

An Assessment Tool for Measuring Learners' Self-Efficacy

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ABSTRACT

Self-efficacy is a psychological concept used to explain one's belief in his or her own ability to accomplish a certain task. Four interrelated aspects are discussed to form one's self-efficacy: mastery experience, vicarious experience, verbal persuasion, and emotional arousal. This concept has been adopted by a number of quantitative studies using questionnaires as a measuring tool. However, little emphasis has been given to the four aspects of self-efficacy, but overall confidence in general, making theoretical interpretation limited. This study therefore developed a 12-item questionnaire to measure self-efficacy in educational contexts, three of which represent each of the aspects. The reliability of the questionnaire was tested with 218 secondary school students, showing high Cronbach's alpha scores of 0.86. The validity of the questionnaire was tested based on the Item Objective Congruence (IOC) index, assessed by three researchers. None of the 12 items were rated lower than 0.75 in average. Finally, the usefulness of the questionnaire has been reassured by its statistical evidence reported in SCOPUS articles. Hence, we recommend other researchers interested in using self-efficacy as a framework to use this questionnaire for measuring students' belief in their own ability to complete any given task.

Keywords

Self-efficacy; Mastery experience; Vicarious experience; Verbal persuasion; Emotional arousal; Measuring tool

Introduction

Students' learning experiences can be cultivated by various factors such as what they see, what they hear, what they experience, and what they feel [1]. These four aspects are believed to form people's belief in their own ability to accomplish a certain task, known as self-efficacy [2]. The concept has been used for different purposes in various fields including intellectual, family, educational, professional, social, religious, moral, life standard and health [3].

Recently, the concept has been used to assess the effectiveness of learning innovations to determine how the innovations can be associated with students' development of their own belief in their ability. Predominantly, it is used to convey how levels of self-efficacy alter after participating in an innovative learning activity using a pre-posttest intervention [4]. In addition, this belief has been

found to relate with the level of growth mindset cultivated among school learners. To be more precise, the greater the level of self-efficacy, the greater the level of growth mindset [5].

Numerous tools for assessing self-efficacy have been proposed [6]. However, they rely exclusively on a single statement pointing to the level of confidence in various fields. Little emphasis has been given to the four aspects of self-efficacy (i.e., what respondents see, hear, experience, and feel), making the theoretical interpretation limited. This study therefore attempted to close this gap by developing a questionnaire to measure self-efficacy applied in educational contexts where students are exposed to learning activities.

To focus on the effectiveness of the questionnaire, this study carried out a reliability test based on Cronbach's alpha values, a validity test based on the Item Objective Congruence (IOC) index, and a

review of empirical evidence showing how this questionnaire has been used in research studies published in SCOPUS. It is believed that those interested in using self-efficacy as a framework to trace students' development of their own belief in their ability especially, teachers, educators, and researchers can adopt, if not adapt, this tool to reveal learning experiences of students in their own contexts.

Literature Review

Self-efficacy is defined as the belief in one's own ability to complete a given task [1]. People with a lower level of self-efficacy are likely to avoid challenging tasks, surrender to difficulties, and withdraw their action from participation. In contrast, others who attain a higher level tend to embrace challenges more persistently which results in achieving more desirable outcomes [2]. In this respect, self-efficacy is similar to the concept of mindset which is a set of beliefs an individual has that guides how one responds to or interprets a situation and an established attitude in one's ability to succeed in certain areas [5].

According to the social learning perspective, Bandura posits four main sources of self-efficacy consisting of *mastery experiences*, *vicarious experiences*, *verbal persuasion*, and *psychological states* [1]. First, the source of belief in people's ability stems from their own direct experiences where they use their skills and abilities to handle challenges by themselves. This source of progress in self-efficacy is the most effective method to develop a strong sense of efficacy. Individuals' efficacy will surge if they can accomplish the task. However, occasional mistakes may lower it. An ample evidence for this is when students become more confident in their ability to run computer programming after participating in an activity on unplugged coding which helps lay a foundation for programming [2].

Secondly, another source of such belief arises from observing others accomplishing a certain task, known as *vicarious experiences*. Intuitively, when people observe a model accomplishing a certain task without any negative impact to them, they are likely to think that if they dedicate their effort and time to do likewise, they would be able

to achieve the same result. On the other hand, they observe that those having a comparable level of competency fail the task, their confidence in accomplishing the task will potentially be reduced [2].

