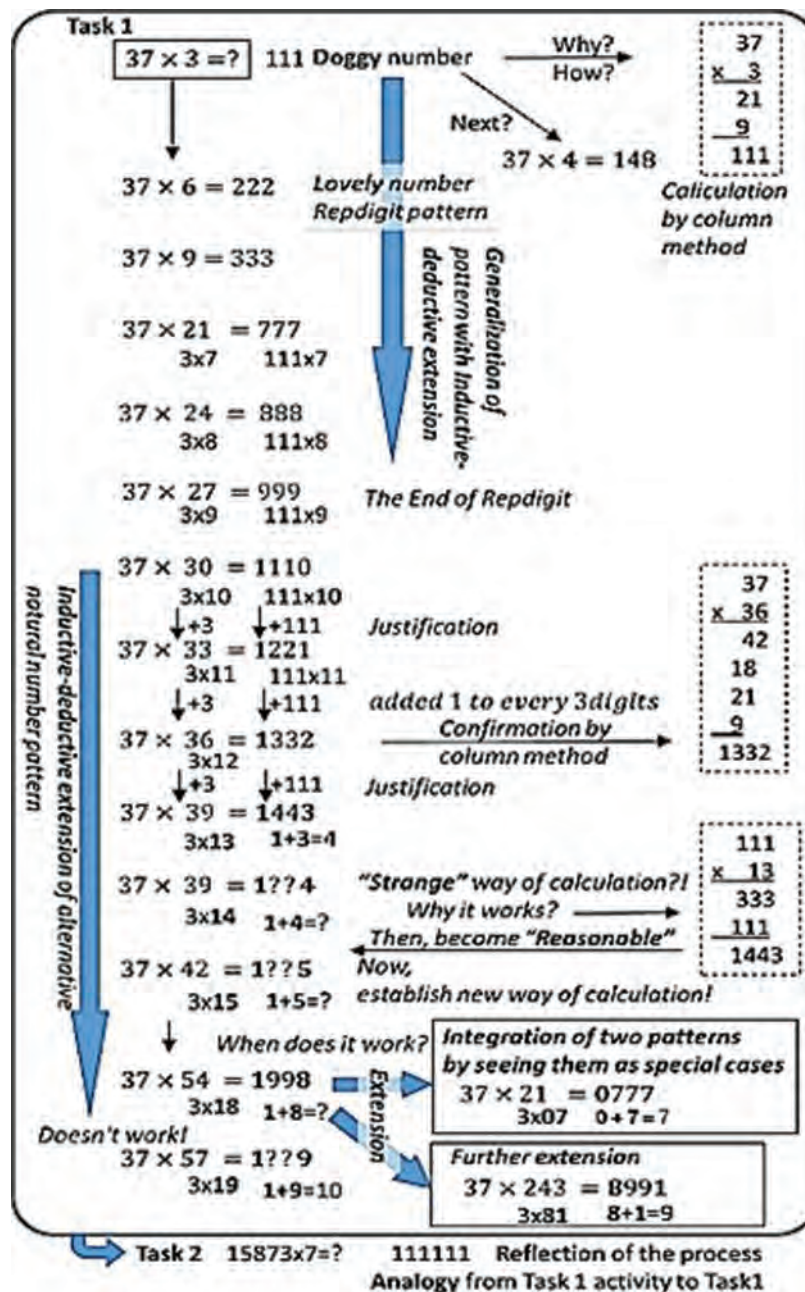


Figure 8. Task sequence to develop mathematical thinking

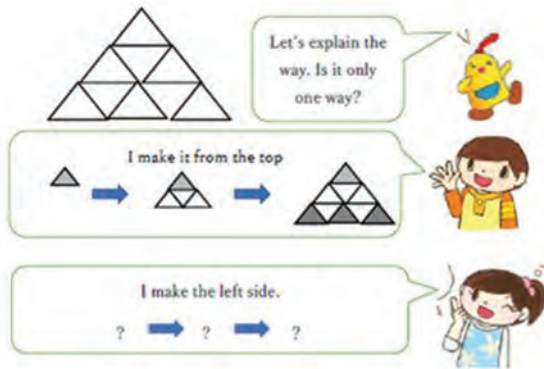
p46). In this example, Task 1 is 37×3 and Task 2 is 15873×7 . At the moment that the students find the answer of Task 2, which is 111111, they reflect on the process of Task 1 and appreciate the discussion of Task 1. Thus, they can imagine by and for themselves the solution of Task 1, which is $37 \times 3 = 111$, and its generalisations. It is the moment of metacognition with analogical reasoning.

Figure 8 consists of Tasks 1, 2 and 3. Task 3 asks the student to pose a question and analog to the previous. In the teacher training, Isoda et al. (2023, pp. 1–2) explained the keys to develop mathematical thinking, that the ideas and ways of thinking could be learned at the moments of the reflection of process, and the value and attitude could be learned as the appreciation of thinking and ideas on the reflection. Task 2

Title: Let's think about the order.

