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# Towards Constructing and Developing a Self-Efficacy Scale for Distance Learning and Verifying the Psychometric Properties

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**Abstract:** Distance learning self-efficacy is the realistic awareness of the individual's cognitive, emotional, and social capabilities, ability to solve problems, preferred thinking style, confidence in himself, and handling of desirable and difficult life activities in online learning environments. The current study aimed to construct and develop a distance learning self-efficacy scale for university students. To achieve this goal, a distance learning self-efficacy scale was constructed after reviewing the literature, namely theoretical and scientific frameworks regarding scales of self-efficacy in Arab and foreign environments. The current research reached a set of dimensions that are comprehensive and include most aspects of distance learning self-efficacy processes. The scale was piloted with 200 undergraduate students to verify validity and reliability. To verify the psychometric properties of the scale in preparation for its development, the final version of the scale was applied to a study sample of 1800 students. The results showed that the scale has good psychometric properties. This is indicated by the results of the Rasch model analysis, as well as the results of the confirmatory factor analysis of the agreement of the indicators of a good fit with the main dimensions of the scale. This means that the scale is valid as a tool for evaluating distance learning systems and that it can be used on learners in online learning environments.

**Keywords:** self-efficacy; self-efficacy scale; psychometric properties; distance learning; higher education



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## 1. Introduction

The conditions of the coronavirus pandemic have forced us to rely completely on distance learning systems. Over time, distance learning has imposed itself on education systems in many countries. It occupies a large space in the learning processes and constitutes an essential part of teaching and learning processes. Therefore, all of these things have imposed an urgent need to conduct continuous evaluations of all dimensions of the distance learning system. The distance education system is characterized by the fact that it is based on a set of dimensions, and on concerted efforts and endeavors, in order to develop a technical education system to meet the basic needs of learners. There is no doubt that any distance education system has a set of dimensions and elements that play an important role in the efficiency of the distance education system as a whole. The most important dimensions and elements of the efficiency of the distance education system can be outlined as follows: [1]

1. Work environment: The work environment in the distance education system includes three basic elements: First is the learner, who depends on self-learning, sets a schedule or daily procedures to start learning online, communicates continuously with teachers, and conducts continuous research with adults and trainers to communicate with them when they need specific information. Second is the teacher, who is trying to interact directly with the students. Third is the educational institution that seeks to achieve continuous care for learners [2];

2. Learning motivation: aims to design motivational situations in e-learning environments to motivate learners to learn. They are based on four components: attention, relevance, confidence, and satisfaction. These components represent a set of necessary criteria to fully motivate the learner [3];
3. A passion for research beyond knowledge: seeks to apply knowledge and problem solving to new situations and seeks an ability to explain hypotheses as well as synthesize and generalize them. This high-level thinking plays an important role in the learning and teaching practices of the education system [4]. It refers to people's awareness and control, not only their cognitive processes but also their emotions and motivations [5];
4. Multimedia programs: play an important role in improving the quality and efficiency of distance learning. It is an integrated type of delivery of educational materials for students, based on the effects of sound, video, text, graphics, and animation (movement of objects in space). Multimedia programs are based on computer science software and hardware and are used as the main support for teaching and learning methods [6].

With the emergence of e-learning applications, especially in the field of e-course design and development, it is imperative to find new assessment tools that fit with the new curricula and assessments [7]. Distance assessment is mainly done to provide feedback to learners, starting from assignments to end-of-semester exams so that they know what they are doing and what they are supposed to do to complete the program or course. Assessment in distance learning is useful for monitoring the effectiveness of academic programs and for adopting appropriate strategies to achieve the desired goals. The practice of assessment in distance learning affects the improvement of students' learning in developing positive attitudes [8]. Karal and Cebi concluded that the assessment and evaluation process is not limited to online tests only, but also includes modules such as forums, homework, wiki pages, and dictionaries that show student performance in the educational process [9].

The individual or the learner constitutes the cornerstone of the success of this system, whatever the strength of the technical infrastructure in its preparation and programs, because they are considered the user and the largest beneficiary of this system. Considering that the personality of the individual is the main driver of the distance learning processes, we were able to search for the aspects of these processes and the methods of their use in distance learning situations, not only to clarify the nature of these processes and their different dimensions but also to determine assessment methods for these processes as well as the extent of their role in the success of this system.

Recently, due to the COVID-19 pandemic, distance learning has become a very urgent need in most countries. At first, education was completely transformed into distance education, and it was then partially transformed. Therefore, it is necessary to ensure the efficiency of the distance learning method, which has become the only one that meets the continuity of the educational process. Therefore, techniques, processes, and methods have been improved to enhance the learning process and activities. In addition, attention to self-efficacy plays an important role in improving academic performance.

The concept of self-efficacy is one of the basic concepts in the interpretation of human behavior. Bandura [10] presented an integrated theory of this concept; he identified the dimensions and sources of self-efficacy. This theory represents an important aspect of social learning theory. Bandura [10] (p. 20) regards self-efficacy as an indicator of the extent of the individual's ability to control his actions. An individual who has a high sense of self-efficacy can find effective methods and is able to face the challenges of his environment and make decisions. According to Bandura, self-efficacy consists of three dimensions: behavioral self-efficacy, which is related to social skills, cognitive self-efficacy, which is related to beliefs and control of thoughts, and emotional self-efficacy, which is related to controlling moods or feelings in life situations [8,10].

Many Arabic studies have presented scientific questionnaires that implicitly seek to assess self-efficacy, including some of the sub-dimensions of distance learning self-efficacy,

which may not rise to the degree of a scale. This is in addition to the fact that in the international references and literature, many attempts to apply some of the questionnaires to the dimensions of self-efficacy for distance learning have been made. The disadvantage of these questionnaires is their lack of comprehensiveness and their reliance on some dimensions and not others. Over time, some researchers have examined some optimal ways to develop a scale that can be applied to measure self-efficacy for distance learning. A study by Shen et al. [9] also demonstrated a scale for the self-efficacy of online self-learning. The authors in [11] developed the Online Learning Self-Efficiency Scale (OLSES), which consists of three dimensions: learning in an online environment, time management, and the use of technology. Although these studies are characterized by some relatively comprehensive processes, they can be developed to include more general, more comprehensive, and deeper dimensions through the methods of determining the behavior of distance learners, and more applications and processes can be developed such that they are valid for application in Arab contexts.

Several conferences have pointed out the need to pay attention to the aspects of self-efficacy in online learning environments. The e-learning and distance education conference "Innovation and Sustainability" emphasized the necessity of creating measurement and evaluation tools for the e-learning and distance education system [12,13]. The international conference "Education and E-Training for Human Capacity Development" also emphasized that there is an urgent need for more forms of evaluation. For example, we may need evaluation models to identify the extent to which individuals can share their learning records, achievements, and skills in preparation for finding suitable future jobs [14].

The urgent need for a deep and comprehensive scale of self-efficacy processes for distance learning, as well as the combined research of previous local and global studies, resulted in a set of sub-scales of self-efficacy. Researchers have sought to develop a scale of self-efficacy that is deep and comprehensive and is based on a set of dimensions that include some distance learning self-efficacy processes, such as learners' educational knowledge and experience, online communication and interaction, feedback processes, learner motivation, and the social effects of distance learning processes.

With the spread and dominance of the various applications of distance education systems, considering it a sustainable learning method in the future, and in light of the urgent need for local and global environments to conduct continuous evaluation processes to determine the extent to which learners benefit from the distance education system, researchers sought to construct and develop a distance learning self-efficacy scale and to verify the psychometric properties of its development.

A self-efficacy scale for learners in online learning environments should be based on approaches, theories, and philosophical frameworks that help identify the different areas of self-efficacy. A set of dimensions is derived from this, covering, as much as possible, a set of behavioral practices for the self-efficacy of learners in online learning environments. Thus, the first question that the current research will seek to answer is: What are the main dimensions (philosophy, approaches, and frames of reference) of the distance learning self-efficacy scale?

The process of constructing and developing the scale has a set of procedures for its preparation, starting with the need for the scale and determining its goal, followed by the preparation of the scale-building project through the analysis and classification of the behavior to be measured, and ending with specifying the scale. Hence, we have to discuss the answer to the second question of the study: What is the proposed perception for developing and constructing a distance learning self-efficacy scale?

Finally, the processes of constructing and developing the scale and determining its specifications are no longer sufficient for the validity of its application unless the scale passes a set of different developing processes. The scale describes the behavioral practices of the learners, is comprehensive regarding the characteristics being measured, and is judged by experts, and the validity and reliability coefficients of the scale are finally calculated. Therefore, the last question that we seek to answer in this research is: What are

the procedures for developing the self-efficacy scale for distance learning and verifying the psychometric properties?

### *1.1. Significance of the Study*

There are many scales and questionnaires used to measure general self-efficacy. In light of continuous technological developments, there is an increasing need to further develop modern assessment strategies and tools, and then develop a measure of self-efficacy for distance learning that is compatible with current technological developments and provides more accurate and reliable results [14]. There is a need for local and international distance education systems to carry out continuous evaluation and development processes to increase the chances of sustainability of the distance education system and impose themselves on the education system. Therefore, there is an urgent need for appropriate assessment tools, as well as a need for Arab environments to have a standardized scale of self-efficacy for distance learning that is applicable, deep, and comprehensive for distance learning self-efficacy processes.

This study attempts to utilize cognitive theories of educational technology and relies on theories and philosophical frameworks to prepare the scale by reviewing the theoretical and philosophical frameworks for the learners' self-efficacy in online learning environments and extracting the behavioral practices of learners. The current scale focuses on the characteristics of learners and their cognitive experiences, emphasizing communication practices to achieve higher rates of interaction, benefiting from feedback processes for correction, guidance, and immediate guidance, employing all forms of social learning, and focusing on motivators and motives as main drivers of the learner in online learning environments.

### *1.2. Literature Review*

Several studies used methods to measure aspects of learning self-efficacy. Some studies aimed to investigate and collect data on self-efficacy but did not develop a scale [15–17]. Some studies have developed self-efficacy scales but focus on the technological dimension [18,19]. Some studies have also developed self-efficacy scales that included some cognitive and technological dimensions [11,20]. Despite the adoption of these scales, they are criticized for not being comprehensive and in-depth for all aspects of self-efficacy in online learning environments.

