第 49 卷 第 10 期
2022 年 10 月

湖南大学学报（自然科学版）
Journal of Hunan University (Natural Sciences)

Vol. 49 No. 10
October 2022

Open Access Article https://doi.org/10.55463/issn.1674-2974.49.10.9

Survey Instrument Validation for a Learner's Motivation to Attain Digital Badge for Micro-Credential Courses: Cognitive Interview and Validity Test

M. Navanitha[1]*, K.S. Savita[1], Noreen Izza Arshad[1], Pradeep Isawasan[2], Donnie Adams[3], Nur Hidayah Che Ahmat[4], Tenku Putri Norishah Binti Tenku Shariman[5]

[1] Computer and Information Sciences Department, Universiti Teknologi Petronas, Perak, Malaysia

[2] Faculty of Computer and Mathematical Sciences, Universiti Teknologi Mara, Perak, Malaysia

[3] Faculty of Education, Universiti Malaya, Kuala Lumpur, Malaysia

[4] Faculty of Hotel and Tourism Management, Universiti Teknologi MARA, Pulau Pinang, Malaysia

[5] Faculty of Creative Multimedia, Multimedia University, Cyberjaya, Malaysia

Abstract: COVID-19 has lately changed the way that people learn and teach by making it accessible at any time, from any location, and for a reasonable price. Traditional face-to-face teaching and learning are losing in popularity as more students choose hybrid or online mode study. The gig economy expansion in today's fast-paced business requires the cultivation of people and specialists with increasingly specific skill sets to fill increasingly specialized positions. Micro-Credential is a prominent actor in 21st-century training and education that offers higher education providers a more dynamic and quick learning style to match these demands. It is observed that learners in Malaysia are substantially new to the Micro-Credential and Digital Badge. Hence, this paper aims to present the findings on survey instrument validation in measuring the motivation of learners to attain the digital badge. The study uses a cognitive interviewing method for pre-test in validating the items of the adopted survey instrument. Then, in a pilot test, the survey instrument is again evaluated to measure the validity and reliability of the items using SPSS statistical software. The findings from the pre-test summarized the feedback and suggestions for improvements in fitting the study context and language used. The improved survey instrument undergoes a pilot test to confirm the validity and reliability of the survey items. The finalized survey instrument is then adopted for the main study with a larger sample of learners – university students, working professionals, business owners, and non-working adults using purposive sampling.

Keywords: digital badge, micro-credential, motivation, survey, pre-test and pilot test.

調查工具驗證學習者獲得微證書課程數字徽章的動機：認知訪談和有效性測試

摘要：新冠肺炎最近改變了人們學習和教學的方式，讓人們可以隨時隨地以合理的價格訪問它。隨著越來越多的學生選擇混合或在線模式學習，傳統的面對面教學正在失去人氣。在當今快節奏的業務中，零工經濟的擴張需要培養具有越來越具體技能的人員和專家，以填補越來越專業化的職位。微證書是21世紀培訓和教育的重要參與者，它為高等教育提供者提供更具活力和快速的學習方式來滿足這些需求。據觀察，馬來西亞的學習者對微證書和數字徽章基本上是陌生的。因此，本文旨在介紹調查工具驗證在衡量學習者獲得數字徽章的動機方面的發現。本研究採用認知訪談法進行前測，以驗證所採用的調查工具的項目。然後，在試點測試中，再次評估調查工具，使用SPSS統計軟件衡量項目的有效性和可靠性。預測試

Received: July 13, 2022 / Revised: August 10, 2022 / Accepted: September 6, 2022 / Published: October 30, 2022

Fund Project: Ministry of Higher Education (Fundamental Research Grant Scheme (FRGS) [FRGS/1/2022/ICT03/UTP/03/1])

About the authors: M. Navanitha, K.S. Savita, Noreen Izza Arshad, Computer and Information Sciences Department, Universiti Teknologi Petronas, Perak, Malaysia; Pradeep Isawasan, Faculty of Computer and Mathematical Sciences, Universiti Teknologi Mara, Perak, Malaysia; Donnie Adams, Faculty of Education, Universiti Malaya, Kuala Lumpur, Malaysia; Nur Hidayah Che Ahmat, Faculty of Hotel and Tourism Management, Universiti Teknologi MARA, Pulau Pinang, Malaysia; Tenku Putri Norishah Binti Tenku Shariman, Faculty of Creative Multimedia, Multimedia University, Cyberjaya, Malaysia

Corresponding author M. Navanitha, navanitha_21000864@utp.edu.my

的結果總結了反饋和改進建議，以適應研究環境和使用的語言。改進後的調查工具進行了試點測試，以確認調查項目的有效性和可靠性。然後，最終的調查工具被用於主要研究，使用有目的的抽樣，對更大的學習者樣本——大學生、工作專業人士、企業主和非工作成年人。

关键词：數字徽章、微證書、動機、調查、預測試和試點測試。

1. Introduction

The coronavirus disease 19 (COVID-19) is the most serious public health concern in the world. SARS-CoV-2 is another name for this virus. COVID-19 is a coronavirus strain that has recently been found and can cause respiratory illnesses in humans. Because of the COVID-19 pandemic, school closures have affected over 98% of the world's student inhabitants [43]. Higher education institutions around the world have responded to the COVID-19 outbreak by cancelling lectures and campus activities to prevent large crowds from congregating on campus [2]. Several improvement techniques, such as the use of flexible online learning and e-assessment strategies, were put in place to help mitigate the impact of the pandemic on teaching and learning delivery.

Technology advancements are affecting the way many people across the world go about their daily lives, but they are also impacting the rapid proliferation of online learning options [13]. Online learning provides greater flexibility and accessibility for students who otherwise would not have been able to get a higher education due to various factors [22]. Besides that, technological advancements in educational environments provide learners with access to emerging instructional materials and the desire to determine, collect, and create content, as well as the ability to connect with people worldwide to share ideas, collaborate and learn new skills.

The development of the gig economy also in fast-paced business in the present era necessitates the need for employees and experts with certain skill sets to meet the demands of ever-more specialized occupations [45]. Higher education providers require a more rapid and dynamic type of learning to meet these demands, which has been met by the introduction of Micro-credential. Micro-credentials are virtual representation of skill or knowledge, usually at a granular level of specificity. Micro-credential has a variety of terms. Alternative credentials, digital badges, micro-certifications, web badges, open badges, mini degrees, and nanodegrees, to mention a few terms commonly used in the literature, are some of the most used.

The term "micro-credential" is the newest buzzword in town. This has been even clearer with the outbreak of the COVID-19 epidemic, which has accelerated the growth of the gig economy. The outbreak has been going on for a year, and scientists fear it will go way too long. This would have altered the overall educational environment. From buying to studying to working, everything has gone online. Everyone now can learn, re-learn, re-skill, and up-skill on various information, skills, and competencies relevant to their interests or professional growth. Most institutions of higher education in nations such as New Zealand, Australia, Malaysia, Singapore, Europe, and Canada are implementing micro-credential.