(two class-hours for second or third grade)

Task 1. How do you develop following picture by using the unit shape .



- 1) Let's explain your original way to the others.
- 2) Which way is most simple to explain the way to others.
- 3) Let's coloring the unit shape to show the way clearly.
- 4) Let's put the number in the unit shape to show the way.

"What does it mean left side? There are two possible interpretation, right?"

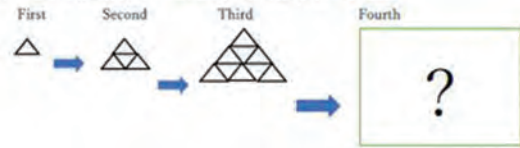
On 1), there are various possible ways. Even though the same way, there are variety of ways to explain, right?

On 2), To explain the way through the phone without camera view, we have to distinguish which objects, place and order such as 'at first, ...' and so on.

On 3) and 4), coloring and numbering are idea to explain however we have to distinguish first and number one and so on.

Task 2 On Task 1, answers the followings.

- 1) Following developed from the top. What shape comes fourth.



- 2) When developing from the left, what shape comes fourth?

- 1) on Task 2 is possible to ask without Task 1 however it depending on the way of interpretation First step, Second step and Third step.
- 2) on Task 2 is change depending on what is left and order.

Task 3 Let's pose similar questions by using other unit shape such as .

Guide for Teachers:

How to represent and explain

Ordering to find the pattern.

Analogical Thinking to apply learned for next step or further task

Figure 9. Reflect Task 1 and 2 through asking students to pose question at Task 3.

in Figure 7 and Task 3 in Figure 8 provide the moments of reflection. For the development of mathematical thinking, Isoda et al. explained the process in the real-world context and the mathematical context given by task sequence. These task sequences provide the mathematical context. On the other hand, most of the examples in Colouring book provide task sequence for real-world context. It will provide the object of mathematization in upper school. For example, Tasks in Figure 2 provide the object for matrix, transformation, number of cases and so on.

The colouring book format is flexible enough to incorporate and promote the mathematical thinking that the standard mathematics curriculum prescribes. For example, figure 10

on the left presents a colouring activity that promotes the use of the representation of numbers on the number line, where the operations are translations on it, which can also be fractions. This is a core representation of numbers and operations.

The activity on the right promotes not only recursive thinking but also introduces the student to the process of abstraction of the characteristics of many phenomena related with motions of particles and organisms. It proposes a mechanism for selecting trajectories (Araya, 2021b). The activity is a first step to develop a mathematical model as a potential. It is a central part of the Theory of Potential, which is central in mathematics, and widely used in

8A

10A

Figure 10. Left, number line representation colouring task. Right, recursive reasoning and steepest local ascent algorithm colouring activity.

physics (gravitation and electromagnetism), chemistry (chemotaxis) and biology. In addition, the activity introduces the student to the algorithm of steepest local ascent or descent. In the continuous case, the gradient algorithm is well-known. This is an algorithm widely used in engineering and machine learning.

Figure 11, on the left, poses a probability problem in an emotionally charged situation. This situation has turned out to be very attractive for students. It introduces the student to Decision Theory. The student has to justify her own decisions in a rigorous mathematical language, establishing a bridge between emotions and mathematical reasoning. Finally, the student has to mathematically evaluate the consequences and select the best decision.

The example of Figure 11 on the right promotes the mathematization of a very frequent problem in daily life, where we face two options: one decision with a potential of big gain or big loss, or a sequence of micro decisions with bounded values of gains and losses. Interestingly, in the end, the amounts involved are exactly equal. This is an exercise in statistical thinking. It requires a deep comprehension of statistics and probability. The activity introduces the student to the Law of Large Numbers. This is one of the central theorems of Probability Theory, and it is a theorem that establishes a bridge between probability and statistics.

Colouring book is developed for elementary school students, the tasks can be applicable for upper school level up to the University level.