Some scales related to distance learning self-efficacy have been developed. Shen et al. [9] developed a scale of self-efficacy for online self-learning, which consisted of five dimensions: continuity, social interaction with colleagues, handling of system management tools, interaction with trainers, and self-efficacy for academic interaction with study groups. Zimmerman and Kulikowich [11] also developed the OLSES, as mentioned above, which was adapted to a Turkish environment to determine its validity and reliability by Yavuzalp and Bahcivan [14].

The purpose of the study by Kundu [21] was to review the role of self-efficacy in online education in order to propose a comprehensive framework for enhancing participants' self-efficacy. The results revealed that self-efficacy, a person's level of confidence to perform a task, is an important factor among teachers and students via online platforms, and improved effectiveness is able to encourage online practices. Finally, the study suggested a framework for enhancing self-efficacy among participants with intervention procedures to make online education effective and impressive.

A study by Binlingan et al. [22] aimed to use the descriptive associative quantitative method to investigate online learning readiness and self-efficacy. It includes five dimensions of the online readiness framework: self-direction, learning preferences, study habits, technology skills, and infrastructure. The results showed that the level of the Internet and the level of self-efficacy are medium; there is a strong positive relationship between readiness and self-efficacy via the Internet. A study by Malureanu and Lazar [23] aimed to understand the relationship between self-confidence, self-efficacy, persistence, utility,

and the ease of use of e-learning platforms. Findings revealed that self-confidence and consistency of interest contributed to boldness, and the ease of use of e-learning platforms anticipated lifelong learning solutions. A study by Saefudin and Yusoff [24] aimed to explain the perception of student participation in online learning during the epidemic. It identified the role that self-efficacy played in student participation in online learning. The results revealed that self-efficacy was a pivotal variable affecting participation. Therefore, increasing students' self-efficacy in academic competence contributed to enhancing their participation and positive attitudes towards the online learning environment during the pandemic.

In the study of Hong et al. [25], which is based on the assumption that Internet self-efficacy (ISE) and the self-efficacy of interacting with learning content (SEILC) have a relationship with the observed ineffectiveness of online learning (PIOL), the results indicate that improving learners' ISE and SEILC could have reduced PIOL. A study by Limiansi and Hadi [26] aimed to look at students' self-efficacy in online learning during the COVID-19 pandemic as well as the differences based on student demographics. The results showed that the students' self-efficacy dominated the category of mediators. The study stated that lecturers needed to improve the quality of online learning through innovative learning packages and motivation and to introduce students to technology and online learning resources so that they can face challenges. While previous research has focused only on computer self-efficacy, the success of e-learning has been extensively researched. A study by Ithriah et al. [27] contributed to revealing the effect of the self-efficacy factor of online learning on the success of e-learning using the D&M model. The result of data processing using Warp PLS shows that the self-efficacy factor of online learning has a positive and important impact on the use of e-learning.

Blanco et al. [28] conducted a study that aimed to investigate the relationship between self-confidence and self-efficacy among students. The results showed that both self-confidence and self-efficacy were described as high. It was concluded that there is a moderately high positive correlation between levels of self-confidence and self-efficacy among students while engaging in online learning. A study by Calaguas and Consunji [29] demonstrated that academic self-efficacy has positive predictive relationships with computer self-efficacy, learning management system self-efficacy, and Internet and information self-efficacy. The modeling also revealed that computer self-efficacy, a learning management system, and Internet and information self-efficacy positively predict online learning self-efficacy.

By reviewing the literature related to distance learning self-efficacy, it was found that there is a scarcity of studies that investigate the multiple dimensions of self-efficacy in online learning [30]. Most of the studies created scales that focused on the technology dimension, general self-efficacy, and the learning dimension only in online learning environments [31]. In addition, they were based on one or more of the dimensions related to distance learning self-efficacy. Hence, this study is distinguished by its quest to review the previous literature, in order to reach the development of a scale of self-efficacy for distance learning that is comprehensive and based on a set of dimensions including communication and social interaction for distance learning processes, knowledge and educational experience for learners, feedback processes, different motivations, and stimuli for learning.

The Zimmerman and Kulikowich [11] scale included only 21 items, which may be insufficient to study behavioral phenomena in online learning environments. This study seeks to provide a measure of self-efficacy that includes 49 items distributed over five different dimensions characterized by comprehensiveness and depth. It is also characterized by the appropriate coverage of dimensions of behavioral phenomena in online learning environments, which may increase the chances of applying the results to future research.

### *1.3. Frameworks and Philosophical Approaches to Self-Efficacy in Online Learning Environments*

Technological advances and the ease of access to the Internet have led to an increase in online learning compared to traditional learning environments. Online learning offers

learning experiences using technology, which provides access, connectivity, flexibility, and the ability to enhance interactions between learners. With the increasing number of users of online learning, there is a need to understand how students can best apply learning strategies to achieve academic success in an online environment [32].

Advances in current technology have led to changes in the way information is distributed and accessed. Internet technologies have become one of the most prevalent ways to access information, because of their impact on education systems and teaching and learning activities. At present, many studies are being conducted to ensure the effectiveness and efficiency of the distance learning method, which meets important educational needs. The important qualities of distance learning are the presentation of lesson content enriched with multimedia objects, the synchronous and asynchronous use of online communication tools, and service that is not dependent on access at a specific time and location. Moreover, e-learning environments enable different communication technologies that are used on independent platforms to be used together [33].

Research on self-efficacy began before online learning occurred, between the late 1970s and early 1990s, before the advent of online learning. In 2008, Hodges stated that "the research on self-efficacy in online environments is still in its infancy" [34] (p. 10). He also suggested that more research is needed in the area of self-efficacy in online learning. Numerous studies on self-efficacy in online learning environments in higher education have been conducted, which is different from that in traditional learning environments.

In the following points, we review the theoretical literature to pave the way for cognitive approaches and approaches that help us determine the cognitive frameworks and dimensions that support building measures of self-efficacy for distance learning:

- Self-efficacy resources for distance learning;
- The impact of distance learning self-efficacy on academic performance;
- The different dimensions of self-efficacy for distance learning.

#### 1.3.1. Self-Efficacy Resources for Distance Learning

Bandura deduced that the sources of self-efficacy are performance achievements (or inactive mastery experiment), indirect experience, verbal persuasion, and physiological states. These four principles are essential to the development of self-efficacy in general, including in the context of learning [12]. Bates and Khasawneh indicate that self-efficacy in the context of online learning is influenced by previous success in online learning, pre-sessional training, the teacher's notes, and anxiety about online learning technology [35]. Lin et al. examined older learners' Internet self-efficacy sources and discovered that they shared Bandura's self-efficacy sources (1997) [36].

#### 1.3.2. The Effect of Distance Learning Self-Efficacy on Academic Performance

Self-efficacy is an important factor in online learning environments. Horzum and Kaker reported that students' high perceptions of online technologies can influence students' interaction with classmates and teachers as well as their behavior in using technology [37]. Furthermore, some researchers claim that self-efficacy can be a main component of academic success in online learning [38]. Shen et al. report that self-efficacy is also associated with students' prior online learning experiences and their gender, regardless of the success of online learning [9]. Lim states that students' computer self-efficacy has a significant impact on their satisfaction and their opinions regarding participation in online courses in the future [36]. Additionally, Zimmerman and Kulikowich reported that students with a high level of self-efficacy for online learning are more likely to succeed in online courses [11].

#### 1.3.3. The Different Dimensions of Distance Learning Self-Efficacy

With the development of high-quality e-learning and online learning environments, as well as the increase in communication technologies and educational platforms [14], students must have the ability to use these technologies and platforms to succeed. It is known that self-efficacy is an important psychological factor and plays a key role in adapting and

dealing with distance learning environments, thus achieving success [11,27,34,39]. In order to increase students' self-efficacy, it is necessary to identify the dimensions and variables that affect the self-efficacy of distance learning.

By reviewing the literature that sought to analyze the factors affecting self-efficacy, and examining the factors that contribute to self-efficacy in the online learning environment, the current study found a set of dimensions on which the self-efficacy of distance learning is based:

1. Educational knowledge and experience: This refers to the learner's familiarity with the knowledge and experiences associated with distance learning systems, such as the ability to install and use a package of programs needed for e-learning systems, the ability to use different search engines for books and electronic scientific resources, and the ability to find educational materials in the online learning system. Some studies have shown strong agreement on the effect of the online learning experience and knowledge on self-efficacy. Choi et al. revealed that the experience of flooding has a direct and indirect effect on attitudes toward e-learning and on technology self-efficacy in ERP training using a web-based e-learning system [40]. Song et al. also examined the effects of medical training on students' prior knowledge, self-regulation, and motivation on learning performance in complex multimodal learning environments, and the results showed that students with more prior knowledge about their carotid artery disease status tended to report higher self-efficacy [41]. Kim and Park investigated the factors that influence an individual's behavior to use e-learning through social cognitive theory by studying the adoption of e-learning by teachers and learners, and the results showed that computer experience significantly affected the computer self-efficacy of learners [42];
2. Communication and interaction: Learners have the ability to communicate with others through distance learning systems, e.g., between teachers and learners through e-learning systems, the ability to achieve social interaction with others according to situations in distance learning systems, the ability to post messages and respond to others' messages in discussion boards via distance learning systems, and the ability to use synchronous technologies to chat and communicate with others. Some studies have concluded with strong agreement on the effect of online communication and on the effect of interaction on self-efficacy. Cho and Cho found that online learners who interact with other learners, the content, and the teacher are more likely to demonstrate higher self-efficacy for learning and higher satisfaction with the course [43]. Lim et al. also emphasized the influence of learner–learner interaction on computer and academic self-efficacy, while academic self-efficacy and computer self-efficacy were affected by the content quality and system quality [44]. Reychav et al. investigated the effect of the social network on mobile collaboration focusing on two aspects of the social network mechanism: the centralization of eigenvectors and reciprocity on the network. The results indicated that the network exchange formed through peer interactions between users can benefit from using mobile devices in collaborative work [45];
3. Feedback: This is the physical or moral motivational feedback that the learner receives through distance learning platforms, such as the learner's ability to possess stimuli when receiving direct feedback through distance learning systems, the learner's ability to benefit from immediate and delayed feedback via distance learning platforms to support correct responses and modify incorrect responses, and the ability of the learner to adapt their learning methods to meet the expectations and learning outcomes through distance learning systems. A few studies have reported a positive impact on self-efficacy when feedback and rewards are given. Liou et al. noted that members of the online Yamol test community improved self-efficacy for knowledge sharing if they expected extrinsic rewards [46]. Wang and Wu suggested that students who received more detailed feedback significantly increased their self-efficacy, and that feedback

and rewards are an opportunity to discover whether they are achieving their learning goals [47];