Furthermore, the third source of self-efficacy originates from someone else's words, called *verbal persuasion*. Positive encouragement given in an appropriate context where actions are taken can help promote one's self-efficacy. In contrast, negative comments can discourage people from taking actions. Verbal persuasion can be more efficient if they are linked with action. That is to say, when people are being encouraged verbally but there are no challenges being faced, self-efficacy is less likely to be developed [5].

Lastly, *emotional arousal* in different settings is also considered as another source of one's efficacy. People tend to envision success when there is no arousal. In contrast, in a situation where there are high levels of stress or adverse situations, self-efficacy is likely to be lowered [7]. However, these factors can be reduced if individuals can develop skills to cope with these threatening circumstances. In order to achieve these skills, one must confront their fear and anxiety so that they gain personal experiences from these situations [7]. It is important to note that this source can be interchangeably called as physiological and psychological states [2].

Recently, self-efficacy has been applied in two different aspects. The first application is to use it as a framework to compare how students' self-efficacy is developed after their participation in an innovative learning activity. For example, an unplugged coding activity using flowcharts was implemented with 160 secondary school students whose levels of self-efficacy was monitored before and after participating in the developed activity. The study revealed a statistical increase in the level of self-efficacy in the post-test, compared to the pre-test in all four aspects [4]. This study suggested that an active learning environment is supportive for learners to interact with others through their mastery experiences via hands-on involvement, vicarious experiences via looking at other team members, verbal persuasion

via group discussion, and emotional arousal through excitement of the learning activity.

Besides, the second application of the concept is on the investigation of the relationship between self-efficacy and growth mindset. A quantitative study with 206 high school students revealed that there were positive correlations between growth mindset and mastery experience, and between growth mindset and verbal persuasion. This study suggested that it is crucial for both parents and teachers to allow their children to expose to a variety of direct experiences as they would enhance their self-efficacy which in turn can help develop their growth mindset. Also, it is important to be aware of their praise for their children. This study suggests that verbal persuasion focused on effort can potentially help cultivate a growth mindset, while compliments on intelligence may potentially lead to a constant development of a fixed mindset. Additionally, students themselves are suggested to learn to exclude some forms of verbal persuasion that may trap them to appreciate praises on intelligence, but keep on exposing to direct experience to grow their self-efficacy and allow their mastery experience to nurture their process of self-betterment [5].

To assess self-efficacy, a number of quantitative tools have been developed. Chief among others is the Self-Efficacy Survey (SES) which was designed to evaluate ten functional areas: intellectual, family, educational, professional, social, religious, erotic, moral, life standard and health. A pool of 150 items was created and validated by two expert judges (15 items for each area). To implement it in empirical settings, between 10 and 18 items were chosen to represent self-efficacy scenarios relevant to the particular area. The initial version of SES was administered to a number of 246 participants. The Cronbach's alpha values of the internal consistency of SES ranged between .48 and .81 [3]. Unfortunately, the questionnaire statements used in the SES only measure levels of confidence in general. No

detailed explanations on how these items came about were discussed in detail. In addition, it is unclear whether the four aspects of self-efficacy: mastery experience, vicarious experience, verbal persuasion, and emotional arousal, are taken into consideration or not.

In addition to this, the Self-Efficacy Questionnaire for Children (SEQ-C) was developed. It included three main aspects: social self-efficacy, academic self-efficacy, and emotional self-efficacy. The SEQ-C contains 24 items, eight of which represent each of the self-efficacy domains. To validate its reliability, it was administered with 330 young adolescents. The internal consistency reliability of the SEQ-C was proven satisfactory as Cronbach's value was .88 for the total self-efficacy score and between .85 and .88 for the three subscale scores [8].

A similar critique can be given to this tool. Despite its positive features in classifying the three domains of self-efficacy, the SEQ-C fails to show the integration of the four sources of self-efficacy described by Bandura [1]. When considering the 24 items, it is possible to relate parts of the questionnaire to one of the four sources, especially emotional arousal. However, no deliberate explanation is given that this is the intention to develop the tool. Also, even though attempts can be made to map, this is only based on our assumptions which might not be true from the point of the author of this paper.

This study therefore aimed to develop a questionnaire to examine levels of self-efficacy in educational contexts. It incorporated the four aspects described by Bandura [1]. The following sessions compose of the methodology to develop and verify the reliability and validity of the questionnaire. Next, the discussion proceeds with the review of the usefulness of this questionnaire in SCOPUS research articles.