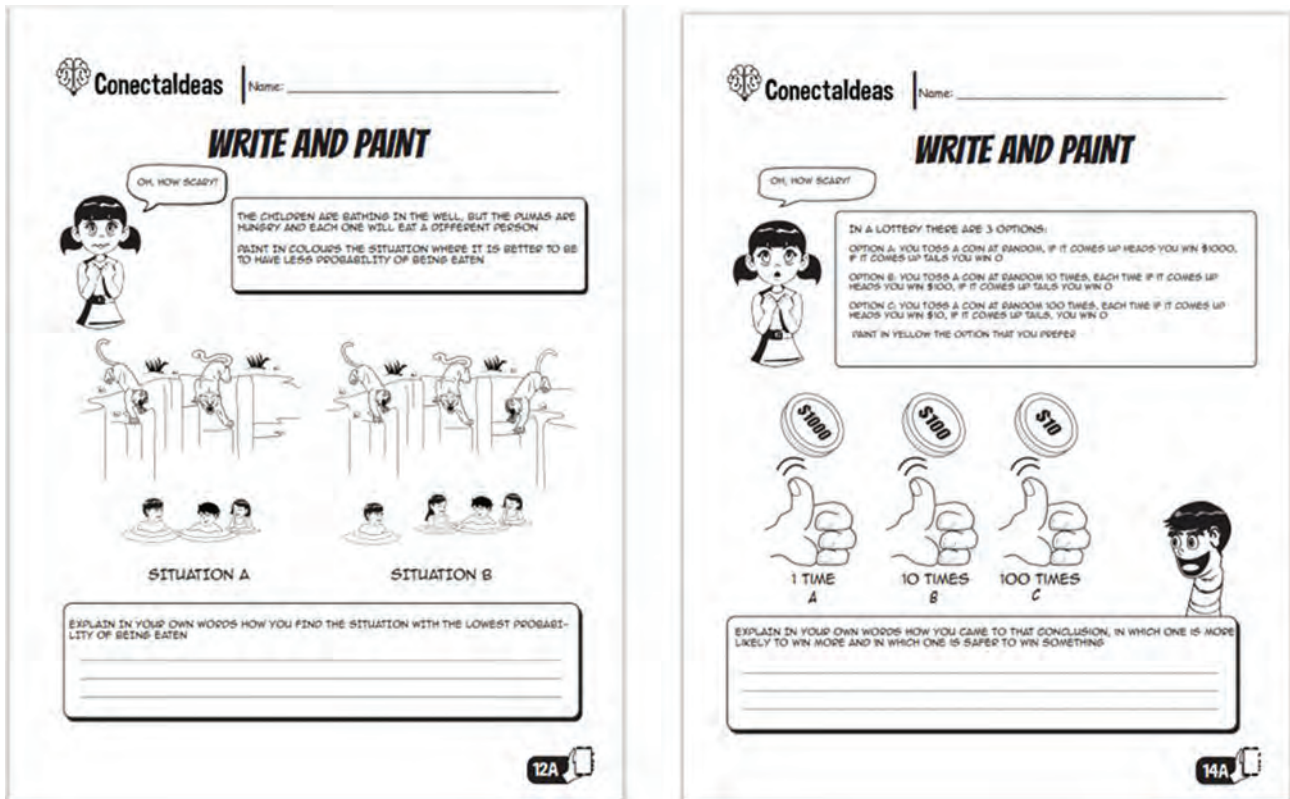


Figure 11. Left, Probability colouring activity. Right, Probability and Statistics colouring activity related to the law of large numbers

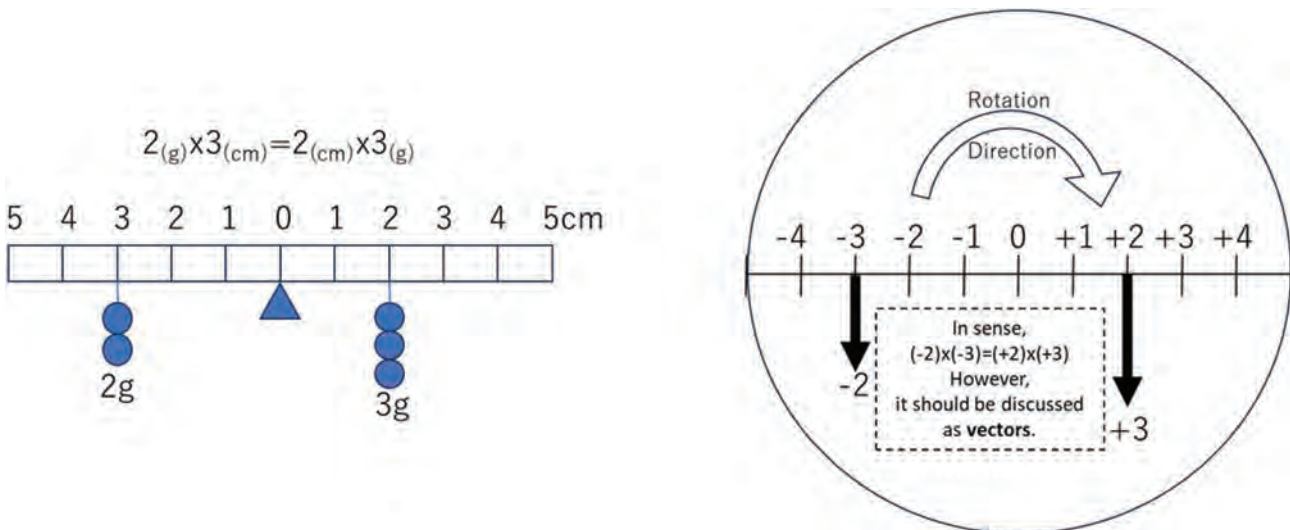


Figure 12. Progress of Representation and Models through Extension of Numbers

Indeed, the left of Figure 10 can be seen as positive and negative numbers if the middle of the place defined as origin. Such perspectives can be given by not only mathematics in upper

level but also the other subjects such as Physics (figure 12). On this mean, Colouring book activities provide the object for future-learning in upper school level.