4. Social impact: The social factor is defined as an individual's assimilation of the self-culture of the reference group, as well as the individual's specific personal agreements with others in specific social situations. It also refers to the ability of the learner to demonstrate their skills to others and the ability to understand and observe others and exercise all forms of social influence through distance learning platforms. For example, learners have the necessary capabilities to monitor the opinions of other members and learn from them through distance learning systems, and they interact with teachers and learners to achieve desirable changes in educational behavior, providing constructive feedback on the contributions of other students to the discussion and accepting different ideas. Some studies have discussed the effect of social influence on self-efficacy. Chu and Chu suggested the role of collectivity and group effectiveness in predicting individual Internet self-efficacy and individual e-learning outcomes. The results showed that Internet self-efficacy fully mediates the relationship between peer support and learners' perseverance in e-learning; in addition, collectivism also modifies the relationship between peer support and Internet self-efficacy [48]. Chu also noted that family support had the most significant role in predicting the effects of e-learning, mediated by general self-efficacy and online communication [49];
5. Learner motivation and orientation: This means that the learner has motives, stimuli, and orientations to accomplish work and carry out various activities through distance learning platforms. The learner, for example, can carry out the proposed activities in distance learning environments that encourage scientific thinking. The learner can determine pre- and post-learning requirements, as well as performance evaluation criteria to build positive expectations and achieve success via distance learning platforms. Learners can achieve self-directed learning via distance learning platforms.

Some studies have indicated that learner motivation and attitude were the main factors affecting online learner self-efficacy. Hong et al. suggested that the intrinsic motivation to learn Chinese can positively predict the self-efficacy of online learning [50]. Wang et al. emphasized that the level of motivation directly affects the level of technological self-sufficiency and that self-efficacy and motivation have a complex interrelationship, and they are likely to influence or support the other [51].

By reviewing the literature and previous studies that address self-efficacy in some of its dimensions, the current study determined a set of dimensions on which the distance learning self-efficacy scale is based. It is comprehensive and in-depth on most aspects of distance learning self-efficacy processes. Thus, we may have reached an answer to one of the research questions: What are the main dimensions on which distance learning self-efficacy measures are based?

## 2. Methods

### *2.1. Research Model and Procedure*

This study used the quantitative descriptive survey approach, which is one of the forms of organized scientific analysis and interpretation to describe a specific phenomenon or problem by collecting, classifying, and analyzing standardized data. Since quantitative research involves a large community, it provides the chance to obtain more accurate results. A distance learning self-efficacy scale was developed, and it consists of five dimensions: educational knowledge and experience, communication and interaction, feedback, social impact, and learner motivation and orientation. Ethical approval was obtained from King Faisal University to conduct the research. The nature of the scale was explained and applied to an exploratory sample and then on the sample. Finally, statistical treatments, analysis, and an interpretation of the findings were conducted.

### *2.2. Population and Sampling*

The study sample was selected through the following steps:

- The study aimed to apply the distance learning self-efficacy scale to a group of male and female students in Arab countries;
- The Arab culture is considered one of the oldest cultures in the world, due to its well-established roots that date back to pre-Islamic times. Arab culture is widespread, humane, transitional, and similar in form, and its legacies depend on an important factor: the Arabic language;
- The Arab countries are classified into three categories: the Levant, the Gulf states, and the Arabs in Africa. Jordan was chosen as a sample representing the Levant, Saudi Arabia was chosen as a sample representing the Gulf countries, and Egypt was chosen as a sample representing of the Arabs in Africa. This is in addition to the Arab countries' participation and interdependence in cultures, customs, and traditions, depending mainly on communication in a single language;
- The population consisted of undergraduate students at Arab Universities during the academic year 2021/2022. The sample of the study consisted of 1800 students randomly selected from Arab universities: 600 students from Saudi Arabia, 700 students from Egypt, and 500 students from Jordan;
- The largest and oldest public universities in each country were identified, and the university administration was contacted to distribute the questionnaire, with the ethics statement of scientific research attached. The universities then sent messages to students requesting their participation. Some colleagues also helped in the process of distribution, supervision, and encouragement of the response process;
- The data were collected through Google Forms, and questionnaires were sent to all potential respondents through email and WhatsApp.

### *2.3. The Scale*

By reviewing the literature and previous studies, the researchers found that there are a group of factors affecting the self-efficacy of distance learning, and through these factors, we were able to identify five main dimensions. By analyzing these dimensions, we deduced a set of items that cover as much as possible and describe learners' practices in online learning environments. Figure 1 below shows the procedures for constructing and developing the scale of self-efficacy for distance learning.

Figure 1 illustrates the procedures for constructing and developing a distance learning self-efficacy scale as follows:

- The purpose of the scale, measuring the self-efficacy of distance learning, was defined;
- The dimensions of the scale were determined by reviewing books, the Internet, expert opinions, and literature reviews. The scale consisted of five dimensions: instructional knowledge and experience (IKE), communication and interaction (CI), feedback (F), social impact (SI), and learner motivation and attitude (LMA);
- Scale items were developed and formulated based on previous studies, the researchers' experience, and some faculty members. The dimensions scale consisted of 78 items. A five-point response scale was developed for each item, starting with completely achieved, highly achieved, moderately achieved, slightly achieved, and not at all achieved;
- The validity of the scale was verified. Thirteen experts from Arab universities examined the scale items. Based on their opinions, ambiguous and unclear words and items were modified, grammatical errors were corrected, and items that were regarded as inappropriate or duplicated by at least 30% of the experts were omitted, as shown in Appendix A;
- To ensure validity and reliability, the scale was piloted with 200 undergraduate students, and the responses and feedback obtained were used in modifying the final scale. Rasch model analysis was used because it is a powerful tool for evaluating construct validity. It also achieves objectivity in psychological and educational measurement [52].

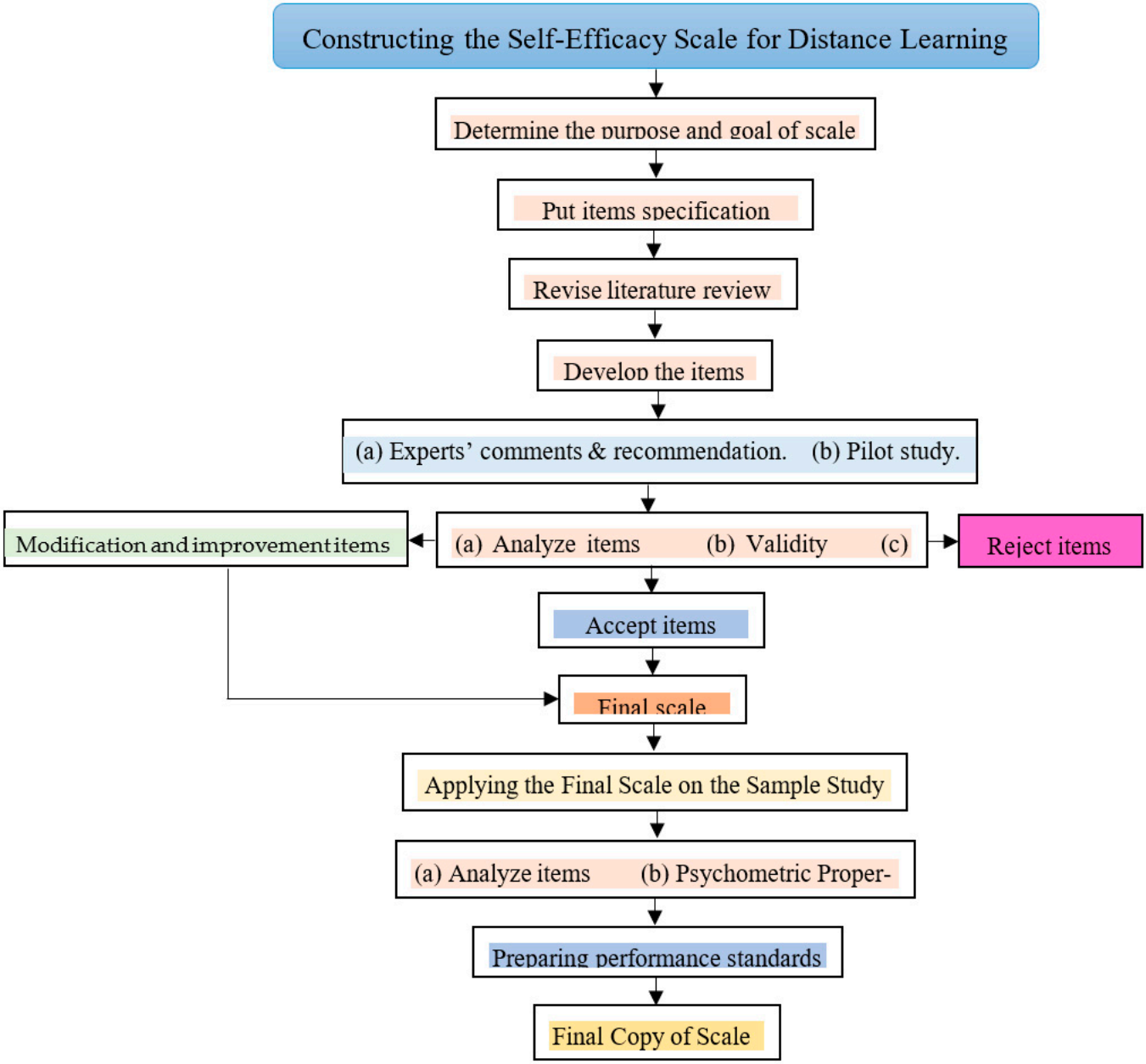


**Figure 1.** Scale construction procedures.

There are important aspects of Rasch model measurement that should be taken into account to understand the interpretations of the analysis of its results:

1. Infit and misfit: The degree of fit of an item or a person is referred to as the infit. For easy interoperation, the infit means that the square is a transformation of the residuals, the difference between the predicted and observed values. As a general guideline, MNSQ values for the infit that lie between 0.4 and 1.5 are considered appropriate, and standardized fit statistic (Zstd) values that range between −2 and 2 are as well. One item in the first dimension was omitted because their MNSQ value of infit and outfit was greater than 1.5 and the Zstd value, as shown in Appendix B [52–55];
2. Item polarity analysis (point-measure correlation PTMEA) or consistency of the items are indications of whether or not the items move in the same direction as the constructs being measured. If a negative indicator exists for a specific item, the data should be re-examined to see if it can be improved or removed because these indicators show that some items or individuals respond differently than the construct. It also detects

construct validity early on. If the value lies between 0.2 and 1, then the data results are appropriate, as shown in Appendix B;

3. Dimensionality aspects are essential for assessing whether the instrument is measured in only one direction and only one dimension. One of the requirements in Rasch model analysis is dimensionality. This is to confirm the instrument's content and construct validity. The forcing on one trait or dimension at a time is referred to as dimensionality. The dimensionality criterion should be more than 40%, and the unexplained variance in the first contrast less than 15. To achieve one dimension and one direction, the raw variance should be explained by measures of more than 40%, and the unexplained variance in the first contrast should be less than 15 [52,53]. The dimensionality data results are appropriate to the Rasch model, as shown in Appendix C;
4. Item separation refers to the ability of all participants to answer items of varying degrees of difficulty. That is, the individuals can be divided depending on the assessed constructs. A higher separation value indicates that more items and persons are spared along a continuum, while lower separation values suggest item repetition and less diversity among persons on the trait. However, the reliability analysis was tested and conducted with 86 items for the self-efficacy scale among 60 students. The criterion for accepting reliability in the Rasch model is that it exceeds 0.50 [56,57]. In addition, acceptable separation should be more than 2 [52]. Data analysis of reliability using the Rasch model is shown in Appendix C. The person reliability was very high, at a value of 0.92, the person separation was 3.31, the item reliability was 0.74, and the item separation was 2.69, which are acceptable.

- The final scale consisted of 49 items;
- The final scale was applied to the sample study, which comprised 1800 students;
- Validity and reliability were ensured based on the Rasch model.

### *2.4. Data Analysis*

To answer the study question and verify the construct validity, Rasch model analysis was conducted using Winsteps software, version 3.68.2. Rasch model analysis was used to verify the validity and reliability of the questionnaire, because it was possible to obtain an estimated value of the ability of an individual and an estimated value of the difficulty and discrimination coefficients for items. The model was also used to obtain a statistical coefficient that indicated the accuracy of estimating the ability of each individual [50]. In addition, factor validity was calculated using exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) using SPSS version 26 and Amos statistical software version 25. Confirmatory factor analysis (CFA) is a type of structural equation modeling (SEM) that looks for patterns in data (SEM). CFA is a useful statistical approach for examining latent construct relationships. It is an analytical tool used to create measurement instruments, assess construct validity, and categorize method impacts. It is used to test the latent structure of a test tool throughout the instrument's development process. It is also utilized to double-check the instrument's primary dimensions and factor loadings. For other aspects of psychometric evaluation, it is an important analytical tool [52,53].

## 3. Results

What are the procedures for developing a self-efficacy scale for distance learning and verifying the psychometric properties in Arab environments? This was our third question.

There are steps to developing a distance learning self-efficacy scale. The construct validity of the scale was verified using two different methods.

### *3.1. Construct Validity According to the Rasch Model*

In order to verify the validity and reliability of the final distance learning self-efficacy scale, the following was performed:

- The validity of the scale was measured using MNSQ values for the infit, and the results showed that the scale had an appropriate degree of validity. Scale validity

scores according to MNSQ values fall within the safe limits, which should lie between 0.4 and 1.5. It is consistent with the item polarity analysis according to PTMEA values, whose values should be between 0.2 and 1. It has a suitable standardized fit statistic (Zstd) value, which should be between −2 and 2, as shown in Table 1 below;

**Table 1.** Item-Fit Analysis for Self-Efficacy Scale (Final).

| Count | Measure | Model S.E | Infit | | Outfit | | Pt-Measure | | Exact OBS% | Match EXP% | Items |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | MNSQ | ZSTD | MNSQ | ZSTD | CORR | EXP | | | |
| 1800 | 0.19 | 0.07 | 1.36 | 1.9 | 1.94 | 1.8 | 0.44 | 0.64 | 54.7 | 50.5 | IKE 5 |
| 1800 | 0.03 | 0.06 | 1.36 | 1.8 | 1.17 | 1.9 | 0.54 | 0.67 | 45.3 | 51.5 | IKE 2 |
| 1800 | 0.50 | 0.07 | 1.16 | 1.8 | 1.87 | 1.5 | 0.56 | 0.68 | 60.4 | 44.9 | IKE 8 |
| 1800 | 0.04 | 0.06 | 1.25 | 0.9 | 1.33 | 1.2 | 0.56 | 0.69 | 45.3 | 49.2 | IKE6 |
| 1800 | 0.06 | 0.07 | 1.45 | 1.6 | 0.97 | −0.3 | 0.57 | 0.64 | 66.0 | 46.7 | CI4 |
| 1800 | 0.65 | 0.07 | 1.26 | 1.7 | 1.81 | 1.6 | 0.57 | 0.65 | 54.7 | 45.0 | LMA8 |
| 1800 | 0.22 | 0.06 | 1.06 | −1.2 | 1.31 | 1.9 | 0.57 | 0.63 | 45.3 | 50.5 | SI10 |
| 1800 | 0.36 | 0.06 | 1.24 | −0.3 | 0.86 | −1.4 | 0.58 | 0.59 | 54.7 | 46.8 | IKE3 |
| 1800 | 0.50 | 0.06 | 1.08 | −0.7 | 0.97 | −0.9 | 0.58 | 0.61 | 56.6 | 55.0 | SI9 |
| 1800 | 0.38 | 0.06 | 1.21 | 0.7 | 0.82 | −0.8 | 0.60 | 0.67 | 56.6 | 49.2 | IKE1 |
| 1800 | 0.60 | 0.06 | 1.43 | −1.6 | 1.34 | −0.7 | 0.60 | 0.67 | 45.3 | 46.7 | LMA10 |
| 1800 | 0.35 | 0.07 | 1.06 | −0.8 | 1.09 | −0.9 | 0.60 | 0.62 | 66.0 | 52.9 | SI8 |
| 1800 | 0.79 | 0.06 | 0.95 | 0.3 | 1.17 | 0.4 | 0.61 | 0.64 | 52.8 | 48.0 | LMA7 |
| 1800 | 0.17 | 0.07 | 0.97 | 0.6 | 0.89 | −1.6 | 0.61 | 0.67 | 64.2 | 50.1 | SI7 |
| 1800 | 0.22 | 0.06 | 1.36 | 0.8 | 1.14 | −1.3 | 0.61 | 0.65 | 54.7 | 45.0 | F4 |
| 1800 | 0.24 | 0.07 | 0.90 | 0.6 | 1.06 | −1.1 | 0.63 | 0.65 | 45.3 | 50.5 | IKE4 |
| 1800 | 0.34 | 0.06 | 1.05 | −0.5 | 0.84 | 1.3 | 0.63 | 0.63 | 62.3 | 55.3 | CI3 |
| 1800 | 0.27 | 0.07 | 1.00 | −0.6 | 1.36 | −.04 | 0.63 | 0.65 | 62.3 | 45.0 | LMA5 |
| 1800 | 0.15 | 0.07 | 0.88 | 1.1 | 0.72 | 1.6 | 0.64 | 0.72 | 54.7 | 50.5 | SI1 |
| 1800 | 0.13 | 0.06 | 0.94 | 1.2 | 0.70 | 1.2 | 0.64 | 0.69 | 45.3 | 51.5 | F3 |
| 1800 | 0.04 | 0.06 | 0.88 | 0.7 | 0.87 | 1.1 | 0.65 | 0.66 | 60.4 | 44.9 | CI10 |
| 1800 | 0.10 | 0.06 | 0.92 | 1.1 | 1.46 | 0.3 | 0.65 | 0.68 | 45.3 | 49.2 | CI5 |
| 1800 | 0.08 | 0.06 | 1.16 | 0.2 | 1.03 | 0.9 | 0.65 | 0.66 | 66.0 | 46.7 | IKE10 |
| 1800 | 0.26 | 0.06 | 0.81 | 0.3 | 1.25 | 0.7 | 0.65 | 0.64 | 52.8 | 52.9 | LMA9 |
| 1800 | 0.34 | 0.07 | 0.86 | 0.0 | 0.93 | 1.0 | 0.65 | 0.68 | 64.2 | 48.0 | F2 |
| 1800 | 0.27 | 0.06 | 0.91 | 0.6 | 0.79 | 1.7 | 0.66 | 0.64 | 64.2 | 50.1 | LMA2 |
| 1800 | 0.15 | 0.07 | 0.98 | 0.6 | 0.83 | 0.4 | 0.66 | 0.66 | 39.6 | 52.2 | CI9 |
| 1800 | 0.09 | 0.06 | 0.93 | 0.2 | 0.98 | −1.1 | 0.66 | 0.68 | 62.3 | 53.5 | LMA3 |
| 1800 | 0.35 | 0.07 | 1.04 | 0.2 | 1.48 | 0.6 | 0.66 | 0.69 | 62.3 | 55.3 | LMA6 |
| 1800 | 0.35 | 0.06 | 1.11 | 0.5 | 0.90 | −1.3 | 0.66 | 0.67 | 54.7 | 45.0 | CI1 |
| 1800 | 0.26 | 0.07 | 1.05 | 0.4 | 1.00 | 0.7 | 0.67 | 0.68 | 45.3 | 50.5 | IKE7 |
| 1800 | 0.18 | 0.06 | 0.98 | 0.3 | 0.85 | −0.5 | 0.67 | 0.66 | 45.3 | 51.5 | CI8 |
| 1800 | 0.62 | 0.07 | 0.97 | 0.9 | 1.06 | 0.6 | 0.67 | 0.69 | 66.0 | 44.9 | LMA1 |
| 1800 | 0.57 | 0.07 | 0.97 | 1.2 | 0.83 | 1.5 | 0.67 | 0.64 | 52.8 | 49.2 | SI6 |
| 1800 | 0.26 | 0.06 | 0.92 | 0.2 | 0.86 | 1.2 | 0.67 | 0.67 | 64.2 | 46.7 | F8 |
| 1800 | 0.18 | 0.06 | 0.85 | 0.3 | 0.87 | −1.0 | 0.67 | 0.68 | 65.2 | 51.8 | F5 |
| 1800 | 0.45 | 0.06 | 0.98 | −1.2 | 0.78 | −1.5 | 0.68 | 0.64 | 62.3 | 48.4 | CI2 |
| 1800 | 0.24 | 0.06 | 0.93 | −1.6 | 0.67 | −0.9 | 0.68 | 0.69 | 56.6 | 49.5 | F6 |
| 1800 | 0.35 | 0.06 | 0.87 | 0.6 | 0.86 | −0.2 | 0.68 | 0.67 | 60.4 | 54.0 | LMA4 |
| 1800 | 0.45 | 0.07 | 0.78 | −0.3 | 0.97 | −1.6 | 0.68 | 0.66 | 50.9 | 46.1 | SI5 |
| 1800 | 0.26 | 0.06 | 1.03 | 0.7 | 0.84 | −1.6 | 0.69 | 0.68 | 51.7 | 43.1 | SI3 |
| 1800 | 0.63 | 0.07 | 0.87 | 1.6 | 0.74 | 1.8 | 0.69 | 0.67 | 62.3 | 51.9 | SI2 |
| 1800 | 0.40 | 0.06 | 0.78 | 0.8 | 1.37 | −1.4 | 0.70 | 0.73 | 52.8 | 47.0 | IEK9 |
| 1800 | 0.16 | 0.06 | 0.92 | −1.3 | 0.92 | −0.4 | 0.70 | 0.68 | 62.3 | 49.2 | SI4 |
| 1800 | 0.13 | 0.06 | 0.94 | −1.2 | 0.67 | −1.8 | 0.70 | 0.70 | 61.4 | 44.9 | F10 |
| 1800 | 0.57 | 0.06 | 0.73 | −1.1 | 0.83 | −1.2 | 0.71 | 0.67 | 45.3 | 49.2 | CI7 |
| 1800 | 0.40 | 0.06 | 0.89 | −1.5 | 0.93 | −0.9 | 0.72 | 0.71 | 66.0 | 46.7 | CI6 |
| 1800 | 0.06 | 0.06 | 0.92 | −1.7 | 0.59 | −1.9 | 0.72 | 0.67 | 54.7 | 50.5 | F9 |
| 1800 | 0.19 | 0.06 | 0.63 | −1.6 | 0.70 | −1.7 | 0.73 | 0.73 | 45.3 | 51.5 | F1 |
| 1800 | 0.18 | 0.07 | 0.73 | −1.9 | 0.64 | −1.4 | 0.74 | 0.69 | 60.4 | 44.9 | F7 |

