Innovative Mobility Program Series for Asian Students' Equitable Learning Opportunities Through Interdisciplinary Methodologies

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Abstract

Virtual Asia Exploration (VAx) and Hybrid Asia Exploration (HAx) are innovative mobility programs designed to provide equitable learning experiences for Asian students, regardless of location or financial constraints. Facilitated by a diverse team of 12 multinational lecturers from 5 countries (Indonesia, Japan, Malaysia, Thailand, and the Philippines), these programs offer an interdisciplinary educational experience consisting of technology, history, and cultures of Asian countries to enhance participants' self-efficacy [1]. VAx was initiated as a response to satisfy the desperate demand for mobility programs hampered by the COVID-19 pandemic, providing a Digital Transformation solution that offers borderless mobility programs regardless of location and budget limitations. After three batches in 2021 and 2022 with a total of 239 certificate awardees, the program transitioned to a hybrid model in 2023. Of the 88 registered participants from 10 different nationalities, 44 attended the onsite sessions at Institut Teknologi Sepuluh Nopember (ITS) Indonesia, engaging in face-to-face lectures and local community field studies. Those unable to travel continued participation online.

Through an interdisciplinary approach [2], the programs and courses aligned with the 21st Century Imperative [3] as well as the Washington Accord 11 Global Attribute Profiles (WA11GAP) defined by The International Engineering Alliance (IEA) [4]. This article explores strategies for encouraging engineering students to participate in mobility programs fostering global competence and Asian pride. In addition, the learning outcomes are assessed based on WA11GAP criteria.

1. Background to start of Virtual/Hybrid programs, and program outlines

Mobility programs have become a top priority for universities worldwide, offering students a variety of skills beyond traditional lecture-based learning [5]. These programs provide a plethora of benefits, including the opportunity to develop soft skills, global competence, personal networking, and cross-cultural communication abilities. [6]. In the Asian region, various

international consortiums and organizations facilitate collaborative mobility programs among member universities. One initiative is the Asian International Mobility for Students (AIMS) Programme. A regional initiative led by the Southeast Asian Ministers of Education Organization Regional Centre specializing in higher education and development (SEAMEO RIHED), AIMS supports student mobility and fosters cooperation in higher education across Asia [7]. Another example is the Asia Technological University Network (ATU-Net) Mobility Special Interest Group (SIG) which promotes collaboration among member institutions. However, due to COVID-19 travel restrictions, educators were challenged to create alternative initiatives, leading to the rapid adoption of Collaborative Online International Learning (COIL) methodologies [8]. Through informal discussions within ATU-Net SIG, unexpected collaborations emerged. Under the strong leadership of Shibaura Institute of Technology (SIT) Japan and ITS Indonesia, the innovative COIL program VAx was launched with three months of preparation to meet the substantial demand for travel restriction-compliant mobility programs. VAx represented not only a conversion from traditional travel-based programs but was a departure from conventional programs featuring unique characteristics as follows [6]:

1) Participation of six engineering institutes and universities from five countries across Asia (Indonesia, Japan, Malaysia, Thailand and the Philippines),
2) A 14-class interdisciplinary curriculum led by 12 multiethnic lecturers including six each in technological and social science fields, supplemented by non-lecture activities like group discussions and team presentations,
3) An engineering knowledge component designed to stimulate participants' borderless engineering interests beyond their specific field of study and teach participants to apply combined technologies to real-life issues around the world,
4) A social science component focusing on Asian culture and history to instill confidence in participants' origins. utilizing group work to facilitate interactions among students of diverse ethnic backgrounds and nationalities, where team composition comprises three or more diverse backgrounds in each team, and
5) 2 credits equivalent, transferrable to the participant's home university upon reception of the certificate of completion and transcript

Table 1 and Image 1 highlight the diversity of the six hosting universities that contributed to all four program components.