Conclusion

The arrival of LLMs makes us rethink education. LLMs, such as ChatGPT, that can write code very efficiently, in any programming language. In addition, LLMs can review code, fix, improve, rewrite, explain, and write comments according to the level specified by the user.

It is therefore central to rethink what to teach. Rather than writing code in a specific programming language, what is critical is specifying the core ideas and algorithms. That is, write “pseudocode”. Therein lies the value of a good programmer.

The proposed Unplugged Computational Thinking Using Coloring-books (UCTUC) strategy focuses on developing pseudocode, and assessing it with peers. It is very attractive to students; it helps develop computational and mathematical thinking, foster metacognitive skills, and easily adapt to the classroom and home environments. It is also a powerful didactic strategy to foster the mathematics values, attitudes and habits needed for a complete development of human character.

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Formative Assessment for Human Character Formation in the Case of Mathematics Education: Self-realisation in Problem Posing Class

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ABSTRACT

This article explores how the teacher's formative assessment is going in the mathematical problem posing class, and the effectiveness of the teacher's formative assessment on students' self-realisation which may be achieved through the interaction in mathematics class. For exploration, this study focused self-realisation from the perspective of self-efficacy as non-cognitive skills in relation to the emergence of competitive and sympathetic attitudes in the mathematical problem posing class and how different students' belief in mathematics affected their performance in the class. On the objective, this article reanalysed the video (Isoda & Abe, 1994). Through the reanalysis of video, this article illustrates how assessment for teaching is necessary for human character formation in mathematics class, explaining self-efficacy as a necessary component to enhance the human character and self-realisation in class is necessary to develop self-efficacy in mathematics class.

Keywords: mathematical problem solving, problem posing, facial expression, emotion, self-efficacy

Introduction

Formative assessment plays a role in both improving teaching quality and increasing student engagement in the classroom. Formative assessment, which is usually defined as a systematic process to continuously gather evidence and provide feedback about learning while instruction is underway (Heritage et al., 2009) and MEXT, Japan, call it as Assessment for Teaching (Shidou to Hyouka: Instruction and Assessment) (Ministry of Education, 1951,

1993). Formative assessment for teaching involves providing students with necessary feedback to promote their performance during an instructional process and enable them towards the next steps in their learning based on diagnosis for supporting the learning (William & Thompson, 2008).

Takahashi and Kageyama (2021) state that formative assessment as an assessment of teaching is as follows: "The student develops



his/her self-assessment standards and a vision of his/her future, a vision of who he/she wants to be, through teacher's instruction and assessment. Students will become learners and independent thinkers when they become aware of their own increased talents and the value of sound reasoning."

Havnes et al. (2012) wanted to explore how formative assessment information is received and attended to between teachers and students. They collected quantitative survey data (group interviews) from three schools. They have found that there are four classroom situations that are rich in feedback opportunities: "(1) the teacher works through a test or assignment when returning these to the students after corrections, (2) student presentations of projects, (3) group work and (4) discussions between the teacher and the students". Even though the study is typical with deep analysis of the data such as class description and interviews for the research on the formative assessment, it does not describe how concrete teachers' formative assessment is going on in the usual class as for the assessment for the objectives in the class by mathematics teachers.

Heckman (2001) focused on the necessity to develop non-cognitive skills from early childhood; however, besides cognitive skills can be quantified using achievement tests, non-cognitive skills cannot be measured numerically. On SEAMEO Basic Education Standards SEA-BES: Common Core Regional Learning Standards CCRLS (Mangao et al., 2017; Isoda et al., 2019), one component of the standards framework for the objective of teaching mathematics is 'Mathematical Values, Attitudes and Habits for Human Character (p.5).'

However, most assessment research is focused on the achievement of cognitive skills and it is not clear what human character formation is ongoing in the typical classroom even if it was written in the curriculum standards. Teachers do the assessment for teaching in their class by observing every student's activity such as facial expressions, attitudes, and so on (Isoda&Abe, 1994). However, we usually focus on measurable aspects even through formative assessment. In this study, to avoid the confusion of assessment which focus on various measurable aspect up to pre and post-tests, we use the term for the assessment for teaching in the class under the objective of the teacher.