- It is also compatible with calibration measurement analysis. The results are in line with the dimensionality analysis, because the raw variance is explained by measures greater than 40%, and the unexplained variance in the first contrast is less than 15. Therefore, dimensionality data results are appropriate according to the Rasch model, as shown in Table 2;

**Table 2.** Item dimensionality of Self-Efficacy Scale.

| | Empirical | | Modeled | |
|---|---|---|---|---|
| Total raw variance in observations | 97.2 | 100% | | 100% |
| Raw variance explained by measures | 47.2 | 48.5% | | 48.8% |
| Raw variance explained by persons | 24.5 | 25.2% | | 25.4% |
| Raw Variance explained by items | 22.7 | 23.3% | | 23.5% |
| Raw unexplained variance (total) | 50.0 | 51.5% | 100% | 51.2% |
| Unexplained variance in 1st contrast | 4.3 | 4.5% | 9.3% | |
| Unexplained variance in 2nd contrast | 3.9 | 4.7% | 8.9% | |
| Unexplained variance in 3rd contrast | 3.5 | 3.6% | 7.8% | |
| Unexplained variance in 4th contrast | 3.0 | 3.1% | 7.4% | |

- The reliability of the scale was measured using person reliability, which is the degree of reliability of individuals responding to the self-efficacy scale, as shown in Table 3. Item reliability of the scale was also calculated, which is intended to indicate the reliability of the item of the scale. The results of the study revealed that the scale has an appropriate degree of reliability for the items of the scale, as shown in Table 3.

**Table 3.** Person and Item separation and reliability for Self-Efficacy Scale.

| | Score | Count | Measure | Error | Infit | | Outfit | |
|---|---|---|---|---|---|---|---|---|
| | | | | | MNSQ | ZSTD | MNSQ | ZSTD |
| Mean | 187.7 | 50.0 | 1.16 | 0.21 | 1.06 | −0.5 | 1.08 | −0.5 |
| S.D | 35.7 | 0.0 | 1.39 | 0.13 | 0.67 | 2.5 | 0.74 | 3.5 |
| Real RMSE | 0.28 | | | | | | | |
| ADJ. SD | 1.36 | | | | | | | |
| Separation | 4.82 | | | | | | | |
| Person reliability | 0.92 | | | | | | | |
| Mean | 1861.7 | 200.0 | 0.06 | 0.18 | 1.00 | 0.2 | 1.07 | 0.1 |
| S.D. | 85.6 | 0.0 | 0.00 | 0.01 | 0.19 | 2.1 | 0.43 | 2.4 |
| Real RMSE | 0.09 | | | | | | | |
| ADJ. SD | 0.34 | | | | | | | |
| Separation | 5.14 | | | | | | | |
| Item reliability | 0.96 | | | | | | | |

### *3.2. Construct Validity According to Factor Analysis*

To verify the construct validity of the scale, factor validity was calculated using exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) using SPSS and Amos statistical software.

1. Exploratory Factor Analysis (EFA)

Exploratory factor analysis was carried out using principal components analysis of the sample responses on the items of the final scale consisting of 49 items, and an oblique rotation was carried out using the Promax method for the extracted factors whose eigenvalue is greater than one. Table 4 shows the results of the exploratory factor analysis using the Promax method.

**Table 4.** The results of the exploratory factor analysis using Promax method.

| Component | Initial Eigenvalues | | |
|---|---|---|---|
| | **Total** | **% of Variance** | **Cumulative %** |
| 1 | 26.774 | 53.548 | 53.548 |
| 2 | 2.169 | 4.337 | 57.885 |
| 3 | 2.003 | 4.007 | 61.892 |
| 4 | 1.733 | 3.466 | 65.358 |
| 5 | 1.208 | 2.417 | 73.241 |

Table 4 shows the presence of five factors with an eigenvalue greater than 1 with an explanatory variance ratio (73.241), where the eigenvalue of the first dimension reached 26,774, with an explanatory variance ratio of 53.548. The analysis also sorted five factors that are identical to the theoretical assumption on which the items were based. These factors exceeded the value of the latent root of 1 and explained 73.241% of the variance in the total sample.

In order to develop the scale, it was necessary to know the loading values of the scale items on their dimensions in the exploratory factor analysis, as shown in Table 5, which must meet the criterion that it is not permissible to adopt the item with loading factors less than 0.40 [57].

**Table 5.** Loading factors of the scale items on their dimensions in the exploratory factor analysis.

| Construct | Items | Loading | | | | |
|---|---|---|---|---|---|---|
| | | **Factor 1** | **Factor 2** | **Factor 3** | **Factor 4** | **Factor 5** |
| Instructional Knowledge and Experience | I1 | | | | | 0.613 |
| | I2 | | | | | 0.714 |
| | I3 | | | | | 0.790 |
| | I4 | | | | | 0.803 |
| | I5 | | | | | 0.493 |
| | I6 | | | | | 0.654 |
| | I7 | | | | | 0.773 |
| | I8 | | | | | 0.675 |
| | I9 | | | | | 0.814 |
| Communication and Interaction | C1 | 0.770 | | | | |
| | C2 | 0.780 | | | | |
| | C3 | 0.776 | | | | |
| | C4 | 0.802 | | | | |
| | C5 | 0.823 | | | | |
| | C6 | 0.811 | | | | |
| | C7 | 0.839 | | | | |
| | C8 | 0.746 | | | | |
| | C9 | 0.752 | | | | |
| | C10 | 0.804 | | | | |
| Feedback | F1 | | 0.819 | | | |
| | F2 | | 0.866 | | | |
| | F3 | | 0.643 | | | |
| | F4 | | 0.766 | | | |
| | F5 | | 0.810 | | | |
| | F6 | | 0.769 | | | |
| | F7 | | 0.893 | | | |
| | F8 | | 0.797 | | | |
| | F9 | | 0.910 | | | |
| | F10 | | 0.879 | | | |

**Table 5.** *Cont.*

| Construct | Items | Loading | | | | |
|---|---|---|---|---|---|---|
| | | **Factor 1** | **Factor 2** | **Factor 3** | **Factor 4** | **Factor 5** |
| Social Impact | S1 | | | 0.771 | | |
| | S2 | | | 0.879 | | |
| | S3 | | | 0.779 | | |
| | S4 | | | 0.759 | | |
| | S5 | | | 0.751 | | |
| | S6 | | | 0.784 | | |
| | S7 | | | 0.773 | | |
| | S8 | | | 0.761 | | |
| | S9 | | | 0.652 | | |
| | S10 | | | 0.663 | | |
| Learner Motivation and Attitude | L1 | | | | 0.713 | |
| | L2 | | | | 0.842 | |
| | L3 | | | | 0.877 | |
| | L4 | | | | 0.793 | |
| | L5 | | | | 0.835 | |
| | L6 | | | | 0.702 | |
| | L7 | | | | 0.778 | |
| | L8 | | | | 0.743 | |
| | L9 | | | | 0.772 | |
| | L10 | | | | 0.703 | |

Figure 2 shows the degree of loading of each item in its dimension. The results showed that a high degree of loading was achieved for each item in its dimension. The results also showed the existence of a strong correlation between the dimensions of the scale. The results of the correlation coefficient between the five dimensions of the scale confirmed the existence of a strong and positive correlation between these dimensions. Indicators of the internal construct validity are shown in Table 6.