Table 1. The developed questionnaire items

No.	Statement	Self-efficacy aspect
1	The learning experience in class makes me feel confident that I can successfully accomplish any relevant tasks in the future	Mastery experience
2	When I see others, who have the same level of competency with me succeed in a certain task, I am confident that I can also do it.	Vicarious experience
3	When my teachers encourage me that I can successfully accomplish a given task, I am confident that I can do it.	Verbal persuasion
4	I feel that I can successfully accomplish any given task if I think I enjoy doing it.	Emotional arousal
5	The learning experience outside the classroom makes me feel confident that I can successfully accomplish any relevant tasks in the future.	Mastery experience
6	When I see my classmates, who have the same level of competency with me succeed in a certain task, I am confident that I can also do it.	Vicarious experience
7	When my parents encourage me that I can successfully accomplish a given task, I am confident that I can do it.	Verbal persuasion
8	I feel that I can successfully accomplish any given task if I feel at ease (not being anxious) about it.	Emotional arousal
9	The learning experience that I encounter by a self-directed approach makes me feel confident that I can successfully accomplish any relevant tasks in the future	Mastery experience
10	When I see my teachers succeed in a certain task, I am confident that I can also do it.	Vicarious experience
11	When my classmates encourage me that I can successfully accomplish a certain task, I am confident that I can do it.	Verbal persuasion
12	I feel that I can successfully accomplish any given task if I think it is interesting for me to do so.	Emotional arousal

Methodology

To develop the 12 statements as shown in Table 1, each of the aspects of self-efficacy: *mastery experience*, *vicarious experience*, *verbal persuasion*, and *emotional arousal* was carefully defined. Then specific contexts that may be relevant to students were drawn to make the statements more vivid. To elaborate this, the mastery experience statements (items 1, 5 & 9) were put into three different contexts, consisting of classroom, outside the classroom, and self-directed learning. Similarly, the verbal persuasion statements were classified into three distinct influencers composing of teachers, parents and peers (items 3, 7 & 11). The statements for vicarious experience were also related to three possible models that students may encounter:

classmates, teachers and others (items 2, 6 & 10). Finally, the emotional arousal statements were revealed into three dimensions: enjoyment, interest, and anxiety.

Once the development of the 12 statements was done by the three authors, the validity of the questionnaire was first tested based on the Item Objective Congruence (IOC) index, assessed by three researchers. These invited researchers are those working on the psychology of learning and self-efficacy is not alienated to them. In order to do so, they were asked to do two things. First, they were asked to map the 12 statements into the four aspects of self-efficacy. Afterwards, they were asked to rate their opinion if the statements are readable, understandable and suitable for representing the four aspects. They could rate 1 to

each of the statements if they think it is perfectly fine. They could give 0 if they feel that it is ambiguous. Alternatively, they could rate -1 if they think that it is somehow not effective. However, they were encouraged to suggest possible improvements if they decided to choose either 0 or -1. To decide whether the statements could be empirically used, the authors did not choose any statement gained an IOC score lower than 0.75, or revised it according to the suggestion from the invited researchers.

The reliability of the questionnaire was tested with 218 secondary school students who participated in a learning activity on game-based learning to enhance their understanding of phylogenetic tree construction. The questionnaire was distributed twice: before (Trial 1) and after (Trial 2) participating in the activity. Cronbach's alpha was used to measure the internal consistency, or how closely related a set of items are as a group. It is considered to be a measure of scale reliability [3]. The general rule of thumb is that a Cronbach's alpha of .70 and above is good, .80 and above is better, and .90 and above is best.

It is important to note that the data collection process with the participating students was carried out with an immense concern of ethical conduct. The students were invited to take part based on their willingness. They could voluntarily decide to join in. All of them were informed about the purpose of this research and they were aware of their own rights to withdraw from participation with no consequences on their study. Both consent and assent forms were retrieved from the students and their guardian, respectively. In addition, their participation and response to the questionnaire were kept confidential and anonymous. Only the three authors can access the data for the sake of data analysis only.

Results

To determine the validity of the questionnaire, rating opinions from the three invited experts were collected. The finalized statements shown in Table 1 were ones that passed this selection criterion (the IOC index of 0.75 and above). In fact, no major comments were given by the invited researchers, only some minor revision to improve

the readability of the statements. Therefore, all of them were rated 1 as a result after the minor revision.