The Organisation for Economic Cooperation and Development (Ikesako, H., & Miyamoto, K.,2015) also enhanced the importance of non-cognitive skills in education and defined "social-emotional skills" as non-cognitive skills stating that "the ability to learn and human nature". Skills are terminology used for curriculum and in psychological and assessment contexts. They are also called abilities.

For illustrating the assessment for teaching under these perspectives, this study reanalyses the video of the lesson study by Isoda & Abe (1994) in the case of problem posing to illustrate the teachers' conduct formative assessments in the class under the objective and how does it function for knowing and developing non-cognitive ability. To promote the practice of Human Character Formation in mathematics classes through reanalysing the video, this paper focuses on: 1) how the teacher conduct assessment for teaching in the mathematic problem posing class. 2) by the teacher's assessment of teaching, students'

self-realisations in the class are a part of the development of human character through mathematics can be seen from students' attitudes on the assessment for teaching, and their beliefs and cognitive skills are also necessary to consider.

Originally, Isoda & Abe's (1994) proposed the assessment for teaching through the observation of students' facial expressions by teachers. On the reanalysis, this paper focused more on how teachers' formative assessment affects students' self-realisation in relation to their competitive and sympathetic attitude as well as functions of students' belief in mathematics which is emergent in their learning process in their class.

Two Factors for Students' Self-realisation: Competitive and Sympathic Attitudes

According to the SEA-BES: CCRLS in Mathematics and Science (2017), the humanistic nature of mathematics can be understood by the competitive attitude to establish new ideas and the sympathetic attitude to understand others for sharing (p.2).

Under assessment for teaching in the classroom by mathematics teachers who conduct student activity in the classes, students challenge today's given task by teachers and recognise their own objective as for what they want to be, and then, self-realize by and for themselves through their achievement and it is a part of human character formation in mathematics (Isoda & Kageyama, 2021). Especially in the classroom, students' self-realisation is achieved by using their cognitive and non-cognitive skills.

Non-cognitive ability has two aspects: One is self-ability such as self-efficacy and self-confidence, and another one is social abilities such as sympathy and cooperativeness which are necessary for collaborating with others. Self-efficacy was proposed by Albert Bandura (1977), which means "the belief in one's capability to organise and execute the courses of action required to manage prospective situations" and is crucial for goal setting. Bandura (1986, 1990) distinguishes between self-efficacy and self-confidence: self-confidence refers to firmness or strength of belief but does not specify its direction; self-efficacy implies that a goal has been set. Self-efficacy is a part of human character and self-realisation is necessary to develop self-efficacy.

Even though self-efficacy is related to both competitive and sympathetic attitudes, the mathematical activity itself is more concerned with competitive attitudes because mathematicians who posed really innovative and outstanding ideas in mathematical discovery are respected as long as understandable for others (Managao et al., 2017). Depending on Bandura, Self-efficacy can be broadly classified into two categories: "task-specific self-efficacy" and "generalized self-efficacy". General self-efficacy is an individual's perception of his or her ability to perform across a variety of situations. Task-specific self-efficacy investigates an individual's perception of his or her ability to perform actions specific to a given circumstance. The existence of two types of self-efficacy: personal, or expectations based on a standard of performance that is internally derived, and competitive, or expectations based on a standard of performance that is externally

derived (Taylor, 1989). In this study, we would focus on task-specific self-efficacy in order to clarify how self-efficacy showed in mathematics classes. Because mathematics classes usually specified the objective of the given task from teachers, here we focus on task-specific self-efficacy.

A sympathetic attitude was defined by the English moral philosopher Hume (1740) as “the trait of paying attention to the situations and feelings of others and sharing and understanding their feelings”. It is also argued that empathy arises when we evoke the attitudes of others in ourselves when we are helping them (Mead, 1934). Like the letter from Pascal to Fermat on 29 July 1654 (see Pascal 1654, p103), a sympathetic attitude is usually related to a competitive attitude because without others’ understanding for sharing new ideas mathematical discovery is never accepted. And if others do not understand, his new idea will be buried. Thus, in mathematics class, teachers and students usually try to confirm others’ understanding. Assessment for teaching by mathematics teachers usually conducts/manage both competitive and sympathetic attitudes.

Competitive Attitude in Mathematic class

Even though a number of practices to develop students’ self-efficacy were done by mathematics teachers and there was questions on the international comparisons such as TIMSS included the perspective of self-efficacy, there are not so many empirical studies which focus on mathematics class. Isoda et al. (2006) used the online Bulletin Board System to create an environment in which Japanese and Australian students could work together in problem-solving

on the Internet, noted that they became aware of differences in mathematics and that the communication between the students revealed a competitive attitude (i.e., they were stronger than their counterparts in mathematics) and it also includes the sympathetic attitude for understanding others to continue communication and sharing innovative ideas each other. This idea can be taken to mean the same thing as the above-mentioned competitive self-efficacy.