Table 5 shows that the loading factors of the items are more than 0.40 within their dimension. Thus, the scale continues with its five dimensions and items consisting of the first-dimension (9) items, the second-dimension (10) items, the third-dimension (10) items, the fourth-dimension (10) items, and the fifth-dimension (10) items.

2. Confirmatory factor analysis (CFA).

To verify factorial construct validity, the scale was applied in its final copy to the study sample in order to conduct a confirmatory factor analysis of the scale items within their dimensions, where the adopted model was drawn for the relationship of the scale items consisting of 49 items and distributed over five dimensions, as shown in Figure 2.

Table 6 shows the values of the indicators of the validity of the internal construction of the scale items, in order to confirm the results of the confirmatory factor analysis of the model adopted for the relationship between the scale items and their dimensions. The table also shows that the model matches the relationship between the scale items with the data. It also confirms that all indicators match the criteria used in this study, which indicates the stability of the model for the relationships between the scale items.

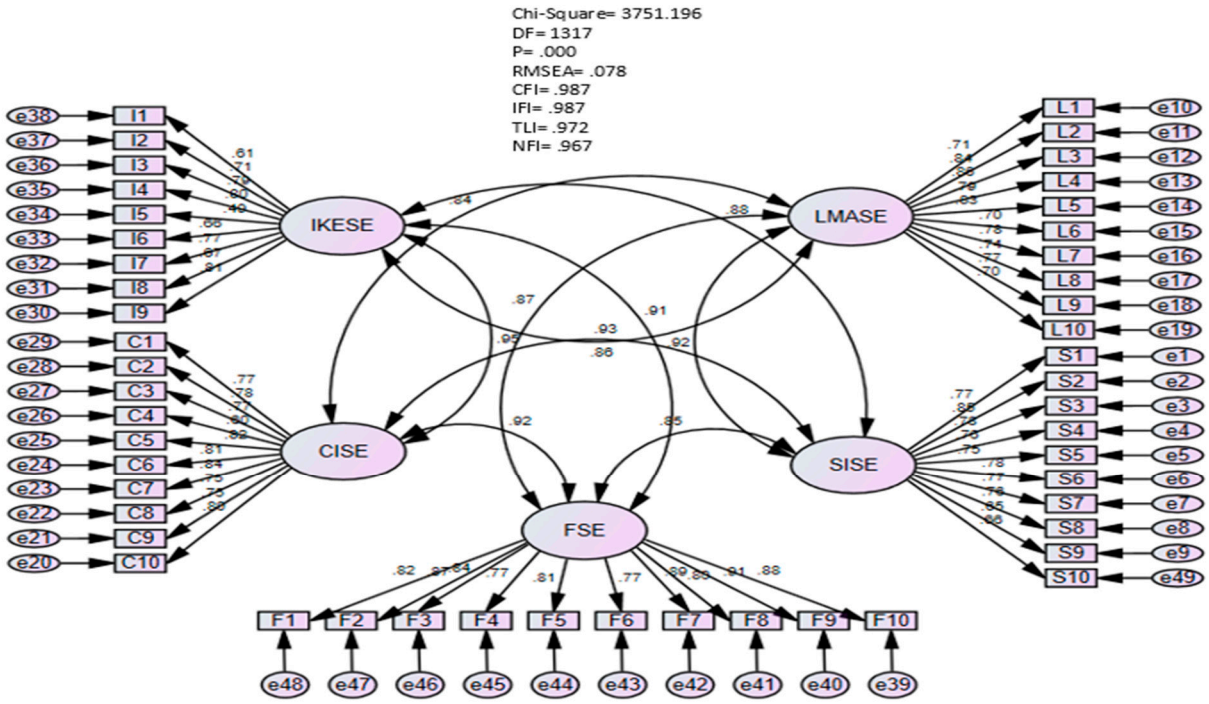


**Figure 2.** Results of the confirmatory factor analysis of the model adopted for the relationship of the scale items to their dimensions.

**Table 6.** The results of the confirmatory factor analysis of the adopted model of the relationship of the scale items to their dimensions.

| Name of Category | Indicators of the Internal Construct Validity | Level of Acceptance | Indexes in the Proposed Model |
|---|---|---|---|
| Absolute fit | ChiSq | P > 0.05 | Significant |
| | RMSE | RMSE < 0.08 | 0.078 |
| Incremental fit | CFI | CFI > 0.90 | 0.987 |
| | TLI | TLI > 0.90 | 0.972 |
| | NFI | NFI > 0.90 | 0.967 |
| Parsimonious fit | ChiSq/df | ChiSq/df < 5.0 | ChiSq/df = 2.85 < 5.0 |

## 4. Discussion

The use of distance learning systems and the increase in their employment in the educational process led to more research in this field. There is no doubt that one of the main influencing factors in the success of these systems is related to the efficiency and effectiveness of the person in the online learning environment. Many studies have attempted to search for dimensions or aspects of educational self-efficacy in online learning environments. Despite the numerous studies on this topic, they have not been comprehensive and in-depth in examining all aspects of self-efficacy in online learning environments. Therefore, the current study focused on researching the various dimensions of distance learning self-efficacy processes to create a comprehensive and in-depth model of online learning self-efficacy practices. With the increased opportunities for the sustainability of distance learning systems, and the urgent need for evaluations and development, the current study attempted to create and develop a model for distance learning self-efficacy in the form of a scale and verify its psychometric properties for standardization processes.

By reviewing the literature that sought to examine and analyze the factors that contribute to self-efficacy in the online learning environment, the current study extracted

five main dimensions on which distance learning self-efficacy was based: the degree to which the learner is familiar with the knowledge and experiences associated with distance learning systems, the learners' ability to communicate and interact with others through distance learning systems, the motivational feedback received by the learner through distance learning platforms, the exercise of all forms of social influence through distance learning platforms, and the learner's ownership, motivations, motivators, and orientations to accomplish tasks and carry out various activities via distance learning platforms.

The development of the scale underwent a set of steps: the purpose of the scale was determined, and the five dimensions of the scale were then determined. The items of the scale were examined by 13 experts from Arab universities to revise and reformulate the scale and delete inappropriate items. After that, the scale was applied to an exploratory sample, and the validity and reliability procedures were verified.

The results showed that the distance learning self-efficacy scale has psychometric properties in terms of construct validity. This is indicated by the results of the assumptions of the Rasch model for the data obtained from its application. The results of the CFA also indicated an agreement of the indicators of good fit with the main dimensions of the scale. This means that the proposed model for distance learning self-efficacy scale is compatible with the data and that the scale is factorially valid. This may be due to the nature of the study sample, which represents the university level, which is characterized by a degree of awareness and ability to respond to the items of the scale, and may also be due to the clarity of the formulation of the items of the scale for respondents and the correlation of items with the behavioral practices of learners in online learning environments.

The results also indicated that the distance learning self-efficacy scale has high reliability, as indicated by the results of the Rasch model for person reliability and item reliability. This increase in reliability may be attributed to the consistency between the items in measuring the trait to be measured among students, in addition to the seriousness of the students in their responses as well as the comprehensiveness and harmony between the different dimensions of the scale. This was evident from the presence of the strong correlation coefficients between them. There is also a correlation between the items on the scale and their dimension, and this was confirmed by the percentages of item loading with corresponding dimensions.

This study sought to present an initial step to the distance learning self-efficacy scale, and after reviewing the studies on distance learning self-efficacy, we found that most of them extracted a tool to measure distance learning self-efficacy but were limited to certain dimensions and aspects and could not completely collect the necessary data for our research purposes. Studies such as that of Zimmerman and Kulikowich [11] sought to develop a scale of distance learning self-efficacy, but they lacked detail, depth, and comprehensiveness for all dimensions of the distance learning self-efficacy system, on which the current study scale is based. Although this study developed a (codified) scale that has psychometric properties in terms of construct validity and factor validity, more experimentation and applications in different environments may be needed to gain more objectivity, credibility, and validity and acquire sustainability as a standardized and developed scale. In addition, researchers agree on this scale in studying the field of online learning environments.

The scale of this study is inconsistent with the studies by Tsai, Wang, and Hsu [19] and Korkmaz and Altun [18], which focused largely on the technological dimension. The scale of the current study focuses on several cognitive and technological aspects of behavior. In contrast, the scale of this study is consistent with the studies of Quade [20] and Zimmerman and Kulikowich [11], which focused largely on some of the cognitive and technological aspects. However, the most important characteristic of this scale, by looking at the philosophical frameworks and references, is its attempt to rely on a set of different dimensions, which include the most important behavioral practices of learners for learning in online learning environments.

The distance learning self-efficacy scale can be used by researchers in the field of distance learning to study and evaluate the behavioral practices and self-efficacy of students

in online learning environments. The distance learning self-efficacy measure includes the following dimensions: educational knowledge and experience, communication and interaction, feedback, social influence, and learner motives and motivation. At the beginning of the scale, the respondents filled in preliminary data such as gender, specialization, level of study, and cumulative average. A five-point Likert scale was used, which is a method for measuring behaviors and preferences used in psychological tests and measures the degree of availability of behavioral practices for self-efficacy for distance learning, where a value 5 of indicates very high availability, 4 indicates high availability, 3 indicates moderate availability, 2 indicates low availability, and 1 indicates very low availability.

## 5. Conclusions, Limitations, and Future Directions

Most of the studies on distance learning self-efficacy have extracted tools for measuring distance learning self-efficacy, but they were limited to only some of the dimensions and aspects used to collect data for the purposes of the research. Although some studies have gone on to develop a scale of distance learning self-efficacy, they lack detail, depth, and comprehensiveness for all dimensions of the distance learning self-efficacy system. To address these shortcomings, this study sought to extract the different dimensions of self-efficacy by reviewing the studies on forms of self-efficacy in online learning environments. This study considered philosophical frameworks and approaches, through which five dimensions and main components of distance learning self-efficacy were extracted: knowledge and educational experience, communication and interaction, feedback, social impact, and learner motivation. The behavioral practices of learners in online learning environments were then identified for each of these dimensions.

