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Long-Term Effects of Short-Term Intervention Using MOOCs for Developing Cambodian Undergraduate Research Skills

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Developing highly skilled researchers is essential to accelerate the economic progress of developing countries such as Cambodia in South East Asia. While there is continuing research investigating Cambodia's potential to cultivate such a workforce, the circumstances of undergraduate students in public provincial universities do not receive ample attention. This is crucial as numerous multinational corporations are participating via foreign direct investments in special economic zones at the border provinces and need talented human resources in Cambodia as well as in neighboring Southeast Asian countries such as Thailand and Vietnam. Student's research capability growth starts with one's belief in their capacity to use the necessary information tools and their potential to succeed in research. In this research paper, we look at how such beliefs, specifically research self-efficacy and information literacy, can be developed through a short-term intervention that uses MOOCs and assess their long-term effects. Our previous research has shown that short-term training intervention has immediate positive effects on the undergraduate students' self-efficacies in Cambodian public provincial universities. In this paper, we present the follow-up study results conducted sixteen months after the said short-term training intervention. Results reveal that from follow-up evaluations that while student's self-efficacies were significantly higher than before the short-term intervention was completed, they were lower than immediately after the intervention. Thus, while perfunctory interventions such as merely introducing the students to MOOCs and other relevant research tools over as little as three weeks can have significant positive effects, efforts must be made to sustain the benefits gained. This implication is essential to developing countries such as Cambodia that need low-cost solutions with immediate positive results in developing human resources to conduct research, particularly in areas far from more developed capital cities.

1 Introduction

Due to the genocide of the Khmer Rouge (1975–1979), Cambodia’s higher education system has suffered because it was followed by continuous civil war, political conflicts, social insecurity, and very unstable economic reform [7]. By the early 1990s, Cambodia switched to a free-market economy, so higher education gained importance and played a role as the key to human resource development.

Cambodia issued its first policy on research in the education system in 2010 [13]. Different sectors collaborated to promote the culture of research in Cambodia by investing funds so that the Ministry of Education, Youth, and Sport (MoEYS) would benefit. The World Bank provided USD 90 million to Cambodia to improve higher education and research quality between 2015 and 2025 and promote cultural research and capacity [34]. This is separate from the USD 23 million funding provided by the World Bank to MoEYS from 2011 to 2015. The World Bank funding was to support teaching, management, and research at Higher Education Institutions [HEIs] through the Higher Education Quality and Capacity Improvement Project [HEQCIP] programs [24]. Cambodia has continued to earn support for its educational institutions even during the COVID-19 pandemic. For instance, the United Nations Educational, Scientific, and Cultural Organization (UNESCO) has supported the strengthening of digital and distance learning in Cambodia when learners were forced to study online due to the educational institution lockdowns [31]. These higher education improvement efforts are expected to aid in moving the country’s developing economy forward as the country attracts international investment.

Multinational companies have been moving manufacturing operations to South East Asia (SEA), for example, through Cambodia’s special economic zones (SEZ) due to the rising labor costs experienced in China and to avoid trade frictions between China and the United States [22]. In particular, Japanese companies have been actively moving their operations to South East Asia (SEA) since the 2008 financial crisis [35]. In recent years, Japanese companies have started looking not just for low-skilled labor in SEA but also for highly skilled workers. Thus, they have been looking to hire local university undergraduate and graduate degree holders [18]. Japanese companies need human resources capable of high-skill activities such as problem-solving, which requires a researcher’s mindset. However, academic research capacity remains a shortcoming for Cambodia, especially in the provinces. About 80% of the universities in Cambodia have been established within just 15 years; thus, the quality of education, especially research skills, remain in the critical stage [32]. Additionally, faculty members at provincial universities are not as experienced in conducting research as their city-based counterparts [13]. Several of these SEZs are in international border facing provinces, as shown in

Figure 1. Thus, the provincial Cambodian talent is not just competing with their city counterparts but also with their neighbors, such as the Thai and the Vietnamese. In 2020, Thailand and Vietnam were ranked 67th and 96th respectively out of 132 countries by INSEAD in terms of global talent competitiveness; Cambodia, on the other hand, was ranked 117th [20].