Sympathic Attitude in Mathematics Class

Through mathematical activities in mathematics education, a sympathetic attitude is necessary to promote the autonomous interactive ability of students (Managao et.al., 2017). It is also regarded as a part of mathematical activity to explain and communicate using mathematical terms. It needs to be noted here that the word “interactive” may easily conjure up images of dialogues between students in group activities, etc., the success of these discussions depends on the students’ ability to sympathise with the other participants for getting others perspective to understand others. For instance, Isoda et al. (2006) found that students can be regarded to be displaying a sympathetic attitude when they make sure the other party understands their message in order to communicate their own thoughts. For understanding others in mathematics, students are necessary to represent other side ideas by and for themselves. For re-present, they have to use mathematical knowledge by themselves. If students do not have it, it is impossible. That’s why teachers need to observe whether other students could understand or not. If not,

teachers usually give feedback to represent explanations.

Mathematical Problem Posing

Problem posing as a part of problem-solving activity is a content of teaching and a powerful pedagogical tool to develop students' mathematical thinking skills which promotes their creativity and innovation by and for themselves. To utilise range of skills, including critical thinking, creativity, communication, and collaboration, several challenges have been already implemented in the classroom since 100 years ago (such as Shimizu, J., 1924). Internationally shared problem-posing strategy is the "what-if" and "what-if-not strategy" proposed by Brown & Walter (1970). The "what-if-not strategy" is used when, after solving a given problem, the conditions of that problem are examined and new related problems are introduced. "What if not strategy" was also independently discussed in Japan such as (Sawada, S., 1984).

Also independently, Isoda et al. (1992) proposed a method of "problem posing from situations such as photos, new paper, and computer animation" for the coming era of multimedia by using "what-if strategy" and "What-if-not strategy". Especially, he promoted problem posing from the situation with "what-if strategy" by allowing students to add and create conditions and context which are necessary to produce mathematical problems from their images inspired by the given situation by using what they already learned. In his approach, students are able to embed each of their perspectives on their learned and experiences into each of their problems.

Thus, the posed problems usually reflect each student's personality. His approach includes information extraction from the situation and problem formulation and generates meaningful questions. The objective of his approach is to develop student's problem posing ability from the situation as a part of problem-solving. Based on Lesson Study, Isoda et al. (1992) proposed a process of teaching how to pose/make problems: In phase I, the class is a teacher-driven development process, which aims to let students understand how to make problems. The case of failed students learn how to make problems from other's works. Phase II showed the students' independent work in creating their own problems, the specific features of the mathematics problems were focused and students felt personality. In phase III, students engage their project work taking pictures for the problem in their life and presenting the reports for their mathematical exploration. In phase I, the teacher intends students to learn how to make problems by themselves through produced examples by students. In phase II, the teacher intends for students to expand how to develop the problem by themselves based on learned ideas for problem making with others. Up to phase II, most of the students were able to make mathematical problems by and for themselves. Phase III intended every student to be able to find mathematical objects in their life as for the bases of mathematical modelling activity.

Re-Analysis of Isoda & Abe (1994) for Self-Assessment

The video in this research is recorded by Isoda & Abe (1994) in 1992 at third grade of Junior

high school students in Japan, which meant 9th grade students internationally.

At the beginning of the class, the teacher showed Figure 1 with simulation by the projector and asked students to make problems by themselves: The conditions $AC \perp BE$ & $AB \perp CD$ are hidden, and students need to think with what-if mode. Hidden condition itself unknown and free to set conditions by students.

T: You may know that in the entrance exam, there is a problem to develop the mathematics problem from the situation. You must know how to develop a mathematics problem from a situation. Then, let's pose the problem from this figure (The task, making problem, given by the teacher with FIGURE 1).

The objective of the teacher is that students learn how to make problems. Students also got it with the given task because the lesson was set a month ahead of their exams.

Episode 1 in Phase I: Sympathetic Attitudes and Self-realisation as Cultural Practice in Mathematics Class

The teacher, Abe, made the assessment for teaching under his objective. After posed today's task teacher was walking around the class

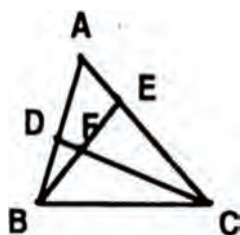


Figure 1. Simulation of a figure by moving point A was demonstrated by the teacher

for knowing what kind of problems they were making (FIGURE 2). When most students were finished, the teacher asked them to present and called one student to come to the front and explain his problem which discuss proof of similarity.

Student Z: Problem, When $FD:CD=1:4$, $BF:BE=1:4$, prove $\triangle BFD \sim \triangle CFE$.

After Z's presentation, the teacher asked students to raise their hands if they made a similar problem. For promoting raising hands, the teacher mentioned student X and some others made a similar problem and asked to rise their hands. At the moment X was called, he smiled (Figure 3).