A scale of self-efficacy for distance learning was constructed and developed by defining its objective and setting its specifications. The extent to which the scale had psychometric properties was then examined by verifying the construct validity of the scale using the Rasch model and factor validity (EFA and CFA). Finally, a scale with a high degree of reliability and validity, as a tool for evaluating the self-efficacy of distance learning, was developed and constructed.

Despite the construction and development of a scale of self-efficacy for distance learning, it cannot be used for many experiments and applications in different environments due to its adoption as a standardized and developed scale to evaluate one of the distance learning system dimensions. It is necessary to build measurement and evaluation tools for e-learning and distance education systems and adopt them as developed and standardized. Examples of future studies in this regard are the preparation and development of various scales to evaluate the structure of the e-learning management system, the quality of the design of the e-portal for distance learning, the quality of digital content, the quality of technical support services, security, and privacy.

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**Institutional Review Board Statement:** Having reviewed the details submitted by the applicant regarding the above-named research project, the Research Ethics Committee at King Faisal University grants its ethical approval to the protocol. Projects may be subject to an audit or any other form of monitoring by the committee at any time. The committee may request a regular report on the progress of the project to ensure that researchers are committed to the highest ethical standards. Researchers are held accountable for the storage, retention, and security of original data obtained from projects. Any substantial alterations to the project or emerging events or matters that may affect the ethical acceptability of the project must be reported immediately to the committee via email (ialjreesh@kfu.edu.sa) or phone (0096615899773).

**Informed Consent Statement:** Informed consent was obtained from all individual participants included in the study.

**Data Availability Statement:** The authors declare that all other data supporting the findings of this study are available within the article and Appendices A–E.

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**Conflicts of Interest:** The authors declare no conflict of interest.

## Appendix A

**Table A1.** Number of items omitted in the Self-Efficacy Scale based on experts.

| No. | Dimensions | Number of Items in the Initial Copy | Number of Items Omitted | Number of Modified Items |
|---|---|---|---|---|
| 1 | instructional knowledge and experience | 14 | 1 | 3 |
| 2 | communication and interaction | 19 | 4 | 5 |
| 3 | feedback | 13 | 0 | 4 |
| 4 | social impact | 14 | 0 | 2 |
| 5 | learner motivation and attitude | 18 | 5 | 4 |
| | Total | 78 | 10 | 18 |

## Appendix B

**Table A2.** Item-Fit Analysis for Initial Self-Efficacy Scale (Initial).

| Count | Measure | Model S.E | Infit | | Outfit | | Pt-Measure | | Exact OBS% | Match EXP% | Items |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | MNSQ | ZSTD | MNSQ | ZSTD | CORR | EXP | | | |
| 200 | 0.17 | 0.18 | 1.47 | 2.1 | 1.50 | 1.9 | 0.43 | 0.54 | 41.5 | 56.1 | IKE 5 |
| 200 | 0.07 | 0.17 | 1.39 | 1.8 | 1.46 | 2.0 | 0.55 | 0.46 | 52.8 | 48.1 | IKE 6 |
| 200 | 0.72 | 0.18 | 1.33 | 1.6 | 1.27 | 1.0 | 0.55 | 0.60 | 50.9 | 48.3 | IKE 8 |
| 200 | 0.08 | 0.20 | 1.14 | 0.8 | 1.03 | 0.2 | 0.57 | 0.59 | 49.1 | 52.6 | L8 |
| 200 | 0.24 | 0.16 | 1.62 | 2.9 | 2.99 | 6.0 | 0.57 | 0.69 | 47.2 | 44.8 | IKE 1 |
| 200 | 0.03 | 0.16 | 1.25 | 1.2 | 1.17 | 0.7 | 0.58 | 0.61 | 49.1 | 47.9 | IKE 2 |
| 200 | 0.56 | 0.19 | 1.26 | 1.3 | 1.22 | 0.1 | 0.59 | 0.63 | 60.4 | 50.9 | SI9 |
| 200 | 0.06 | 0.17 | 1.50 | 2.2 | 1.31 | 0.6 | 0.60 | 0.64 | 54.7 | 49.3 | CI4 |
| 200 | 0.45 | 0.17 | 0.93 | 0.3 | 0.76 | 1.4 | 0.60 | 0.58 | 54.7 | 46.8 | IKE 3 |
| 200 | 0.04 | 0.20 | 0.98 | 0.0 | 0.95 | 0.1 | 0.61 | 0.61 | 56.6 | 55.0 | LMA10 |
| 200 | 0.11 | 0.18 | 0.91 | 0.4 | 0.82 | 0.8 | 0.63 | 0.61 | 56.6 | 49.2 | LMA 7 |
| 200 | 0.30 | 0.16 | 1.29 | 1.4 | 1.31 | 0.5 | 0.63 | 0.67 | 45.3 | 46.7 | SI 8 |
| 200 | 0.52 | 0.19 | 1.06 | 0.4 | 1.00 | 0.3 | 0.63 | 0.64 | 66.0 | 52.9 | SI 10 |
| 200 | 0.20 | 0.18 | 0.97 | 0.1 | 1.17 | 0.3 | 0.64 | 0.65 | 52.8 | 48.0 | SI 1 |
| 200 | 0.57 | 0.19 | 0.95 | 0.2 | 0.87 | 0.8 | 0.64 | 0.63 | 64.2 | 50.1 | LMA 5 |
| 200 | 0.17 | 0.19 | 1.08 | 0.5 | 1.04 | 0.3 | 0.64 | 0.66 | 64.2 | 52.2 | F4 |
| 200 | 0.35 | 0.19 | 1.08 | 0.4 | 1.06 | 1.1 | 0.65 | 0.62 | 39.6 | 53.5 | LMA 1 |
| 200 | 0.15 | 0.20 | 0.89 | 0.5 | .81 | 1.3 | 0.65 | 0.61 | 62.3 | 55.3 | SI 7 |
| 200 | 0.44 | 0.15 | 1.11 | 0.6 | 1.06 | 0.4 | 0.65 | 0.65 | 62.3 | 45.0 | CI1 |
| 200 | 0.06 | 0.19 | 0.80 | 1.1 | 0.72 | 1.8 | 0.65 | 0.70 | 54.7 | 50.5 | IKE 4 |
| 200 | 0.13 | 0.19 | 0.78 | 1.2 | 0.70 | 0.2 | 0.66 | 0.67 | 45.3 | 51.5 | LMA 9 |
| 200 | 0.02 | 0.17 | 0.99 | 0.0 | 0.87 | 1.1 | 0.66 | 0.68 | 60.4 | 44.9 | CI 3 |
| 200 | 0.10 | 0.18 | 1.21 | 1.1 | 1.46 | 0.3 | 0.66 | 0.66 | 45.3 | 49.2 | IKE 10 |
| 200 | 0.08 | 0.18 | 1.03 | 0.2 | 1.03 | 0.9 | 0.66 | 0.64 | 66.0 | 46.7 | SI 6 |
| 200 | 0.26 | 0.17 | 1.05 | 0.3 | 1.25 | 0.7 | 0.66 | 0.64 | 52.8 | 52.9 | CI 8 |
| 200 | 0.34 | 0.18 | 0.98 | 0.0 | 0.93 | 0.0 | 0.67 | 0.66 | 64.2 | 48.0 | CI 9 |
| 200 | 0.27 | 0.20 | 0.88 | 0.6 | 0.79 | 2.0 | 0.67 | 0.64 | 64.2 | 50.1 | LMA 2 |

**Table A2.** *Cont.*

| Count | Measure | Model S.E | Infit | | Outfit | | Pt-Measure | | Exact OBS% | Match EXP% | Items |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | MNSQ | ZSTD | MNSQ | ZSTD | CORR | EXP | | | |
| 200 | 0.15 | 0.20 | 0.89 | 0.6 | 0.83 | 0.4 | 0.67 | 0.64 | 39.6 | 52.2 | LMA 3 |
| 200 | 0.09 | 0.18 | 0.94 | 0.2 | 0.98 | 0.1 | 0.67 | 0.66 | 62.3 | 53.5 | F5 |
| 200 | 0.35 | 0.19 | 1.02 | 0.2 | 1.48 | 0.6 | 0.67 | 0.68 | 62.3 | 55.3 | F6 |
| 200 | 0.35 | 0.19 | 0.89 | 0.5 | 0.90 | 0.3 | 0.67 | 0.66 | 54.7 | 45.0 | LMA 4 |
| 200 | 0.26 | 0.19 | 1.06 | 0.4 | 1.00 | 0.7 | 0.67 | 0.68 | 45.3 | 50.5 | LMA 6 |
| 200 | 0.18 | 0.20 | 0.92 | 0.3 | 0.85 | 0.5 | 0.68 | 0.66 | 45.3 | 51.5 | F3 |
| 200 | 1.01 | 0.18 | 1.15 | 0.9 | 1.06 | 0.6 | 0.68 | 0.69 | 66.0 | 44.9 | SI 5 |
| 200 | 0.51 | 0.18 | 0.78 | 1.2 | 0.83 | 1.2 | 0.68 | 0.64 | 52.8 | 49.2 | CI 5 |
| 200 | 0.25 | 0.16 | 0.94 | 0.2 | 0.86 | 1.6 | 0.68 | 0.67 | 64.2 | 46.7 | CI2 |
| 200 | 0.14 | 0.17 | 0.93 | 0.3 | 0.87 | 0.6 | 0.69 | 0.67 | 64.2 | 52.9 | F8 |
| 200 | 0.46 | 0.18 | 0.79 | 1.2 | 0.74 | 0.5 | 0.69 | 0.64 | 62.3 | 48.4 | CI 10 |
| 200 | 0.26 | 0.18 | 0.70 | 1.6 | 0.66 | 0.2 | 0.69 | 0.64 | 56.6 | 49.5 | F2 |
| 200 | 0.31 | 0.21 | 0.89 | 0.5 | 0.87 | 1.2 | 0.69 | 0.67 | 60.4 | 54.0 | SI 3 |
| 200 | 0.43 | 0.16 | 0.93 | 0.3 | 0.87 | 2.1 | 0.69 | 0.68 | 50.9 | 46.1 | CI 7 |
| 200 | 0.26 | 0.16 | 0.99 | 0.0 | 0.94 | 1.5 | 0.69 | 0.69 | 50.9 | 45.1 | IKE 7 |
| 200 | 0.51 | 0.19 | 0.79 | 1.1 | 0.74 | 0.3 | 0.69 | 0.65 | 62.3 | 50.9 | SI 2 |
| 200 | 0.26 | 0.17 | 0.84 | 0.8 | 1.52 | 2.4 | 0.70 | 0.70 | 52.8 | 47.0 | IKE 9 |
| 200 | 0.03 | 0.18 | 0.74 | 1.3 | 0.68 | 0.4 | 0.70 | 0.66 | 62.3 | 49.2 | F10 |
| 200 | 1.03 | 0.18 | 0.95 | 0.2 | 0.92 | 2.1 | 0.70 | 0.69 | 50.9 | 48.0 | SI 4 |
| 200 | 0.09 | 0.19 | 0.61 | 2.1 | 0.56 | 1.6 | 0.73 | 0.66 | 75.5 | 52.8 | F9 |
| 200 | 0.25 | 0.18 | 0.90 | 0.5 | 0.90 | 0.6 | 0.73 | 0.72 | 45.3 | 49.8 | CI 6 |
| 200 | 0.02 | 0.18 | 0.67 | 1.8 | 0.62 | 0.7 | 0.74 | 0.68 | 71.7 | 50.1 | F7 |
| 200 | 0.08 | 0.18 | 0.71 | 1.6 | 0.68 | 1.6 | 0.75 | 0.70 | 58.5 | 49.1 | F1 |