The Malaysia Qualification Agency's (MQA) Micro-Credential guidance has developed as the most critical motivation for both major and small players in the education and training industry to embark on this journey [1]. The learners in a world require growing degrees of flexibility; the Malaysia Qualifications Agency (MQA) has made steps to make education substantially more accessible to a larger spectrum of individuals in a short time. Because of this effort, a new learning paradigm known as micro-credentialing has emerged, which meets the urgent demand for developing skills and upgrading in the digital economy [9]. Micro-credential is still in the early stages of development in Malaysia.

Micro-credential program is based on the concept of MOOC and ODL. Hence, the implementation of micro-credential may also have similar problems as discussed by the scholars ODL and MOOC. However, bear in mind that the concept of Micro-credential program is flexible, stackable and cost-effective. Therefore, there are different between MOOC, ODL and Micro-credential. Micro-credential (MC) certification programs are well-known in Western countries, and most Malaysians are unfamiliar with the notion of Micro-credential [6].

So, the research question for this research is 'How to develop and validate the survey questionnaire to measure the motivation in attaining digital badge in micro-credential. Hence the 1st objective of this paper is to develop the survey instrument and validate the survey questionnaire to measure the motivation in attaining digital badge in micro-credential, and while the second objective is to discuss the results from a pilot test that validates the survey questionnaire.

2. Literature Review

The concept of micro-credential originated with "digital badges," which were first recognized to

personalize student learning; they are designed to make visible and validate learning in both formal and informal settings and have the opportunity to assist transform where and how learning is recognized [15]. Micro-credential allows learners to practice mastery of defined competencies, often known as learning goals, such as collaborative and communicative dispositions and various abilities such as set design and research skills [8]. Learners can better track their progress in acquiring practical and transferable information, skills, and attitudes.

When comparing the micro-credentialing method to standard professional development systems, four primary qualities define it from the latter. These include competency-based, personalized, on demand, and shareable. The characteristics of micro-credential are competency-based, personalized, on demand and shareable.

A digital badge is a web-based visual graphic that indicates a skill or competency that a learner has acquired by successfully completing a set of tasks or criteria stated by a legitimate issuer [34]. Digitized badges are a symbol or indicator of a certain achievement or ability or a particular trait or interest that can be used in various contexts to set objectives, inspire behavior to symbolize successes and convey success [37]. Digital badges contain information on the requirements that must be met by the learner to acquire the badge, and they can be shared and exhibited on social media platforms and online portfolios with peers, current or potential employers, and on social media networks [10, 16].

Due to the increased popularity in the use of digital badges, research is being conducted to determine whether and to what extent badge systems can be implemented in higher education institutions [32]. One issue that is currently being debated in the badge community is whether badges are better suited for lower-level courses rather than higher-level courses and why [41]. Further investigation is needed on the use of badges in higher education, which is still another question that must be answered.

Few studies have been done in micro-credential with different perspectives. Table 1 shows the summary of studies done by other researchers.

Table 1 Summary of the literature review

Authors	Title	Result
[47]	Value of open micro-credentials to earners and issuers	In this research paper, the researcher shares about the result of implementation open micro-credentials. It has been proposed as a solution to both the skills gap of recent graduates and the need for continued lifelong learning opportunities.
[48]	The value of micro-credentials: The employer's perspective	In this paper, the study discusses the fact that companies seek out recent graduates who have mastered employability skills upon graduation from their community college and expect recent graduates to demonstrate those skills immediately upon hiring. Additionally, the researcher stresses a problem where employers reported that credentials carry inconsistent value. As a result, the participants mentioned their perspective of a micro-credentialing structure, which is the digital badge awarded to confirm competency achievement, and the structure must be connected with a rigorous curriculum and criteria for attainment.
[49]	Developing a framework for the university-wide implementation of micro-credential and digital badges: A case study from a Malaysian Private University	In this article, the author discusses six major opportunities for implementing micro-credential in undergraduate programs across the university. It comprises the platform, information pack, design, and evaluation concepts for micro-credential, as well as a description of the student's journey through each stage of the micro-credential eco-system. The article concludes by urging universities to create a strategic micro-credential implementation plan to ensure that students primarily view digital badges to promote their accomplishments to potential employers and that those employers truly understand and value badges as the evidence of students' accomplishments.
[50]	Digital badge from the perspective of self- determination theory	The major goal of this study is to investigate the relationships between three Self-Determination Theory (SDT) elements and the intention to submit an application to businesses that use badges to denote accomplishments. Here, the researcher looked at how the motivational components of the theory affected the respondents' perceptions of the worth of digital badges and their intents.
[51]	Micro-credential life & employability skills: evaluating students' and teachers' attitudes toward implementing micro-credential in higher education	This research examined the perspectives and attitudes of students and instructors on the introduction of a micro-credential course in a higher education setting. The purpose of the course is to give the students the life skills and employability abilities they will need to succeed in the ever-changing post-pandemic employment market. According to the research findings, students appeared to perceive the courses favourably and find them useful. These results indicate that introducing a micro-credential course gives university students the chance to develop their employability and life skills. The results also showed that while many teachers thought such courses were helpful, they displayed an inconsistent understanding of the abilities needed for upcoming job markets.

3. Methodology

The phrases pre-test and pilot test are sometimes used synonymously, there is one significant distinction between the two [3]. In a pre-test, just a tiny portion of the total sample size is used to evaluate one or a few study components. On the other hand, the study is conducted in its entirety during the pilot test, but with a lower sample size.

Pre-test questionnaire is an important step in making a great survey questionnaire. In its essence, pretesting is a way to look for and find potential problems with the questionnaire, such as questions that are hard to understand, terms or ideas that are misunderstood, how easy it is to move through the questionnaire, and the format of the questionnaire. Besides the pre-test technique, this study uses cognitive interviews with field experts to provide their opinions from different points of view. Based on the results of the cognitive interviews, the questionnaire will be altered. During the cognitive development, the interviewer can observe and identifier different types of problems that respondents might face. So, the strengths and drawbacks of the questionnaire can be found so that it can be changed and made better before it is used to collect the main data.

According to [31], cognitive interviewing has become known the last few decades as an excellent way to evaluate surveys in multi-national, multi-cultural environments. Cognitive interviews can also find overall patterns of how each question is interpreted and possible sources of error and bias in measurement. The question-and-answer process is a theory that guides the way cognitive interviews are done. The researchers usually use a four-step process to figure out how to answer survey questions [31]. First, they figure out what the question is really asking, then they remember the information they need, then they judge their answer, and finally they map their answer to one of the available response categories. From this method, cognitive interviewing can determine how people do each of these four things if the right steps are followed. Moreover, cognitive interviews show not only the sources of error and bias, but also the specifics of how error and bias come about in the lives of respondents.