Table 1: Six Hosting Engineering Institutions

No	Country	Institute name	Acronym
1.	Indonesia	Institut Teknologi Sepuluh Nopember	ITS
2.	Japan	Shibaura Institute of Technology	SIT
3.	Malaysia	Universiti Malaysia Terengganu	UMT
4.	Malaysia	Universiti Malaysia Perlis	UniMAP
5.	Thailand	King Mongkut's University of Technology Thonburi	KMUTT
6.	The Philippines	Cebu Technological University	CTU

Image 1: Geographic Location of Hosting Institutions

The successful completion of three batches in 2021 and 2022 resulted in a total of 239 certificate recipients. In 2023, the program series was upgraded to a hybrid model in response to the lifting of travel restrictions and the growing demand for in-person experiences from both students and educational institutions. While the core structure remained unchanged, an 8-day onsite program in Indonesia was introduced for the social science learning component. Participants now had the option to select either a fully online virtual course (VAx) or a hybrid model consisting of half virtual and half onsite courses (HAx). The onsite courses were designed to be affordable for all interested participants, as out-of-pocket costs only included round-trip transportation to and from Surabaya International Airport. Onsite accommodation, ground transportation, and regularly scheduled meals were sponsored by ITS. This effective utilization of the school facilities provides participants with equitable educational opportunities.

The HAx offered several additional features:

6) Participants had the opportunity to share travel and accommodations with newly acquainted students from diverse backgrounds, including with respect to gender and sexual orientation.
7) Face-to-face interactions with multi-ethnic participants and lecturers facilitated deeper engagement and understanding.
8) Emphasizing real-world experiences, participants engaged in activities aimed at nurturing awareness of their role as future leaders, including team-building exercises, exploration of

historic heritage sites related to colonization, wars, and independence, and interactions with Indonesian local communities through visits to villages and presentations at vocational schools.

As a result, 44 participants traveled to Surabaya, the second-largest city in Indonesia, for the onsite courses. Additionally, more than ten ITS student volunteers actively supported the program, benefiting from cross-cultural communication opportunities with the participants. Image 2 showcases the diversity of participants in the onsite program of HAx batch 1.

Finally, a total of 53 participants, including those enrolled in the online component, received certificates and transcripts upon completion of the program.

Image 2: Participants of HAx onsite program, September 2023

2. Requirements for Future Global Engineers

Becoming an engineer requires a diverse array of skills. The Washington Accord (WA), established in 1989, was an international accord of bodies accrediting bachelor-level engineering programs [9]. Graduate Attributes and Professional Competencies (GAPC) by the IEA defines the following WA11GAP, which engineering students are supposed to acquire through their undergraduate studies [4]:

1) Engineering knowledge

2) Problem analysis
3) Design/development of solutions
4) Investigation
5) Tool usage
6) The Engineer and the World
7) Ethics
8) Individual and collaborative teamwork
9) Communication
10) Project management and finance
11) Lifelong learning

The WA11GAP criteria apply across educational qualifications in the engineer, engineering technologist, and engineering technician tracks. The criteria highlight the distinctive characteristics and areas of commonality between the expected outcomes of different types of programs [10]. Thus, it is necessary for most engineering students to acquire these skills and experiences through their undergraduate studies. The challenge for educators lies in devising effective methods to provide students with practical learning experiences that facilitate the acquisition of these skills.

3. Literature review

The objectives of this VAx/HAx program are to equip participants with both global competence and engineering skills encompassing technical and non-technical proficiencies. While global competence is a 21st Century Imperative [3], the challenge lies in establishing standardized assessment methods due to the varied nature of the program. The major challenges in 21st century skills revolve around designing appropriate and authentic assessments and understanding their complexity, alongside developing learning progressions.

The Programme for International Student Assessment (PISA), an initiative by the OECD, measures 15-year-olds' abilities to apply their reading, mathematics, and science knowledge and skills to real-life challenges. PISA's measurement method involves a combination of cognitive tests, surveys, and questionnaires designed to measure students' knowledge, skills, and attitudes related to global issues and intercultural understanding, which are also pertinent for acquiring 21st-century skills [11]. Standard assessment methods are lacking in the context of custom-made content in international mobility programs like VAx/Hax. These programs facilitate experiential learning, fostering cognitive and communicative skills alongside other attributes such as emotional maturity and intercultural competence, posing challenges for evaluation.

Interdisciplinary education seeks to develop boundary-crossing skills through project-based assessment [2]. These assessments allow students to demonstrate their understanding of concepts across disciplines, nurturing critical thinking, problem-solving, teamwork, and communication abilities [12]. Qualitative approaches like cognitive tests, surveys, and questionnaires are commonly used to measure the results of interdisciplinary education through project-based assessment.