To estimate the internal consistency which implies the reliability of the questionnaire, the Cronbach's alpha values were computed. The first trial was carried out among 218 secondary school students prior to their participation in the learning activity (game-based learning). The Cronbach's alpha value of the internal consistency was 0.84, showing its great level of internal consistency. Since this learning activity was set to compare students' self-efficacy before and after their participation in the activity, it is then possible for us to perform another Cronbach's alpha test. Likewise, this second trial revealed that the questionnaire contains a great value of Cronbach's alpha of 0.86 which points out its great level of internal consistency.

Table 2. The reliability tests

Trial	Cronbach's alpha	No. of items
1	0.84	12
2	0.86	12

Discussions

Based on the two statistical tests, it is evident that this 12-item questionnaire can be effectively used to investigate learners' self-efficacy. Three sets of rationales can be discussed to support this claim. First, the three invited researchers who are experts in the field of learning psychology unanimously agreed that the 12 statements can be mapped with the four aspects of self-efficacy with no difficulty. Also, their rated opinions verified that each of the statements serves to measure what is intended for. Second, this becomes more evident when using the questionnaire among the participating students, none of them were curious about what the statements mean and in fact could complete the questionnaire with no additional clarification questions. Third, the Cronbach's alpha values gained from both trials confirmed that the internal consistency of the 12 statements is exceptional, which is as high as that of SEQ-C [8], nonetheless higher than that of SES [3]. On top of that, none of the previous measuring tools fully map their

statements to the four aspects of self-efficacy: *mastery experience*, *vicarious experience*, *verbal persuasion*, and *emotional arousal*, making this questionnaire of interest for those aiming to measure learners' efficacy in these dimensions originally described by Bandura [1].

In order to highlight the usefulness of this questionnaire in the field of educational research, two SCOPUS indexed articles are cited here to reveal how the questionnaire was successfully used in empirical studies. The first study used the questionnaire to explore the level of self-efficacy of secondary school students who participated in an unplugged coding activity using flowcharts to help students develop computational thinking skills. The study employed the full set of 12 items whose results conveyed that the level of self-efficacy of the participants gained after participating in the activity was statistically greater than the mean gained before attending the learning activity [4]. However, instead of using the term emotional arousal, this study uses the term psychological state, which indicates exactly the same construct. The analysis of this study depends on a Wilcoxon-signed rank test of, both the summation of the entire statements and the individual aspects of self-efficacy. This somehow allows readers to gain insightful information not only about the overall self-efficacy, but also how each of the aspects developed over the course of the study.

The second study [5] used the questionnaire to explore the statistical relationship between self-efficacy and mindset among school learners. It reveals that these two psychological concepts are theoretically associated in that mastery experience and verbal persuasion play essential roles in the development of one's mindset. Also, it shows the survey results using 18 closed-ended items based on a 5-Likert scale with 206 high school students, 12 of which are self-efficacy statements, and the rest are related to mindsets. Correlation tests revealed that the theoretical assumption was valid from a statistical viewpoint. There were weak positive correlations between growth mindset and mastery experience ($r = 0.3$), growth mindset and

verbal persuasion focused on effort ($r = 0.4$), as well as mastery experience and verbal persuasion focused on effort ($r = 0.4$).

Conclusion

This study proposed a 12-item questionnaire to measure self-efficacy in educational contexts. The statements included in the questionnaire represent four main aspects of self-efficacy: *mastery experience*, *vicarious experience*, *verbal persuasion*, and *emotional arousal*. The validity of the questionnaire was validated based on the Item Objective Congruence (IOC) index by three experts. The reliability of the questionnaire was tested with 218 secondary school students. The Cronbach's alpha values of 0.84 and 0.86 were retrieved before and after participating in a game-based learning activity, respectively. Finally, the usefulness of the questionnaire has been reassured by its statistical evidence reported in SCOPUS articles. We therefore recommend other researchers interested in using self-efficacy as a framework to adopt this questionnaire for measuring students' belief in their own ability to complete any given task, or adapt it to meet their expectation.

Limitations and Future Studies

The original version of this questionnaire was in Thai as it was distributed to high school students in Thailand whose first language is Thai. Thus, the result of Cronbach's alpha values reported in this paper was from the original version. However, shown in Table 1 is a verbatim translation version. Therefore, other researchers aiming to adopt the questionnaire in their research setting may want to verify the reliability of the English version. In addition, this questionnaire was used among secondary school students, both junior and high school levels. However, no evidence has been gained from learners with older age groups as well as younger ones. The extension of the usefulness of this questionnaire across age groups may be helpful to verify the validity of this measuring tool.

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