Table 2 shows, the pre-test questionnaires were distributed to the following groups of learners, undergraduate and postgraduate students, employee, employer, and an information system (IS) expert. The cognitive interview is conducted with the following:

Table 2 Pre-test demography

Age	Location	Role	Affiliation
24 years old	Malaysian	Chief Executive Officer	SegWitz Sdn Bhd Company
31 years old	Malaysian	Tax Officer	Johor Inland Revenue Board
20 years old	Malaysian	Undergraduate student	PETRONAS University of Technology
38 years old	Malaysian	Postgraduate student	PETRONAS University of Technology
55 years old	Malaysian	Professor	University Sains Malaysia

The interviews were conducted using an online platform, which is Google meet. The sessions are carried out based on their preferred date and time, as well as availability. All the 5 sessions were completed in a period of two weeks. The survey questionnaire was shared with five of them, 3 days before the interview session. Each cognitive interviewing session took about 1.5 h, where it starts with a brief introduction to the questionnaire and its aim. The sessions are recorded on the basis of the given consent. During the cognitive interviewing session, each of them shared their thoughts using think-aloud protocol. The feedback concerns and gestures were recorded accordingly. Additionally, the participants are requested to think out loud and recognize how Micro-Credential courses are being used in Malaysia presently. Additionally, they were also requested to share verbal feedback on the design of the survey questionnaire. By using an observational think-aloud method during a cognitive interview, the interviewer's interruptions and comments are kept to a minimum. This keeps the interview free from bias. Moreover, the interviewer can learn new things about the micro-credential's programs because of the open-ended cognitive process.

To evaluate the validity and reliability of a survey questionnaire, it must first be put through a pilot testing process. According to [3], the pilot test might reveal problems with the instruments, methodology, or sample that need to be fixed before moving on to the major research. Pilot tests also help establish whether the research process will work. It also tells you how to use your different resources most effectively during your systematic investigation.

4. Survey Instrument Development

The questionnaire is classified as data gathering research instrument that consists of a group of questions or items that capture replies from that same set of questions in a standardized or pre-set order [5]. The design of the questionnaire influences the response rate as well as the reliability and validity of the data obtained. Clarity in the design of individual questions, a clear objective for the questionnaire, a clear structure of the questionnaire, and effective execution of the pre-test and pilot test can achieve maximum response rate, validity, and reliability. The survey questions must be understood by the respondent in the manner intended by the researcher, and the researcher must understand the respondent's answers in the manner intended by the respondent. Furthermore, the validity of an instrument is the degree to which it measures what it is intended to measure accurately. Typically, validity is defined as the

degree to which an instrument measures what it is intended to measure [26].

The current study's instrument is built on the use of existing validated metrics from a thorough examination of the literature. These chosen items or questions were then modified to meet the study's setting. The use and adaption of items from other validated survey instruments have two major advantages: validity and reliability have been verified, and comparisons between new findings and existing findings from another research are allowed. The survey items were validated using pre-test sessions that included cognitive interviews. The survey questionnaire was designed to assess eight constructs: Technology Self-Efficacy, Internet Self-Efficacy, Autonomy, Competence, Relatedness, Intention to Achieve a Digital Badge, Instant gratification, and Actual Attainment of a Digital Badge.

Students' perceptions of their skills to use technology-related tools and sites to perform learning behavior to attain the desired learning outcome are referred to as technological self-efficacy (TSE) [4, 24]. Individuals with a higher level of TSE are less concerned about technology's usability and are more likely to succeed at technology-related endeavours [42].

In the context of online learning or teaching, TSE is associated with learners and educators' belief in their own technological abilities to learn. Most learners believe that integrating technology into their learning process is simple; yet, there are some learners who consider that learning how to integrate technology into their learning process [42]. According to the research, students' technology self-efficacy has a significant impact on their behavioural preferences regarding using technological tools as part of their learning strategy [33]. Hence, technology self-efficacy plays a big role in learners learning approach. As a result, technology self-efficacy has a major influence on learners' learning approaches.

[12] investigates Internet Self-Efficacy (ISE), which is stated as a person's belief in his or her ability to successfully do the behavior essential for effective internet use. Internet self-efficacy is considered to be influenced by user attitudes and computer anxiety [28]. Individuals who have a positive opinion toward computers have a higher level of Internet self-efficacy than those who have a negative attitude toward computers. A learner's performance on online tests and in information searches is improved when they have high levels of internet self-efficacy [19]. Despite internet self-efficacy exhibiting a statistically significant positive relationship with learners' satisfaction, it could not be used to predict students' wellbeing.

Autonomy is specified as the ability to make decisions on one's own and is related to sentiments of personal independence [7]. Autonomy is improved when individuals have a choice and the ability to control their own actions, as well as when others recognize and accept their sentiments.

Competence is a term used to describe someone who possesses the necessary characteristics to accomplish a certain activity, or to describe the state of possessing adequate knowledge, judgment, skill, and/or ability to perform a specific task [38]. The ability to engage successfully in one's surroundings is associated with the feeling of competence. The individual also believes that they possess the abilities necessary for success to attain their objectives. The sensation of mastery that a competent person has over their environment is a powerful feeling. When activities become too difficult or when a person receives unfavourable feedback, feelings of competence can rapidly deteriorate.

Relatedness is defined as the ability to feel both an attachment to other individuals and a sense of belonging among other people [17]. Feelings of intimacy and belonging to a social group are all part of the experience of relatedness. Self-determination is more difficult to achieve if one does not have connections, as one would not have access to both help and support. Individuals' feelings of connectedness are heightened when they are valued and cared for by others, and when they are a part of a welcoming atmosphere. Instead, competition destroys emotions of connectedness with other people and by cliques, as well as by negative feedback from others.

The design of the research instrument consisted of a cover letter and 9 pages survey questionnaire. The cover letter included the title of the survey questionnaire, the purpose of the study, the definition of key terms, confidentiality consent statement, an appreciative note and contact details. A cover letter is essential as it highlights the importance of the respondent's participation in the research along with the assurance of anonymity that will increase the response rate.

The questionnaire was divided into two sections. The first section focuses on demographic details. The second section consisted of eight parts: Part 1: Internet skills, Part 2: Technology skill, Part 3: Self-Ownership, Part 4: Self-Competence, Part 5: Self-Interaction, Part 6: Intention to Attain Digital Badge, Part 7: Self-Reward and Part 8: Outcome of Digital Badge Attainment. The response format for the second section was interval-level based, with rating questions used to obtain each respondent opinion on a 5-point Likert scale. The most common Likert scales are 4-point, 5-point, 6-point, or 7-point rating scales. The 4-point and 6-point scales have no midpoint, in contrast to the 5-point and 7-point Likert scales. All parts as mentioned above consisted of 8 questions. The questions were measured using 5-point Likert scale ranging from (1) Strongly disagree; (2) Disagree; (3) Neither agree nor disagree; (4) Agree; (5) Strongly agree.