## Appendix C

**Table A3.** Item dimensionality of Initial Self-Efficacy Scale.

| | Empirical | | Modeled | |
|---|---|---|---|---|
| Total raw variance in observations | 98.6 | 100% | | 100% |
| Raw variance explained by measures | 48.6 | 46.2% | | 49.7% |
| Raw variance explained by persons | 25.9 | 16.1% | | 26.6% |
| Raw Variance explained by items | 22.6 | 20.1% | | 23.2% |
| Raw unexplained variance (total) | 50.0 | 50.7% | 100% | 50.3% |
| Unexplained variance in 1st contrast | 5.3 | 5.9% | 9.3% | |
| Unexplained variance in 2nd contrast | 4.6 | 5.7% | 8.9% | |
| Unexplained variance in 3rd contrast | 4.2 | 5.0% | 7.8% | |
| Unexplained variance in 4th contrast | 3.4 | 4.7% | 7.4% | |

## Appendix D

**Table A4.** Person and Item separation and reliability for Initial Self-Efficacy Scale.

| | Score | Count | Measure | Error | Infit | | Outfit | |
|---|---|---|---|---|---|---|---|---|
| | | | | | MNSQ | ZSTD | MNSQ | ZSTD |
| Mean | 194.3 | 50.0 | 1.66 | 0.46 | 1.07 | −0.6 | 1.08 | −0.5 |
| S.D | 39.7 | 0.0 | 2.28 | 0.15 | 0.71 | 3.6 | 0.74 | 3.5 |
| Real RMSE | 0.26 | | | | | | | |
| Adj. sd | 2.18 | | | | | | | |
| Separation | 3.31 | | | | | | | |

**Table A4.** *Cont.*

| | Score | Count | Measure | Error | Infit | | Outfit | |
|---|---|---|---|---|---|---|---|---|
| | | | | | MNSQ | ZSTD | MNSQ | ZSTD |
| Person reliability | 0.92 | | | | | | | |
| Mean | 233.2 | 60.0 | 0.00 | 0.18 | 1.00 | 0.0 | 1.08 | 0.1 |
| S.D. | 10.5 | 0.0 | 0.36 | 0.01 | 0.22 | 1.1 | 0.56 | 1.6 |
| Real RMSE | 0.19 | | | | | | | |
| Adj. sd | 0.31 | | | | | | | |
| Separation | 2.69 | | | | | | | |
| Item reliability | 0.74 | | | | | | | |

## Appendix E. Distance Learning Self-Efficacy Scale

**Part A: Biographical information**

For statistical purposes only. Place a tick where appropriate.

| | | |
|---|---|---|
| 1 | Gender | Male<br>Female |
| 2 | Academic branch | Scientific<br>Literary |
| 3 | Educational Level | Preparatory Year<br>first year<br>second year<br>third year<br>fourth year<br>five year |
| 4 | Rate | Less than 70<br>70–79<br>80–89<br>90–100 |

Please respond to the following items indicating degree to which you achieve the activities and tasks associated with the items of the scale by placing a tick (√) in the appropriate box to the right of the corresponding items.

**Part B: Dimensions of scale**

| First Dimension: Instructional Knowledge and Experience | | degree of achieved | | | | |
|---|---|---|---|---|---|---|
| Items | | Very High | high | Moderate | Low | Very low |
| 1 | I use Microsoft Word processing software package easily. | | | | | |
| 2 | I can easily upload assignments and educational materials into distance learning systems. | | | | | |
| 3 | I can use communication tools within distance learning systems easily. | | | | | |
| 4 | I can easily search for the information I need in electronic sources. | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| 5 | I have the ability to create a plan to successfully complete specific tasks and all activities required in distance learning systems. | | | | | |
| 6 | I can upload tasks to an online storage (Dropbox, Google Drive, Yandex Disk, OneDrive, etc.). | | | | | |
| 7 | I can easily move between course content in the DLMS (ndex disk, OneDrive, etc.). | | | | | |
| 8 | I am good at dealing with unexpected computer events efficiently. | | | | | |
| 9 | I can manage my files and data using cloud computing applications such as (OneDrive or SharePoint) remotely from anywhere | | | | | |

| Second Dimension: Communication and Interaction | | degree of achieved | | | | |
|---|---|---|---|---|---|---|
| Items | | Very High | high | Moderate | Low | Very low |
| 1 | I always strive to ask my questions as clearly as possible for effective communication with the teacher through distance learning systems. | | | | | |
| 2 | I can easily contact the teacher in the distance learning systems anytime and anywhere. | | | | | |
| 3 | I have the ability to achieve social interaction with other students according to different situations in distance learning systems | | | | | |
| 4 | I do not hesitate to seek or provide assistance from others when needed via distance learning systems. | | | | | |
| 5 | I have the ability to respond to other people's messages in the discussion board in distance learning systems. | | | | | |
| 6 | I can inform the management of the distance learning system when unexpected situations arise in a timely manner. | | | | | |
| 7 | I participate in discussion forums via distance learning platforms that help in deepening my thought for the study contents. | | | | | |
| 8 | I plan to engage in online interaction with other students in advance. | | | | | |
| 9 | I am actively communicating to take advantage from technical support services via email, phone or online chat | | | | | |
| 10 | I can communicate with others using asynchronous technologies (discussion group, message board, email, etc.), and synchronous technologies (Skype, WhatsApp, Messenger, etc.). | | | | | |

| Third Dimension: Feedback | | degree of achieved | | | | |
|---|---|---|---|---|---|---|
| Items | | Very High | high | Moderate | Low | Very low |
| 1 | I willingly adapt my learning styles to meet the expectations and outcomes of learning via distance learning systems. | | | | | |
| 2 | I get more motivated when the distance learning system gives me direct/timely feedback. | | | | | |
| 3 | I do best when I have specific knowledge of the field of learning via distance learning systems. | | | | | |
| 4 | Some pictures and drawings via distance learning platforms contribute to providing feedback on the assessments of my learning outcomes | | | | | |
| 5 | Distance learning platforms meet my educational needs and desires. | | | | | |
| 6 | I receive through distance learning platforms motivational feedback, whether material or moral | | | | | |
| 7 | The immediate positive reinforcement provided via distance learning platforms helps me achieve academic achievement. | | | | | |
| 8 | Through distance learning platforms, I benefit from immediate and delayed feedback to support my correct responses and correct my incorrect responses | | | | | |
| 9 | I can compare the correct performance with the learning objectives when the knowledge data of the scientific course is clear through the distance learning systems | | | | | |
| 10 | Distance learning platforms help me connect previous knowledge with current knowledge. | | | | | |

| Fourth Dimension: Social Impact | | degree of achieved | | | | |
|---|---|---|---|---|---|---|
| Items | | Very High | high | Moderate | Low | Very low |
| 1 | I have the capabilities to monitor and learn from other members' opinions through distance learning systems. | | | | | |
| 2 | I have the capabilities to demonstrate my teaching skills and share them with other members via distance learning systems. | | | | | |
| 3 | I seek through distance learning systems to interact with teachers and learners in order to reach desirable changes in my educational behavior. | | | | | |
| 4 | Actively participate in the online participatory testing community | | | | | |
| 5 | I provide constructive feedback on the contributions of other students to the discussion via distance learning systems. | | | | | |
| 6 | I regularly check messages from other students on the discussion board via distance learning systems. | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| 7 | I never get angry when learners express completely different ideas from my own via distance learning systems. | | | | | |
| 8 | I seek to present scientific topics for effective discussion through social media. | | | | | |
| 9 | Social media has helped me to gain various knowledge about my educational studies. | | | | | |
| 10 | Social media gives me constructive dialogue skills. | | | | | |

| Fifth Dimension: Learner Motivation and Attitude | | degree of achieved | | | | |
|---|---|---|---|---|---|---|
| Items | | Very High | high | Moderate | Low | Very low |
| 1 | I carry out the proposed activities in distance learning environments that encourage scientific thinking. | | | | | |
| 2 | I follow the guidelines for suggested content and activities when sharing via distance learning platforms. | | | | | |
| 3 | My participation in discussions via distance learning platforms helps me feel the joy of learning. | | | | | |
| 4 | Through distance learning platforms, I think that I am able to be creative by responding to questions submitted electronically | | | | | |
| 5 | I enjoy challenging topics and work across distance learning platforms that require new solutions. | | | | | |
| 6 | If I hear about a new information technology, I always look for ways to try it out. | | | | | |
| 7 | I monitor my progress to ensure that I am on the right track in my online learning systems. | | | | | |
| 8 | I can meet online task deadlines with very few reminders. | | | | | |
| 9 | I am sure I can learn the online courses even with distractions. | | | | | |
| 10 | I am willing to take on challenges and successfully complete all required online activities. | | | | | |

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