Constructivism advocates for formative assessment throughout the learning process to monitor students' progress, provide feedback, and inform instructional decisions. Formative assessment encourages active engagement and participation from students in the learning process. This may involve self-assessment, peer assessment, reflection activities, and opportunities for students to monitor and evaluate their learning progress [13], [14].

Per WA11GAP, some studies indicated that graduates' attributes cannot be assessed directly. Hence, it is necessary to develop measurable and pre-determined standards to evaluate learning. In 2001, Massachusetts Institute of Technology (MIT) published the Conceive, Design, Implement, and Operate (CDIO) syllabus that could be customized to any engineering program [15].

4. Objectives of this research

In the VAx/HAx series, the content covered is highly effective for developing global competence and closely aligns with the GAPC. As most participants are from engineering institutions, the learning outcomes are beneficial for developing their future engineering careers. However, certain attributes could be hard to impart through traditional lectures alone. These attributes require practical application and experiential learning, which are more suitable for mobility programs. Since mobility programs are typically elective rather than mandatory for degree acquisition, encouraging voluntary participation is essential. Understanding the motivation and incentive of the participants who achieved satisfactory results is crucial for encouraging future engagement. This research investigates the learning outcomes of these unique programs through the following research questions (RQs):

RQ1: What were the initial objectives of participants who chose to attend this program and travel to Indonesia, often at their own expense? What motivators would encourage future participants to join international mobility programs?

RQ2: What are participants' learning outcomes related to WA11 GAPs?

RQ3: Which program content and/or conditions were influential to participants' learning outcomes?

5. Program Structure

1) Hosting Institutions and Participant Home Universities

VAx was initiated by the six core members of the ATU-Net Mobility SIG. Consequently, participants are engineering students studying in one of the 40+ ATU-Net member institutions. The diversity among lecturers and participants encourages a multi-ethnic environment.

2) Lecture components

The program's interdisciplinary approach begins with six lectures focusing on technological topics. While these courses cover a broad range of concepts, the underlying themes are "ongoing technical advancement," "social issues," and "creation of innovation through the technical application and ideas."

An additional six lectures explore the cultures and histories of each participating country. Typically, engineering students put lower priority on social science subjects such as anthropology. However, this course aims to challenge that tendency by shedding light on the richness of Asian countries. By understanding and appreciating the diversity of Asia, participants are encouraged to develop a deeper connection with their heritage and cultivate pride in their Asian identity. The interdisciplinary lectures, listed in Table 2, aim to stimulate participants' engineering curiosity beyond their specific field of study in technical aspects and to provide insights into the richness and value of Asian cultures and histories from social science perspectives.

Table 2: Interdisciplinary Lecture Composition

	Technological lectures	Culture and history lectures
1	Evolution of robotics	Malaysia northern region
2	Point-of-care medical tests	Thailand
3	Innovative technologies for sustainability	The Philippines
4	Electric power generation	Malaysia eastern region
5	Smart farming	Indonesia
6	P2P networks and electronic information systems	Japan

3) Extracurricular activities and environment

Beyond the conventional lectures for knowledge acquisition, every aspect of the HAx program offers valuable learning experiences, particularly for participants traveling abroad for the first time, or at least new to Indonesia. Managing flight tickets, travel insurance, and entry visas to navigating passport requirements, every logistical aspect can become part of the learning experience. Sharing an on-campus hostel room with a new friend and continuous interaction throughout the 8-day program presents a rare opportunity for cultural exchange and personal growth. Each team is intentionally composed of individuals from at least three different ethnic backgrounds, promoting diversity and cross-cultural understanding. Off-campus activities, including team building with Indonesian traditional games, cultural dances, and field trips, further enrich the learning experience. Additionally, presentations at vocational schools and visits to community villages offer opportunities for interaction with local teenage students.