The eight items in the Technology self-efficacy survey instrument were derived from the existing literature [12, 29, 35]. Additionally, the eight items in the Internet self-efficacy survey instrument were adapted from previous literature [30, 36, and 44]. The following items for autonomy, competence, and relatedness were adapted from prior research [7, 39, and 40].

Additionally, the eight elements of the survey instrument for Intention to obtain a Digital Badge were developed from the existing literature [25, 46]. Besides, the eight items in the Instant gratification survey instrument were modified from the existing literature [23]. The final eight questions of the survey instrument for Actual Attainment of digital badge were adopted from the existing literature [11].

5. Results and Discussion

The outcomes of the cognitive interviews with the five respondents listed above are divided into four groups which are based on the general structure, time allotted, question interpretation, overall impression of content, and coverage. From the perspective of a general format, the respondents indicate their lack of patience upon first viewing the lengthy instruction that is composed of a few paragraphs of background of the project. The survey participants encountered unclear terminology while completing the questionnaire. Additionally, answering the survey questionnaire will take more time to finish it. The respondents also stated that the questionnaire is too long and that most people would not be engaged in or felt exhausted from answering the questions. Those responses were the overall perception of the questionnaire content and coverage. Table 3 is a summary of the pre-test findings from the cognitive interviews.

Table 3 Summary of pre-test

Categories of pre-test result	**Original item**	**Revised item**
General format	The background knowledge about micro-credential given in the instruction section is extremely long, with several paragraphs and links.	The instruction is shortened.
Item interpretation	Some questions have similar meanings such as I have access to Internet I have an Internet connection at home I'm confident to use technology for online learning I'm confident to use software/application for online learning I'm confident with terms/words relating to computer hardware and software for online learning I'm confident to use technology for personalized/customized online learning. I feel technology availability is important for me to perform online learning I feel technology availability is important for me to complete online activities I feel technology accessibility is important for me to perform online learning I feel technology accessibility is important for me to complete online activities I can express myself during online learning I can express my opinions during online learning I'm excited to interact with my course mate/teammate I'm excited to discuss them with my course mate/teammate I can earn multiple badges for one online course I can stack it with multiple online courses. Total: 17 questions	Questions with similar meanings were removed from the survey. These are the questions that replaced the question with similarity. I'm confident to use Internet for online learning I'm confident to use technology to improve the skills in operating computer software for online learning I'm confident to use technology for flexible online learning. I feel technology availability is important for me to perform online learning I feel technology accessibility is important for me to perform online learning I can express my opinions during online learning I'm excited to interact with my course mate/teammate I can earn multiple badges for one online course Total: 8 questions
Time frame	The respondents took around 30 min to complete it. Hence, the respondent suggested reducing the number of questions with similarity. Total questions: 120	For each item, more than two questions were eliminated which is irrelevant to the scope of the study. Total questions: 70
Overall impression of content and coverage	The coverage of the questionnaires is complete, easy to read and understand, the language being used in the questionnaire is straightforward. However, the respondent suggested that the questionnaire needs to be shortened.	Reducing the number of items in the survey questionnaire based on the scope of the study.

The result of the pilot test was that more than half of the respondents were between the ages of 21 and 30 (19 respondents/51.4%); the rest were between the ages of 18 and 20 (15 respondents/40.5 %); and 3 were between the ages of 31 and 40 (8.1%). The 37 people fall into one of these age categories. In this study's 12 participants (19.7% of the total sample size) expressed an interest in taking Micro-credential courses related to technology. In 2nd place was engineering with 7 respondents (14.2%), followed by management with 6

respondents (16.2%).

The respondents' educational backgrounds, most them hold a diploma or certificate (14 respondents/37.8%), followed by a bachelor's degree (11 respondents/ 29.7%), and then a master's degree (8 respondents/ 21.6%). The rest falls somewhere in the middle. In this study, 19 of the respondents in this study come from the student profession, which is 51.7% of the total, while 6 of the respondents (16.2%) come from the business owner profession and then followed by the executive profession, which (10.8%. Lastly, this study also looks at how much the respondent earn monthly. Less than RM 4,999 is the highest range, with 27 respondents and a percentage of 73. Between RM 5,000 to RM 10,000, there were 9 respondents, and only one person said they made more than RM 10,000.

The reliability analysis was conducted to ensure the quality of the research instrument and to assess the reliability of the measurement items. For a set of items to be regarded as a reliable scale, the generally accepted cut-off alpha value in social science is 0.70 or higher [14].

Table 4 displays the outcomes of a reliability analysis for the variables within the range from 0.875 to 0.961. The Internet self-efficacy (ISE) variable has a value of 0.948, while the technology self-efficacy (TSE) variable has a value of 0.921. Additionally, the competence variable has a value of 0.934 and the relatedness variable has a value of 0.933. Furthermore, the value of the intention to attain a digital badge is 0.930, instant gratification is 0.94, and actual attainment of a digital badge is 0.961. In this research, the lowest value in the reliability analysis is Autonomy (AU), which is 0.875, indicating that the value of alpha is greater than 0.70. The reliability analysis for each item determined that all measurements were acceptable, valid, and reliable for use in the main study.

Table 4 Reliability analysis

Variable	Cronbach's Alpha	Number of Items
ISE	0.948	8
TSE	0.921	8
AU	0.875	8
CP	0.934	8
RT	0.933	8
IDG	0.930	8
IG	0.949	8
AADG	0.961	8

Normality tests are used to determine whether a distribution is normal. Normal quantile-quantile (Q-Q) plots are just another way for determining the normality of a data set. A variable is defined to have a roughly normal distribution if the bulk of the observed values (the smaller dots) is on a straight line in the plot [21, 27].

The both skewness and kurtosis are near to zero (0), which is a rare occurrence, and the data distribution pattern is deemed normal [14]. Therefore, a general rule of thumb for skewness is that a number more than +1 or lower than -1 shows a highly skewed distribution, while for kurtosis it has a value greater than zero, then the distribution has heavier tails [20]. However, [18] argued that the data is considered normal if skewness is between -2 to +2 while values of the Kurtosis should be within the -2 and +2 range.

In the Q-Q plot, most observed values are on a straight line, which illustrates regularly distributed items. As shown in Table 5, it was determined that the items and data obtained for the pilot testing were within the normal distribution range.