To have a competitive edge, Cambodians in the provinces should have the research competency required by the SEZ investors. Additionally, they should be equipped with autonomous learning skills to enable them to quickly pick-up new skills as demands continuously change. Research and information literacy self-efficacies are essential attributes to conducting research and autonomous learning. Universities educate students that then work in society upon graduation. Their skills then form the foundation of the research capability of a nation. Thus, it is crucial to understand the self-efficacies of undergraduate students, especially in developing countries. While many researchers have investigated undergraduate students' self-efficacies in various geographical regions, Cambodian provincial universities' circumstances remain understudied.

Aside from being an individual's belief in his ability or capability to complete a specific task [4], self-efficacy is also seen as a person's ability to control a challenging task using their beliefs with their practices [23]. Self-efficacy, however, is not the same as competency; students who have high research self-efficacy do not necessarily have high research ability since the research environment – resources, mentoring, and motivation, among others – also matter [16]. Nevertheless, high research self-efficacy was found to be highly correlated to positive research attitude, which can serve as a starting point for future researchers [19]. Individuals who have high perceived self-efficacy believe that they will be successful, and they will continue to endeavor until finishing the task [10]. High research self-efficacy has been connected to future research involvement and higher research productivity in many studies conducted [21, 5, 14]. The gains from high research self-efficacy can be expected to be further magnified when combined with information literacy self-efficacy.

One of the most cited definitions of information literacy is the one given by the American Library Association in 1989. Information literacy is the set of abilities required by individuals for recognition when information is needed. They can locate, evaluate, and effectively use the information necessary [2]. Information literacy self-efficacy can be an individual's judgment of their own ability to access information, evaluate and use this information effectively [3, 17]. From here, we can see the relevance between information literacy self-efficacy and autonomous learning, where students are expected to control and regulate their own learning.

Students often gain those autonomous learning skills they need as part of their growth in tertiary education. However, progress is sometimes slow, and they have difficulty understanding some of the basic tenets of information literacy.

which are conceptually similar in Cambodia). The questionnaires were delivered as five-point Likert scales.

A training intervention was administered to 461 undergraduate students at three public provincial universities in Cambodia between August to October 2018 to address the deficiency in the said self-efficacies [27, 28]. The participants were pooled from the respondents in the original study. The participants answered the same sets of questionnaires before and after the intervention. The training lasted three weeks and was 60 hours in total covering topics such as using statistical analysis software, Massive Open Online Courses (MOOCs), and referencing software. Typically, training interventions address the concerns directly: in our case, research self-efficacy and information literacy self-efficacy. However, through the analysis of the cross-sectional study results, we learned that the current infrastructure in these universities – from the facilities, curricula, and even teacher training – was lacking. Interventions directed at the target self-efficacies may work. However, the students may not have the chance to cultivate their knowledge and transform their self-efficacies to quality research outputs. We decided to design the interventions to cover the more practical topics and investigate if these indirect, yet pragmatic, approaches can have positive results.

While knowing how to use statistical and reference management software have direct usage in research, the benefit of being exposed to MOOCs is not as straightforward but can be profound. Because MOOCs are typically self-directed learning experiences, they promote self-regulated learning skills [1]. Independent learning can come in handy in research projects as it is expected for researchers to find gaps in their knowledge that they must quickly fill. Some learners additionally require the structure provided by courses to assess if their learning has been enough. During the training intervention, the learners attended MOOCs on edX for three days (four hours per day, thus 12 hours in total). They were given the freedom to choose courses on English language, academic writing, research methodologies, and statistics. The goal was simply to familiarize the learners with the learning format. The students were taught how to create accounts, choose courses, and navigate the edX platform. They were also required to at least complete a quiz and the researcher was available throughout the training to provide support. The decision whether to complete the MOOCs they enrolled in is left to the students. Trainings for using statistical software and reference management software were done for eight and four days, respectively.