Figure 2. The teacher was reading student X's problem

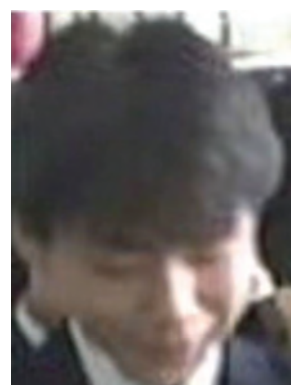


Figure 3. Student X smiled after the teacher mentioned his name

T: This is a good example. Who developed the problem of similarity? Please raise your hands! Mr. X,..., you developed, right? (FIGURE 3) Please raise your hand (FIGURE 3). How many of you developed the problem of similarity, one, two, three...

The teacher recognised student X's achievement and shared it with the whole class. It coursed that X felt happy for his problem being shared with others. This X's happiness implies that sharing their own ideas with the teacher in the whole class is a trigger of sympathy and the key to self-realisation in mathematics class. This was the result of the teacher's assessment for teaching while looking around students in the class to observe what types of problems students were developing.

Episode 2 in Phase I: Competitive Attitude for Sharing Ideas in Class

At that moment, X smiled and raised his hand, student Y who was seated left behind X looked uncomfortable (FIGURE 4-①). The teacher Abe and observers assume the reason is that X's idea was shared by the whole class by the teacher, while Y's thought was not, yet. Y's problem which might be delightful for him did not recognise in the class, yet. It was a reflection of Y's competitive attitude. Because the teacher recognised other students' uncomfortableness, he said:

T: So, who else thinks we can make a problem like this, except for the similarity?

It was also the result of the assessment for teaching. He already observed various types of problem were produced by students. At the morment of his saying, X sneaked a glance at

Y (FIGURE 4-②). After saw student Y raise his hand, X si(FIGURE 4-③) and he looked back to the front and crossed his arms with a triumphant look (FIGURE 4-④).

Depending on the class teacher Abe's explanation, they were friends, and X, as well as other students, knew that Y has one of the highest mathematical abilities in the class, and thus, X might expect that Y may raise his hand to show his problem to the others. That's the reason why, X looked at Y. It implies that their good relationship is not only friendly but also rival because it emerged as a competitive relationship between X and Y. X's self-realisation in the whole class was uncomfortable for Y because his achievement was not yet shared. X imagined Y's situation and expected his response. It is also the consequence of a teacher's assessment for teaching. Indeed, this situation is caused by the teacher's request to make mathematical problems and his constant observations of the students' works for his formative assessment. Only the teacher knew each student's problem, thus he could choose the problem of similarity at first as for the first exemplar. The teacher also knew other students' problems and he asked student Q to present.

Student W: When D is the midpoint of AB and E is the midpoint of AC, find the area ratio of the square ABC and the pentagon DBCEF.

And discussed the two ways to make problems: One is seeking the answer problem by student W and another one is proof problem by student Z. Even though Y's problem was not discussed in the class, he could show his presence with rising his hands.

These two episode implicates that students' self-realisation in classroom are depending on



① Student X raised his hand while Student Y looked uncomfortable



② Student X sneaked a glance at Student Y



③ Student X smiled after saw student Y raise his hand.



④ Student X crossed his arms with a triumphant look

Figure 4. Teacher's formative assessment in Phase 1

teacher's decisions whose problems are easier for sharing in the whole class at this phase. Teacher's action is based on his objective that whole students are able to learn how to make problems by and for themselves. As for exemplar, students were selected by teacher to explain how to develop proof problem and seeking answer problem.

Episode 3 Shift to Phase II: Difference of each student's belief in mathematics

After the discussion of two ways of making a problem, the teacher asked student W to solve his problem. His solution used the idea of the centre of gravity (FIG 5). Meanwhile, three students R, U, and V listened to W's explanation (FIG 6-①).

After W's presentation, the teacher asked students to raise their hands if they understand his explanation.



Figure 5. Student W presented the problem by using center of gravity

T: Who got it (Student W's explanation)?

Half of students raise their hands, including student R, U, and V (FIG 6-②).

T: Then, who can explain it a little more clearly? What is $\sim 2:1$, then why is $2:1$ ~ when it is the centre of gravity. Is this problem correct?

After all student R, U, V raised their hands, R began to talk and smile with friends, U lost concentration, and V still tried to follow the teacher's question. While he was listening to W's explanations, V followed the diagram on the blackboard, and sometimes shaking his head which can be considered V kept his reasoning throughout the whole process when we compared with R and U.

Teacher: Where is the part of assumption in this problem? If you want to change the problem, where can you change?

This question related with revision of problem by using what-if-not strategy. Thus, from this teachers' question, Phase II begins. Student V asked teacher (FIGURE 6-③ & 6-④).