6. Research Methodology

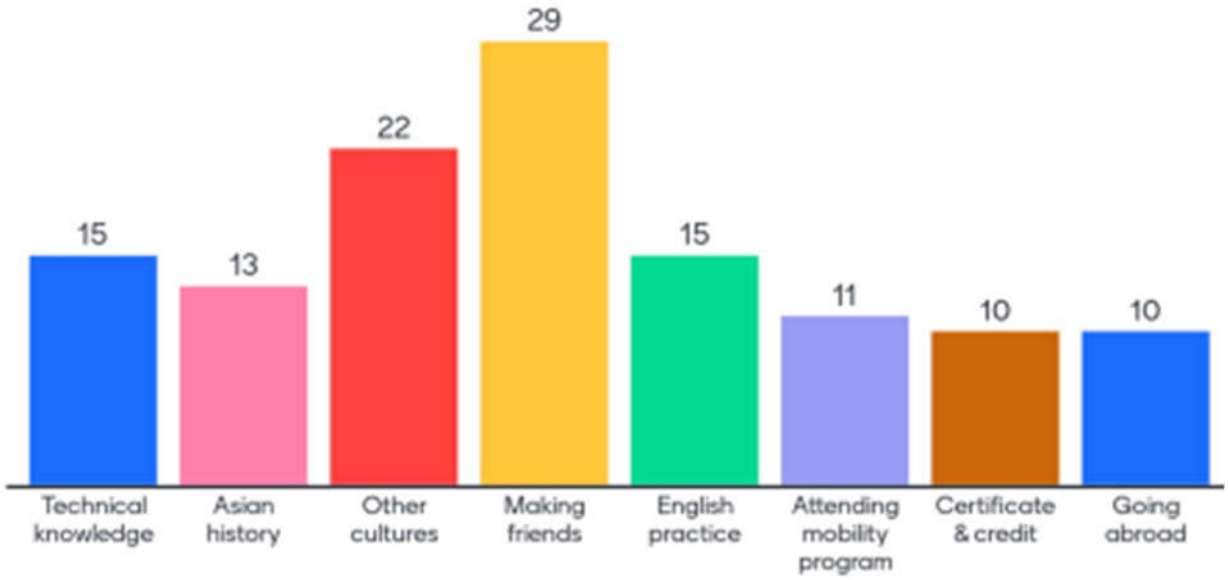
Data were obtained through the following methods. As there is no standard assessment method for such programs, and given the challenges inherent in quantitatively assessing the values of multi-ethnic environments and mutual learning conditions, simple statistical analysis is applied.

1) Questionnaire distributed to participants at the commencement and conclusion of the program.
2) Self-evaluation using Likert scale to gauge participant's learning experiences.
3) Interviews with a select group of students.

7. Data Analysis

Based on the questionnaire data, the initial objectives of attending the onsite program are illustrated in Chart 1. Among the 44 onsite participants, 29 individuals (65.9%) cited "Making friends" as their primary goal, while 22 participants (50%) mentioned "Knowing other cultures." Next, 15 participants (34.1%) highlighted "Technical knowledge" and "English practice" as their objectives. While it may be assumed that most participants are extroverts by nature, given their voluntary decision to travel to Indonesia, the opportunity to make new connections emerge as a significant incentive. Educators should recognize the intrinsic value of interpersonal networking when promoting participation in mobility programs. Highlighting the potential for personal growth and cross-cultural exchange can effectively encourage students to pursue international opportunities despite associated costs and time commitments.

Chart 1: Results of questionnaire about participants' objectives



In Chart 2, the post-program questionnaire gauged the effectiveness of participants' experiences and environment throughout the program, utilizing a Likert scale ranging from 1 to 5. Although the difference between the scores of 4.40 and 4.33 is minimal, it is noteworthy that the highest-rated factor was “Informal interaction with professors & staff of hosting universities.” This emphasizes the influential role of professors in shaping participants’ learning experiences. Additionally, “Group work and final presentation” also emerged as highly effective in enriching participants’ experiences. This is considered to be consistent with the initial objectives of

"Making friends" and "Interest in other cultures." Visits to "local community" and "vocational school" also earned high scores, indicating interactions with local people were inspiring for the participants.