Table 5 Normal distribution range

Variables	Skewness Statistic	Kurtosis Statistic	Decision
ISE	-1.622	1.899	Normally distributed
TSE	-1.420	1.638	Normally distributed
AU	-1.105	0.747	Normally distributed
CP	-0.914	-0.266	Normally distributed
RT	-1.297	0.807	Normally distributed
IDG	-0.971	0.209	Normally distributed
IG	-1.244	0.697	Normally distributed
AADG	-0.983	-0.224	Normally distributed

6. Conclusion and Further Studies

This research validates a survey questionnaire to measure the motivation to create digital badge for micro-credential courses. The survey questionnaire was adopted and adapted from validated instruments from other researchers. The survey items are then evaluated and validated via a pre-test and pilot test. The items represent eight variables, which are Internet Self-Efficacy, Technology Self-Efficacy, Autonomy, Competency, Relatedness, Intention to Attain Digital Badge, Instant Gratification, and Actual Attainment of Digital Badge, which total up to 64 items. The study observed that a small sample size for pre-test and pilot tests could be a limitation in generalizing the findings to a large population. Hence, using this validated survey instrument, the main study will be conducted on four categories of learners using purposive sampling for the period of three to six months. Other researchers can adopt the validated survey questionnaire for validation and data gathering purposes. With this, a much comprehensive finding can be presented for research and practical purposes for the implementation of micro-credential and digital badge at higher learning institutions.

Acknowledgment

The authors are grateful to PETRONAS University of Technology for the administrative support and Ministry of Higher Education under Fundamental Research Grant Scheme (FRGS) [FRGS/1/2022/ICT03/UTP/03/1] for the financial support as well as to the reviewers for the constructive feedback.

References

[1] ABDULLAH H.S., ALIAS A.K., KOOI A.L.T., KHALIL M.A.K.M., CHOY C.S., and YUSOFF N.M. *Guidelines to good practices: micro-credential*, Documentation. Malaysian Qualifications Agency, 2020.

[2] ADAMS D., CHUAH K. M., SUMINTONO B., and MOHAMED A. Students' readiness for e-learning during the COVID-19 pandemic in a South-East Asian university: a Rasch analysis. *Asian Education and Development Studies*, 2021, 11(2): 324-339. https://www.emerald.com/insight/content/doi/10.1108/AEDS-05-2020-0100/full/html

[3] BACON-SHONE J. *Introduction to Quantitative Research Methods*. Hong Kong, 2022. https://www.researchgate.net/publication/265793712_Introduction_to_Quantitative_Research_Methods

[4] BANDURA A., FREEMAN W.H., and LIGHTSEY R. Self-Efficacy: The Exercise of Control. *Journal of Cognitive Psychotherapy*, 1997, 13(2), 158–166. https://doi.org/10.1891/0889-8391.13.2.158

[5] BOPARAI, JASPREET K, SINGH S., and KATHURIA P. How to Design and Validate A Questionnaire: A Guide. *Current Clinical Pharmacology*, 2018, 13(4): 210-215.

[6] CHE AHMAT N.H., AIZAT BASHIR M.A., RAZALI A.R., and KASOLANG S. Micro-credential in Higher Education Institutions : Challenges and Opportunities. *Asian Journal of University Education*, 2021, 17(3).

[7] CHIU T.K.F. Digital support for student engagement in blended learning based on self-determination theory. *Computers in Human Behavior*, 2021, 124: 106909. https://doi.org/10.1016/j.chb.2021.106909

[8] DEMONTE J. *Micro-credential for teachers: what three early adopters have learned so far*. Report. American Institutes for Research, 2017. https://www.air.org/resource/report/micro-credentials-teachers-what-three-early-adopters-have-learned-so-far

[9] DUKLAS J. *Micro-Credentials. Trends in Credit Transfer and Credentialing.* Duklas Cornerstone Consulting Inc., 2020. https://www.bccat.ca/pubs/Reports/MicroCredentials2020.pdf

[10] DUNCAN O.J. *Assessment of Digital Badges and Microcredentials on Student Learning Outcomes in the Introductory Public Speaking Course*. Southern Illinois University Carbondale, 2020. https://opensiuc.lib.siu.edu/cgi/viewcontent.cgi?article=2310andcontext=gs_rp

[11] DYJU, P., and LINDSTROM G. Perceptions and Uses of Digital Badges for Professional Learning Development in Higher Education. *Tech Trends*, 2017, 61(4): 386-392. https://doi.org/10.1007/s11528-017-0168-2

[12] EASTIN M.S., and LAROSE R. Internet self-efficacy and the psychology of the digital divide. *Journal of Computer-Mediated Communication*, 2000, 6(1). https://doi.org/10.1111/j.1083-6101.2000.tb00110.x

[13] FERRI F., GRIFONI P., and GUZZO T. Online Learning and Emergency Remote Teaching: Opportunities and Challenges in Emergency Situations. *Societies*, 2020, 10(4): 86. https://doi.org/10.3390/soc10040086

[14] FIELD A. *Discovering Statistics Using IBM SPSS Statistics.* SAGE Publications Inc., 2018.

[15] FRENCH D., and BERRY B. Teachers, micro-credential, and the performance assessment movement. *Voices in Urban Education*, 2017, 46: 37-43. http://badge.aurorak12.org/%0Ahttp://www.annenberginstitute.org

[16] GHASIA M., MACHUMU, H., and DESMET E. Micro-credential in Higher Education Institutions: An Exploratory Study of Its Place in Tanzania. *International Journal of Education and Development Using Information and Communication Technology*, 2019, 15(1): 233.

[17] GILAL F. G., ZHANG J., PAUL J., and GILAL N.G. The role of self-determination theory in marketing science: An integrative review and agenda for research. *European Management Journal*, 2019, 37(1): 29-44. https://doi.org/10.1016/j.emj.2018.10.004

[18] HAIR J.F., HULT G.T.M., RINGLE C.M., and SARSTEDT M. *A primer on partial least squares structural equation modeling (PLS-SEM).* SAGE Publications Inc., 2021.

[19] HAMDAN K.M., AL-BASHAIREH A.M., ZAHRAN Z., AL-DAGHESTANI A., AL-HABASHNEH S., and SHAHEEN A.M. University students' interaction, Internet self-efficacy, self-regulation and satisfaction with online education during pandemic crises of COVID-19 (SARS-CoV-2). *International Journal of Educational Management*, 2021, 35(3): 713-725. https://doi.org/10.1108/IJEM-11-2020-0513

[20] HATEM G., ZEIDAN J., and MOREIRA C. Normality testing methods and the importance of skewness and kurtosis in statistical analysis. *Science and Technology*, 2022, 3(2).