The use of MOOCs not just for academic purposes but also for professional and capacity building is not new. In January 2021, the online course aggregator Class Central has listed more than 300 courses specific to career development [8]. Recognized institutions in the region such as the Asian Development Bank (ADB) have developed several MOOCs intended for capacity building of government employees in developing countries within the region [26]. And while the

creation of MOOCs is not yet widespread in Cambodia, several Cambodian universities had been embracing the use of MOOCs. With the onset of the COVID-19 pandemic, Cambodian universities have promoted MOOCs such as through the Erasmus+FRIENDS Project MOOC [11]. Another notable example is the Institute of Technology of Cambodia's efforts to use MOOCs both in English and in their native language Khmer even before the pandemic has started [15].

The result indicates that short-term training is an effective means to promote information literacy and research self-efficacies among students. This result is not surprising: it is known that providing educational activities such as short-term training interventions can help raise self-efficacy beliefs [4]. What remains to be understood is how effective is the said intervention. Will the students sustain their gained self-efficacies until they are given a chance to demonstrate their research skills later in their career? We addressed these questions through a follow-up study detailed in this paper.

3 Methodology

After one year and four months, we conducted a follow-up survey at two public provincial universities in Cambodia. We randomly selected 60 students from each university from the same pool of 461 respondents during the training intervention (or the post-test), with the added criteria of coming from the best and worst performing universities during the pre-test and post-test for practical purposes. As mentioned previously, the post-test students were pooled from the 1009 respondents during the cross-sectional study (or the pre-test). Of the 120 students contacted, 95 students responded. After data processing, 87 responses were deemed to be complete for further analysis.

This research study adopted a mixed method approach to respond to each research question. Descriptive statistics such as the minimum, maximum, and mean scores of each research self-efficacy and information literacy self-efficacy items on each test (pre-test, post-test, and follow-up) were calculated. A paired samples t-test was used for the pre-test, post-test, and follow-up surveys of each of the 87 respondents to determine research self-efficacy and information literacy self-efficacy over time. The data were analyzed using the Statistical Package for Social Sciences (SPSS). An alpha value (α) of .05 (level of significance) was used for each statistical analysis. Cohen's *d* was used for calculating the effect sizes, which were typically interpreted as small for values between 0.2 to 0.5, medium for values from 0.5 to 0.8, or large for values greater than or equal to 0.8 [9]. Randomly selected students were invited for unstructured interviews to probe on their views about potential research careers in the future.

4 Results and Discussion

The RSE and the ILSES items are grouped into factors using the pre-test results with principal component analysis (PCA). The subsequent studies for post-test and follow-up are presented here according to these computed factors for brevity. The RSE resulted in four factors which we consequently labeled as research design skills, practical research skills, quantitative and computer skills, and writing a paper for a journal publication. The ILSES, on the other hand, resulted in three factors, which we labeled as information literacy skills for research production, information handling skills, and skills in using library resources.

Figure 2 shows that the respondents' research self-efficacy levels during the pre-test and the follow-up were under the median score of 3 for the five-point Likert scale. The overall research self-efficacy mean scores are higher during the post-test and follow-up than the pre-test. Statistical analysis with the follow-up data also showed a significant difference with the pre-test scores. These findings indicate that while the participants became more accepting of research self-efficacy from the post-test due to the IT training intervention, their attitudes had become less confident on research one year and four months after the intervention. The levels are still better in comparison to the pre-test. Thus, even though the training intervention is only short-term, its impact remains on their research self-efficacy.