Chart 2: Post-program questionnaire about onsite program content effectiveness

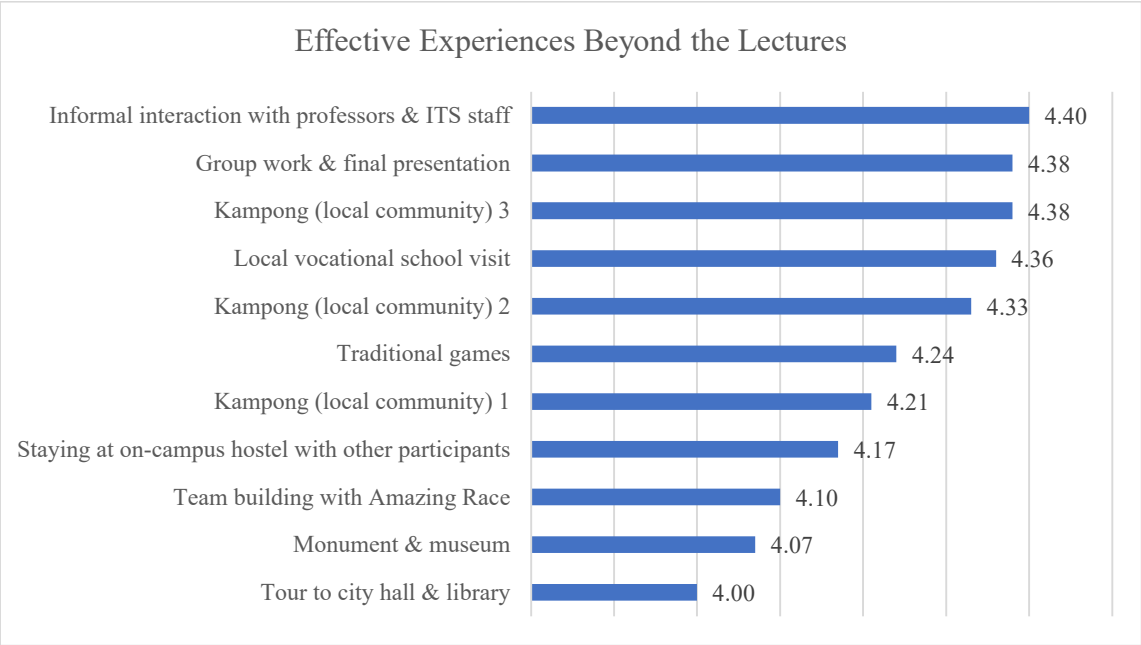


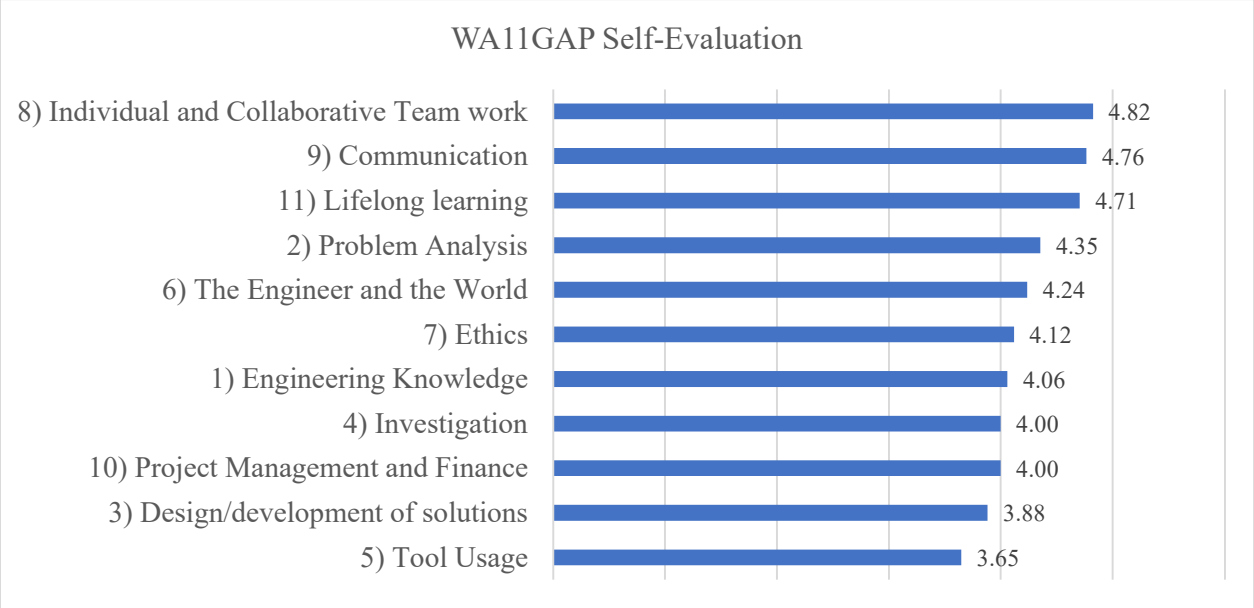
Image 3 captures a visit to the local village Kampong, providing participants with exposure to domestic lifestyle experiences. Meanwhile, Image 4 shows a presentation at the local vocational school, offering participants the opportunity to introduce their countries to Indonesian youngsters, fostering cross-cultural interaction and understanding. These extracurricular activities gave memorable impressions that are difficult to obtain inside the classroom. Post-program interviews revealed that several students found the experience of presenting on their own countries particularly impactful, leading to a deeper realization of the uniqueness of their Asian backgrounds.