[21] HERNANDEZ H. Testing for Normality: What is the Best Method. *ForsChem Research Reports*, 2022, 6: 3-38. https://doi.org/10.13140/RG.2.2.13926.14406

[22] ISAAC O., ALDHOLAY A., ABDULLAH Z., and RAMAYAH T. Online learning usage within Yemeni higher education: The role of compatibility and task-technology fit as mediating variables in the IS success model. *Computers and Education*, 2019, 136: 113-129. https://doi.org/10.1016/j.compedu.2019.02.012

[23] KAUR P., DHIR A., CHEN S., MALIBARI A., and ALMOTAIRI M. Why do people purchase virtual goods? A uses and gratification (UandG) theory perspective. *Telematics and Informatics*, 2020, 53: 101376. https://doi.org/10.1016/j.tele.2020.101376

[24] KEENGWE J., and HOFMEISTER D. Faculty integration of computer technology into instruction and students' perceptions of computer use to improve their learning. *Journal of Information Technology Education*, 2007, 6: 169-179. https://jite.org/documents/Vol6/JITEv6p169-180Keengwe218.pdf

[25] KHAMARUDDIN P. F.M., SAUKI A., OTHMAN KADRI, N.H., RAHIM A.N.C.A., and KADRI A. Technology Acceptance Model Analysis on Students' Behavioral Intention of Using Moodle for FYP. In: *7th World Engineering Education Forum, 13-16 November, 2017*, 2017: 18098472. https://doi.org/10.1109/WEEF.2017.8467082

[26] KHANAM S., TALIB F., and SIDDIQUI J. An instrument validation of TQM enablers and IT resources in Indian ICT organizations. *Journal of Systems and Information Technology*, 2020, 22(2): 179-200. https://doi.org/10.1108/JSIT-01-2017-0004

[27] KHATUN N. Applications of Normality Test in Statistical Analysis. *Open Journal of Statistics*, 2021, 11(01): 113-122. https://doi.org/10.4236/ojs.2021.111006

[28] KUO Y. C., TSENG H., and KUO Y.T. Internet self-efficacy, self-regulation, and studenperformance: african-american adult students in online learning. *International Journal on E-Learning: Corporate, Government, Healthcare, and Higher Education*, 2020, 19(2): 161-180.
[29] KUOY.C., WALKER A.E., SCHRODER K.E.E., and BELLAND B. R. Interaction, Internet self-efficacy, and self-regulated learning as predictors of student satisfaction in online education courses. *Internet and Higher Education*, 2014, 20: 35-50. https://doi.org/10.1016/j.iheduc.2013.10.001
[30] BONSAKSEN T. *BITS Scale Table*. 2013. https://www.researchgate.net/figure/tems-of-the-general-self-efficacy-scale_tbl1_258852251
[31] MASSEY M. The development and testing of a module on child functioning for identifying children with disabilities on surveys. II: Question development and pretesting. *Disability and Health Journal*, 2018, 11(4): 502-509. https://doi.org/10.1016/j.dhjo.2018.06.006
[32] MICROHE. *Challenges and Opportunities of Micro-credential in Europe. Briefing Paper on the Award, Recognition, Portability and Accreditation of Micro-Credentials: an Investigation through Interviews with Key Stakeholders and Decision Makers*. The European Commission, 2019.
[33] PAN X. Technology Acceptance, Technological Self-Efficacy, and Attitude Toward Technology-Based Self-Directed Learning: Learning Motivation as a Mediator. *Frontiers in Psychology*, 2020, 11(October). https://doi.org/10.3389/fpsyg.2020.564294
[34] PERKINS J., and PRYOR M. Digital badges: Pinning down employer challenges. *Journal of Teaching and Learning for Graduate Employability*, 2021, 12(1): 24-38. https://ojs.deakin.edu.au/index.php/jtlge/
[35] PRASETIYO W.H., NAIDU N.B.M., SARI B.I., MUSTOFA R.H., RAHMAWATI N., WIJAYA G.P.A., and HIDAYAT O.T. Survey data of internet skills, internet attitudes, computer self-efficacy, and digital citizenship among students in Indonesia. *Data in Brief*, 2021, 39. https://doi.org/10.1016/j.dib.2021.107569
[36] RAFIQUE G.M., MAHMOOD K., WARRAICH N.F., and REHMAN S.U. Readiness for Online Learning during COVID-19 pandemic: A survey of Pakistani LIS students. *Journal of Academic Librarianship*, 2021, 47(3): 102346. https://doi.org/10.1016/j.acalib.2021.102346
[37] RUDDY C., and PONTE F. Preparing students for university studies and beyond: a micro-credential trial that delivers academic integrity awareness. *Journal of the Australian Library and Information Association*, 2019, 68(1): 56-67. https://doi.org/10.1080/24750158.2018.1562520
[38] RYAN R.M., and DECI E.L. Intrinsic and extrinsic motivation from a self-determination theory perspective: Definitions, theory, practices, and future directions. *Contemporary Educational Psychology*, 2020, 61(April): 101860. https://doi.org/10.1016/j.cedpsych.2020.101860
[39] SØREBØ Ø., HALVARI H., GULLI V.F., and KRISTIANSEN R. The role of self-determination theory in explaining teachers' motivation to continue to use e-learning technology. *Computers and Education*, 2009, 53(4): 1177-1187. https://doi.org/10.1016/j.compedu.2009.06.001
[40] STANDAGE M., DUDA J.L., and NTOUMANIS N. A test of self-determination theory in school physical education. *British Journal of Educational Psychology*, 2005, 75(3): 411-433. https://doi.org/10.1348/000709904X22359
[41] STEFANIAK J., and CAREY K. Instilling purpose and value in the implementation of digital badges in higher education. *International Journal of Educational Technology in Higher Education*, 2019, 16(1). https://doi.org/10.1186/s41239-019-0175-9
[42] THANH T., and DOAN T. The Effect of Perceived Risk and Technology Self-Efficacy on Online Learning Intention : An Empirical Study in Vietnam. *The Journal of Asian Finance, Economics and Business*, 2021, 8(10): 385-393. https://doi.org/10.13106/jafeb.2021.vol8.no10.0385
[43] UNESCO. *1.3 billion learners are still affected by school or university closures, as educational institutions start reopening around the world*. 2020. https://en.unesco.org/news/exams-and-assessments-covid-19-crisis-fairness-centre
[44] WEIGOLD A., and WEIGOLD I.K. Measuring confidence engaging in computer activities at different skill levels: Development and validation of the Brief Inventory of Technology Self-Efficacy (BITS). *Computers and Education*, 2021, 169(August): 104210. https://doi.org/10.1016/j.compedu.2021.104210
[45] WHEELAHAN L., and MOODIE G. Gig qualifications for the gig economy : micro-credential and the 'hungry mile.' *Higher Education*, 2022, 83(6): 1279-1295. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8331095/
[46] YAU H.K., and CHENG A.L.F. The influence of study mode on the confidence in using technology for learning: An empirical study in hong kong higher education. In: *Proceedings of the International MultiConference of Engineers and Computer Scientists March 13 - 15, 2013, Hong Kong*, 2013, Vol II.
[47] YOUNG D., WEST R.E., and NYLIN T.A. Value of open microcredentials to earners and issuers: A case study of national instruments open badges. *International Review of Research in Open and Distance Learning*, 2019, 20(5): 104-121. https://doi.org/10.19173/irrodl.v20i5.4345
[48] GAUTHIER T. The value of microcredentials: The employer's perspective. *The Journal of Competency-Based Education*, 2020, 5(2): e01209. https://doi.org/10.1002/cbe2.1209
[49] LIM C.L., NAIR P.K., KEPPELL M.J., HASSAN N., and AYUB E. Developing a framework for the university-wide implementation of micro-credentials and digital badges: a case study from a Malaysian private university. In: *2018 IEEE 4th International Conference on Computer and Communications*, 2018: 1715-1719.
[50] PANGARIBUAN C.H., HIDAYAT D., PUTRA O.P.B., AGUZMAN G., and FEBRIYANTO R. Digital badge from the perspective of self-determination theory. *Palarch's Journal of Archaeology of Egypt/Egyptology*, 2020, 18(1): 116-127.
[51] AHMED D., and GHADA J. Micro-credentials Life and Employability Skills: Evaluating Students' and Teachers' Attitudes Towards Implementing Micro-credentials in Higher Education. In: *Proceedings of the AUBH E-Learning Conference 2021: Innovative Learning and Teaching - Lessons from COVID-19*, 2021.