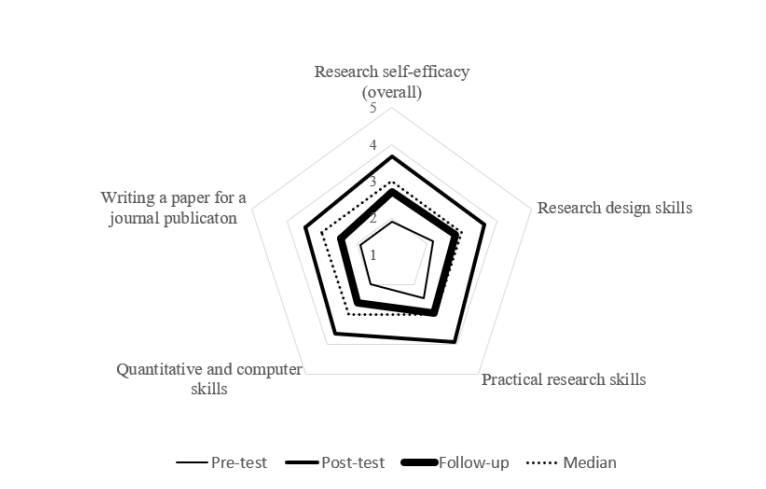


Figure 2: Mean scores for pre-test, post-test, and follow-up on research self-efficacy

Figure 3 shows that respondents' overall information self-efficacy levels during the pre-test and follow-up survey results were under the median score of 3 for the Likert scale. We also noticed that the pre-test scores are the lowest for all factors, while the post-test is the highest. The result for information literacy self-efficacy is thus, like that of the research self-efficacy. This means that doing just one intervention is better than none, but it is not enough to sustain a long-term effect after one year and 4 months.

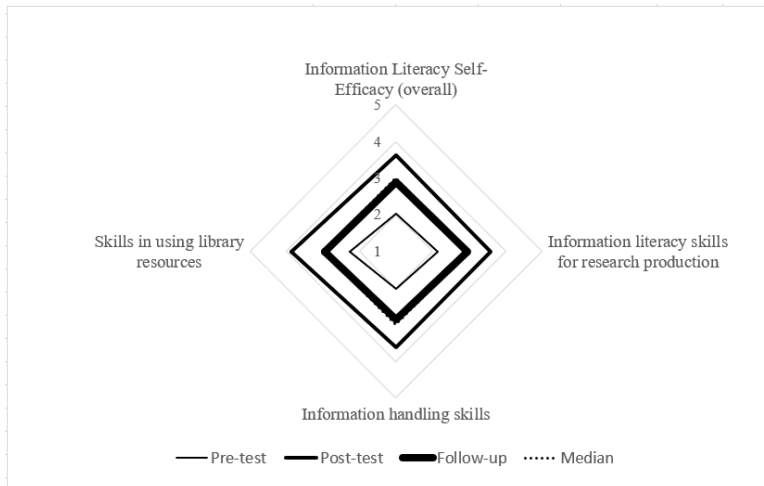


Figure 3: Mean scores for pre-test, post-test, and follow-up on information literacy self-efficacy

Table 1 shows the mean score differences between follow-up assessment and pre-test on subscales of research self-efficacy. The observation revealed a significant mean difference between follow-up and pre-test on overall research self-efficacy ($t = 11.07, df = 86, p = .000$) with a mean score difference of 0.81 in value. Effect sizes of these differences were also large and found to be 1.279, .916, 1.006, 1.070, and 1.187 for each factor, respectively.

Table 2 shows the mean score differences between follow-up assessment and pre-test regarding subscales of information literacy self-efficacy. It is observed that the mean difference between follow-up assessment and pre-test students regarding overall information literacy self-efficacy ($t = 10.68, df = 86, p = .000$) was remarkable with a value of .88. The high effect sizes of these differences were also observed to be .990, .998, .699, and 1.145 for each factor, respectively.