Image 3: Visit to a Local Village

Image 4: Presentation at Vocational School

Chart 3 depicts the effectiveness of this program related to the WA11GAP criteria assessed with Likert Scale self-evaluation from onsite participants (n=15), ranging from 0 (nothing) to 5 (Excellent). While these scores are subjective, it is evident that the participants recognized the improvements in particular skills or awareness and would likely keep seeking similar programs. The major outcomes based on the WA11GAP criteria are “Individual and Collaborative Team work” (4.82), “Communication” (4.76), “Lifelong learning” (4.71), “Problem analysis” (4.35), and “The engineer and world” (4.24), respectively.

Chart 3: Post-program self-evaluation about WA11GPA



Post-program interviews and feedback from questionnaires highlighted the value of learning about both one's own culture and the cultures of others. Participants emphasized the significance of presenting their backgrounds to local vocational school students as a means of succinctly conveying the essence of their homeland. This ambassadorial role not only allowed them to represent their nations but also instilled a sense of responsibility to mentor local youth as senior figures from abroad. Interestingly, Japanese participants unanimously acknowledged that other Asian students are more advanced in presentation skills, attributing this discrepancy to the limited active learning programs in Japan, especially prior to undergraduate studies. They expressed the necessity for further practical experiences in holding discussions and presentations, and expressed the willingness to attend extracurricular activities during their ordinary student life.

Based on these results, the initial research questions (RQs) can be addressed as follows:

RQ1: The primary objectives of participants include making friends and fostering curiosity about other cultures. These could be a great motivator even for engineering students to encourage participation in mobility programs, in addition to the educational benefits. While earning study credits is also an essential incentive, it is a secondary factor in encouraging their actions to travel abroad.

RQ2: Regarding WA11GAP, mobility programs are great opportunities for team work, communication, and awareness of lifelong learning, which can be more effective to acquire through practice rather than traditional educational studies.

RQ3: The most influential factor for participants' learning outcomes is the facilitation of interaction and collaboration among multinational participants, professors, organizing staff, and local communities. Presentations to local vocational students and local community visits provided participants with inspiring experiences to raise awareness about society beyond their borders.

8. Conclusions and further research:

Graduates from university courses often face a skills gap, lacking essential attributes such as communication, decision-making, problem-solving, leadership, emotional intelligence, stoical ethics, etc. [16]. Mobility programs offer valuable opportunities for engineering education beyond the classroom, leading to the acquisition of WA11GAP skills, such as teamwork, communication skills, lifelong learning, and societal awareness. Building friendships with peers from different countries serves as a compelling incentive for young students to participate in mobility programs, facilitating cross-border mutual understandings through interdisciplinary education.

This finding extends to the hypothesis that mobility programs, particularly those involving interaction with local communities and younger students, can cultivate participants' awareness of leadership qualities. Therefore, leadership development will be integrated into the upcoming HAx Batch 2 scheduled for June-September 2024. Reflection and peer feedback mechanisms will also be implemented to perpetually enhance future programs and facilitate ongoing academic investigation.

Furthermore, the authors have developed a text-mining tool for qualitative analysis of non-technical skills [17], which has proved effective for identifying factors that contributed to the learning outcomes of WA11GAP improvements. Future research endeavours will explore this tool's potential for further investigation in tandem with program enhancements.

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