参考文:

[1] ABDULLAH H.S.、ALIAS A.K.、KOOI A.L.T.、KHALIL M.A.K.M.、CHOY C.S. 和 YUSOFF N.M.

良好實踐指南：微證書、文檔。馬來西亞資格認證機構，2020年。

[2] ADAMS D.、CHUAH K.M.、SUMINTONO B. 和 MOHAMED A. 東南亞大學在新冠肺炎大流行期間學生對電子學習的準備情況：快的分析。亞洲教育與發展研究，2021，11(2)：324-339。https://www.emerald.com/insight/content/doi/10.1108/AEDS-05-2020-0100/full/html

[3] BACON-SHONE J. 定量研究方法簡介。香港，2022年。https://www.researchgate.net/publication/265793712_Introduction_to_Quantitative_Research_Methods

[4] BANDURA A.、FREEMAN W.H. 和 LIGHTSEY R. 自我效能：控制的運用。認知心理治療雜誌，1997，13（2），158-166。https://doi.org/10.1891/0889-8391.13.2.158

[5] BOPARAI、JASPREET K、SINGH S. 和 KATHURIA P. 如何設計和驗證問卷：指南。當前臨床藥理學，2018, 13(4): 210-215.

[6] CHE AHMAT N.H.、AIZAT BASHIR M.A.、RAZALI A.R. 和 KASOLANG S. 高等教育機構的微證書：挑戰與機遇。亞洲大學教育雜誌, 2021, 17(3).

[7] CHIU T.K.F. 基於自決理論對學生參與混合學習的數字支持。人類行為中的計算機，2021年，124：106909。https://doi.org/10.1016/j.chb.2021.106909

[8] DEMONTE J. 教師微證書：三個早期採用者到目前為止學到了什麼。報告。美國研究所，2017年。https://www.air.org/resource/report/micro-credentials-teachers-what-three-early-adopters-have-learned-so-far

[9] DUKLAS J. 微證書。學分轉移和認證的趨勢。杜克拉斯基石諮詢公司，2020年。https://www.bccat.ca/pubs/Reports/MicroCredentials2020.pdf

[10] DUNCAN O.J. 在介紹性公開演講課程中評估數字徽章和微證書對學生學習成果的影響。南伊利諾伊大學卡本代爾分校，2020年。https://opensiuc.lib.siu.edu/cgi/viewcontent.cgi?article=2310andcontext=gs_rp

[11] DYJU, P. 和 LINDSTROM G. 高等教育專業學習發展數字徽章的感知和使用。技術趨勢，2017年，61(4)：386-392。https://doi.org/10.1007/s11528-017-0168-2

[12] EASTIN M.S. 和 LAROSE R. 互聯網自我效能和數字鴻溝的心理學。計算機介導通信雜誌，2000年，6(1)。https://doi.org/10.1111/j.1083-6101.2000.tb00110.x

[13] FERRI F.、GRIFONI P. 和 GUZZO T. 在線學習和緊急遠程教學：緊急情況下的機遇和挑戰。社團, 2020, 10(4): 86. https://doi.org/10.3390/soc10040086

[14] FIELD A. 使用IBM SPSS統計發現統計數據。智者出版公司，2018年。

[15] FRENCH D. 和 BERRY B. 教師、微證書和績效評估運動。城市教育之聲，2017，46：37-43。http://badge.aurorak12.org/%0Ahttp://www.annenberginstitute.org

[16] GHASIA M.、MACHUMU、H. 和 DESMET E. 高等教育機構中的微證書：對其在坦桑尼亞的地位的探索性研究。使用信息和通信技術的國際教育與發展雜誌，2019年，15(1)：233。

[17] GILAL F. G.、ZHANG J.、PAUL J. 和 GILAL N.G. 自我決定理論在營銷科學中的作用：綜合回顧和研究議程。歐洲管理雜誌, 2019, 37(1): 29-44. https://doi.org/10.1016/j.emj.2018.10.004

[18] HAIR J.F.、HULT G.T.M.、RINGLE C.M. 和 SARSTEDT M. 偏最小二乘結構方程建模(偏光掃描電鏡) 入門。智者出版公司，2021年。

[19] HAMDAN K.M.、AL-BASHAIREH A.M.、ZAHRAN Z.、AL-DAGHESTANI A.、AL-HABASHNEH S. 和 SHAHEEN A.M. 新冠肺炎大流行危機期間大學生的互動、互聯網自我效能、自我調節和對在線教育的滿意度。國際教育管理雜誌, 2021, 35(3): 713-725. https://doi.org/10.1108/IJEM-11-2020-0513

[20] HATEM G.、ZEIDAN J. 和 MOREIRA C. 正態性檢驗方法以及偏度和峰度在統計分析中的重要性。科學技術，2022, 3（2）。

[21] HERNANDEZ H. 正態性測試：什麼是最好的方法。福斯化學研究報告，2022，6：3-38。https://doi.org/10.13140/RG.2.2.13926.14406

[22] ISAAC O.、ALDHOLAY A.、ABDULLAH Z. 和 RAMAYAH T. 也門高等教育中的在線學習使用：兼容性和任務技術適合作為信息系統成功模型中的中介變量的作用。計算機與教育, 2019, 136: 113-129. https://doi.org/10.1016/j.compedu.2019.02.012

[23] KAUR P.、DHIR A.、CHEN S.、MALIBARI A. 和 ALMOTAIRI M. 為什麼人們購買虛擬商品？使用和滿足理論視角。遠程信息處理和信息學，2020年，53：101376。https://doi.org/10.1016/j.tele.2020.101376

[24] KEENGWE J. 和 HOFMEISTER D. 教師將計算機技術融入教學和學生對計算機使用的看法以改善他們的學習。信息技術教育學報，2007，6: 169-179. https://jite.org/documents/Vol6/JITEv6p169-180Keengwe218.pdf

[25] KHAMARUDDIN P. F.M., SAUKI A., OTHMAN KADRI, N.H., RAHIM A.N.C.A. 和 KADRI A. 技術接受模型分析學生使用模塊化面向對象的動態學習環境進行最後一年的項目的行為意圖。載於：第七屆世界工程教育論壇，2017年11月13-16日，2017：18098472。https://doi.org/10.1109/WEEF.2017.8467082

[26] KHANAM S.、TALIB F. 和 SIDDIQUI J. 印度信息和通信技術組織中全面質量管理促成因素和信息技術資源的儀器驗證。系統與信息技術雜誌, 2020, 22(2): 179-200. https://doi.org/10.1108/JSIT-01-2017-0004

[27] KHATUN N. 正態性檢驗在統計分析中的應用。開放統計雜誌，2021，11（01）：113-122。https://doi.org/10.4236/ojs.2021.111006

[28] KUO Y. C., TSENG H. 和 KUO Y.T.