Table 1: Comparison of research self-efficacy scores during pre-test and follow-up

Factor	Pre-test		Follow-up		Paired samples test		Effect size
	Mean	SD	Mean	SD	t	Sig.	
Research design skills	1.93	0.61	2.81	0.41	11.93	0.000	1.279
Practical research skills	2.2	0.70	2.96	0.53	8.55	0.000	0.916
Quantitative and computer skills	1.81	0.61	2.6	0.46	9.38	0.000	1.006
Writing a paper for a journal publication	1.64	0.64	2.47	0.49	9.98	0.000	1.070
Research self-efficacy	1.90	.58	2.71	0.40	11.07	.000	1.187

Table 2: Comparison of information literacy self-efficacy scores during pre-test and follow-up

Factor	Pre-test		Follow-up		Paired samples test		Effect size
	Mean	SD	Mean	SD	t	Sig.	
Information literacy skills for research production	2.14	0.76	2.95	0.54	9.24	0.000	0.990
Information handling skills	2.03	0.72	2.86	0.57	9.31	0.000	0.998
Skills in using library resources	2.26	0.89	2.96	0.55	6.52	0.000	0.699
Information literacy self-efficacy	2.02	.70	2.9	0.49	10.68	.000	1.145

From these results, we learn that the students are better off with short-term training intervention than without it even in the long run. However, the positive effects can fall apart if no follow-up action is made. When the selected universities' curricula were analyzed, we learned that there is only a single computer-based course offered during the first year, and students can opt-out of the research requirement for graduation by taking comprehensive exams instead. Because research skills and information literacy skills cannot be separated, the number of courses about research and IT in these undergraduate programs should be increased. However, upgrading curricula can be costly both in time and money as it will require a careful reevaluation of the current curricula, consultation with relevant stakeholders, and retraining. This is where introducing the students to MOOCs can have a compounding effect. Multiple research studies have shown that MOOCs can be a game-changer for developing countries. It provides access to high-quality learning materials produced by top institutions in other parts of the world without the time, cost, and location restrictions [33].

The follow-up study also involved informal interviews with the students on what they learned from the short-term intervention and how it has impacted them. The students indicated that through the short-term intervention, they learned how to enroll in MOOCs and conduct basic data entry and analysis. They saw the activity as very practical in improving their research skills which led them to having better understanding of other related concepts such as qualitative approaches. Because of this, they gained confidence in writing a thesis instead of just taking the examination option for graduation. These perceptions support the effectiveness of our approach; with their improved self-efficacies, the students gained confidence in exposing themselves to research activities, which can cascade into skill development through practice.

Undergraduate students should also be directed to activities that develop these skills to positively affect these skills. This can be done by making the research option more palatable to students by enticing the faculty to develop their research skills and let them serve as positive role models. Un and Sok [30] pointed out that only a handful of academics in Cambodia had completed doctoral programs; about the same number of academics did not even hold qualifications at the master's level. Eam's [12] research found that faculty members' research interest in Cambodia was directly related to competence. Students should be provided the skills throughout their entire stay in the university and not just in select years.

5 Conclusion

Cambodia has been setting its sight on using higher education to advance its economy, as evidenced by the attention being given to higher education not just by the Cambodian government but by international bodies such as the World Bank. With the current global job market demands, provincial universities are prime candidates for these developments. Several SEZ that attract multinational companies seeking highly skilled research capable human resources are being built in the provinces. Our previous studies have shown that undergraduate students in the provinces are not well-equipped with research and information literacy self-efficacies. These are essential skills to succeed in conducting research, and this concern can be remedied with a short-term intervention targeting practical skills, one of which is familiarization with MOOCs. The follow-up study discussed in this paper supports our previous studies' results that short-term intervention positively affects both research self-efficacy and information literacy self-efficacy. However, after an extended period, the effect tapers off without follow-up support. Thus, our follow-up study also reinforces our previous recommendations to integrate research and information literacy throughout the undergraduate curriculum (i.e. from the first year to the fourth year).

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