Student V: May I change the conclusion ... E is the midpoint of BC.

So as the teacher asked questions as above, student V raised his hand. When we compared with the difference of three students' attitude, we can discuss their beliefs in mathematics individually which led each of them to the different behaviour. From teacher Abe's perspective, R and U believe mathematics as the subject of understanding. So they stopped thinking or being distracted by others after they thought they have understood W's explanation. In contrast, V believes mathematics can continuously develop.

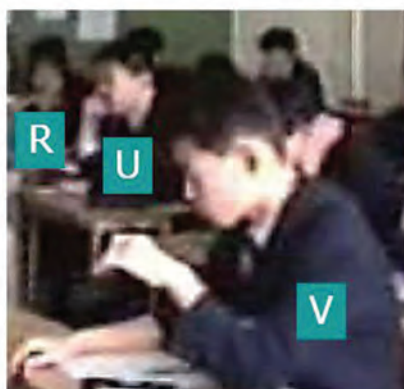
After this discussion, the teacher looked around the class again. The teacher observed



① Three students R, U and V listening the explanation of Q



② Three students raise their hands



③ The teacher asked, can anyone explain more clearly



④ The teacher asked, which condition did student Q changed

Figure 6. Teacher's assessment for teaching in Phase 2

U did not engage and confirmed him how to change the problem again. After walking around, the teacher asked whole students how they changed W's problem and R answered that she changed the seeking answer problem to the proof problem.

Even though all students shared the objective to learn how to develop the problem, their actual achievements are depending on their beliefs in mathematics as well as their cognitive skills. For this emergence of their beliefs, teachers' assessments for teaching are also functioned. After W explained his complicated proof problem, the teacher confirmed whether every student could follow his explanation or not, and kept asking students for learning how to change the condition for the next step. In contrast, in Phase I, the teacher just asked students to raise their hands if they made different problems without allowing them to explain further. The reason is that, in Phase I, the teacher intends to instruct students on how to make problems by themselves and chose the proof problem and the seeking answer problem to present. In Phase II, the teacher wanted students to expand their problem which included what-if-not strategy. Even U began to talk with her friends, she could follow his request but R could not. The difference between U and R implicates the difference in their cognitive skills for mathematics.

Conclusion

On the reanalysis of the video, this study focused on three episodes to illustrate students' self-realisation under the shared objective of making problems. In the discussion of the episode, as a case study, posed research

questions 1) and 2) are already illustrated. In conclusion, we would like to confirm how assessment for teaching is necessary for human character formation in mathematics class explaining self-efficacy as a necessary component to enhance human character and self-realisation in class is necessary to develop self-efficacy in mathematics class.

In the episodes, self-efficacy to make the problem was seen in the following: X's smile was emergent because the teacher knew what problem X made and made it possible to be shared X's achievement in the class. It is really an opportunity for him to self-realize in his class under the objective/task to make problems. Y raised his hands after X called and X looked at Y: It can be seen as competitive interaction among them. Y raised his hands based on his self-efficacy. Y could show his presence with his hands in class but he did not call by teacher. This meant the teacher's assessment affect Y's self-realisation and may not be strong as affect for X. Anyway, the relationship between X and Y is friendly and rival which was a part of their human characters.

Even teacher realised Y's desire to express, the teacher could not choose him because he planned the lesson to discuss both the proofing problem and seeking answer problem and the next step 'what if not' after the discussion of 'what if'. The teacher preferred presenters based on his objective what he would like to teach within the class hour.

Even though the making problem was a shared objective, the performance of students was very much different, and the teacher's assessment for teaching was changed

depending on his observation of students. R, U and V understand the explanation of proof for W's problem. However, after his confirmation as assessment, their performance was different. We interpret their difference as coming from the difference in their belief and cognitive skills. The teacher observed U's stagnation and made feedback to support him: It was the assessment for teaching mathematically weak students. The teacher also confirmed R by asking the answer to his question. In the class, the teacher changed the assessment for teaching to enhance each student's performance under his objective and plan. From the perspective of competitive and sympathetic attitude, V's attitude is more competitive as well as X and Y but R and V are more sympathetic because if they understand they stop their reasoning. These differences imply that the meaning of self-realisation is different depending on students even if the teacher shares objective with students.

From the perspective of mathematics, teachers would like to develop students like X, Y, and V: it means that the necessity to improve the performance of U and R. R may need to develop better beliefs like V because she enjoyed talking with her friend instead of further reasoning. Her enjoyment and smiling with her friend is a part of her human character which cannot be denied by us however if she got further mathematical belief her performance might enhance. U may need to support his lack of cognitive skills because of stagnation. For U's self-realisation, it is necessary to enhance his cognitive skills as the bases for overcoming stagnation.

These were conclusions found from the re-analysis of the video.

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