互聯網自我效能、自我調節和學生表現：在線學習中的非裔美國成人學生。電子學習國際期刊：企業、政府、醫療保健和高等教育，2020，19(2)：161-180。
[29] KUOY.C.、WALKER A.E.、SCHRODER K.E.E. 和 BELLAND B.R. 互動、互聯網自我效能和自我調節學習作為在線教育課程學生滿意度的預測指標。互聯網與高等教育, 2014, 20: 35-50. https://doi.org/10.1016/j.iheduc.2013.10.001
[30] BONSAKSEN T. 技術自我效能感簡要盤點比例表。2013. https://www.researchgate.net/figure/tems-of-the-general-self-efficacy-scale_tbl1_258852251
[31] MASSEY M. 開發和測試用於在調查中識別殘疾兒童的兒童功能模塊。II：問題開發和預測試。殘疾與健康雜誌，2018年，11(4)：502-509。https://doi.org/10.1016/j.dhjo.2018.06.006
[32]MICROHE。歐洲微證書的挑戰和機遇。關於微證書的獎勵、認可、可移植性和認證的簡報：通過採訪主要利益相關者和決策者進行的調查。歐盟委員會，2019年.
[33] PAN X. 技術接受度、技術自我效能和對基於技術的自主學習的態度：學習動機作為中介。心理學前沿，2020，11(十月). https://doi.org/10.3389/fpsyg.2020.564294
[34] PERKINS J. 和 PRYOR M. 數字徽章：確定雇主面臨的挑戰。研究生就業能力教學雜誌，2021年，12(1)：24-38。https://ojs.deakin.edu.au/index.php/jtlge/
[35] PRASETIYO W.H.、NAIDU N.B.M.、SARI B.I.、MUSTOFA R.H.、RAHMAWATI N.、WIJAYA G.P.A. 和 HIDAYAT O.T. 印度尼西亞學生的互聯網技能、互聯網態度、計算機自我效能和數字公民身份的調查數據。數據簡報，2021年，39。https://doi.org/10.1016/j.dib.2021.107569
[36] RAFIQUE G.M.、MAHMOOD K.、WARRAICH N.F. 和 REHMAN S.U. 新冠肺炎大流行期間在線學習的準備情況：對巴基斯坦信息系統學生的調查。學術圖書館學雜誌，2021年，47(3)：102346。https://doi.org/10.1016/j.acalib.2021.102346
[37] RUDDY C. 和 PONTE F. 讓學生為大學學習及以後的學習做好準備：提供學術誠信意識的微證書試驗。澳大利亞圖書館和信息協會雜誌，2019，68(1)：56-67。https://doi.org/10.1080/24750158.2018.1562520
[38] RYAN R.M. 和 DECI E.L. 自決理論視角下的內在和外在動機：定義、理論、實踐和未來方向。當代教育心理學，2020，61(四月)：101860. https://doi.org/10.1016/j.cedpsych.2020.101860
[39] SØREBØ Ø., HALVARI H., GULLI V.F. 和 KRISTIANSEN R. 自決理論在解釋教師繼續使用電子學習技術的動機中的作用。計算機與教育，2009，53(4)：1177-1187. https://doi.org/10.1016/j.compedu.2009.06.001
[40] STANDAGE M.、DUDA J.L. 和 NTOUMANIS N. 學校體育自決理論測試。英國教育心理學雜誌，2005年，75(3)：411-433。https://doi.org/10.1348/000709904X22359
[41] STEFANIAK J. 和 CAREY K. 灌輸在高等教育中實施數字徽章的目的和價值。國際高等教育教育技術期刊，2019，16(1). https://doi.org/10.1186/s41239-019-0175-9
[42] THANH T. 和 DOAN T. 感知風險和技術自我效能對在線學習意圖的影響：越南的實證研究。亞洲財經雜誌，2021，8(10)：385-393. https://doi.org/10.13106/jafeb.2021.vol8.no10.0385
[43] 聯合國教科文組織。隨著世界各地的教育機構開始重新開放，仍有13億學習者受到學校或大學停課的影響。2020. https://en.unesco.org/news/exams-and-assessments-covid-19-crisis-fairness-centre
[44] WEIGOLD A. 和 WEIGOLD I.K. 衡量從事不同技能水平的計算機活動的信心：技術自我效能簡要清單的開發和驗證。計算機與教育，2021，169（8）：104210。https://doi.org/10.1016/j.compedu.2021.104210
[45] WHEELAHAN L. 和 MOODIE G. 零工經濟的零工資格：微證書和“飢餓里程”。高等教育，2022，83(6)：1279-1295。https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8331095/
[46] YAU H.K. 和 CHEN A.L.F. 學習模式對使用技術學習信心的影響：香港高等教育的實證研究。在：2013年3月13日至15日，香港，2013年，第二卷，國際工程師和計算機科學家多方會議論文集。
[47] YOUNG D.、WEST R.E. 和 NYLIN T.A. 開放微證書對收入者和發行者的價值：國家儀器開放徽章的案例研究。國際開放與遠程學習研究評論，2019，20(5)：104-121。https://doi.org/10.19173/irrodl.v20i5.4345
[48] GAUTHIER T. 微證書的價值：雇主的觀點。能力本位教育雜誌，2020年，5(2)：e01209。 https://doi.org/10.1002/cbe2.1209
[49] LIM C.L.、NAIR P.K.、KEPPELL M.J.、HASSAN N. 和 AYUB E. 為在大學範圍內實施微證書和數字徽章開發框架：馬來西亞私立大學的案例研究。在：2018年電氣和電子工程師協會第四屆計算機與通信國際會議，2018：1715-1719。
[50] PANGARIBUAN C.H., HIDAYAT D., PUTRA O.P.B., AGUZMAN G. 和 FEBRIYANTO R. 自決理論視角下的數字徽章。帕拉克的埃及考古學雜誌/埃及學，2020年，18(1)：116-127。
[51] AHMED D. 和 GHADA J. 微證書生活和就業技能：評估學生和教師對在高等教育中實施微證書的態度。在：2021年巴林美國大學電子學習會議論文集：創新學習和教學-2021年新冠肺炎的經驗教訓。