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Barriers Towards the Implementation of E-portfolio in Education Based on the Diffusion of Innovation Theory

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Abstract. The current research aims to identify the barriers faced by the candidates during the implementation of the e- portfolio in an educational environment. How to implement the e-portfolio at the College of Education, Sultan Qaboos University in light of the theory of diffusion of innovation. The research sample consisted of 122 out of 233 field-training candidates from undergraduate students in all disciplines at the College of Education, Sultan Qaboos University. The research applied the descriptive approach, and the research tool is a questionnaire consisted of 39 items entitled "Barriers of Application of the e-portfolio". Statistical treatments were performed as the mean, standard deviation, T-test, and ANOVA by using SPSS. The results indicated that there are barriers during the implementation of the e-portfolio related to candidates and other related to educational environment. The results also indicated that there are statistically significant differences at the level of significance (0.05) attributable to each of the two variables of specialization, and technological skills in identifying barriers related to candidates and the educational environment. According to the results, the research recommends integrating the e-portfolio into all courses, using special platform for applying the e-portfolio uniformly.

Keywords: barriers; diffusion of innovation; E-portfolio; high education

1. Introduction

The College of Education at Sultan Qaboos University (SQU) obtained institutional academic accreditation in 2016, and is now preparing to renew accreditation in its second cycle 2023 from the Council for the Accreditation of Educator Preparation (CAEP). It is a foundation where applicants are subject to an evaluation aimed at verifying that they met five criteria. The E-portfolio is considered evidence of the first standard, Content and Pedagogical Knowledge of CAEP standards. In light of this, the College of Education sought to integrate the

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e-portfolio in teachers' preparation programs for undergraduate degrees for the following reasons: the benefits of thinking and reflecting on the experiences gained, promotion of learning, assessment and evaluation, an professional development (Batson, 2011); (Poole et al., 2018) and strengthening the evidence required for the first standard of CAEP.

Therefore, the College of Education, SQU worked on integrating the e-portfolio into the teacher's preparation programs for the undergraduate degree to meet the academic accreditation requirements. Barrett (2004) indicated that the e-portfolio could be designed or interspersed to meet the needs of the programs or the institutions. After studying the plans for various bachelor's programs at the College of Education, SQU, it was noticed that the number of credit hours is 125, which does not allow adding a course related to the e-portfolio within the student's plan. Accordingly, the e-portfolio has been integrated as one of the activities in the student teaching course, so the students should be familiar with the e-portfolio in a number of previous educational courses for the student teaching course.

It is worth mentioning that the student teaching course is the last station in the student's journey at the College of Education. Candidates of genders male and female apply all the experiences gained during their studies and includes them in the e-portfolio. In addition, the candidates also collect some evidences that confirm his readiness to be a teacher during the previous academic years. However, when the candidates applied the e-portfolio, we noticed that the candidates faced many barriers. These barriers prevent them from applying the e-portfolio, which leads to poor assessment, lack of integration of knowledge, inability to identify previous learning and link it to new learning, inability to identify strengths and weaknesses in their learning, and loss of many professional documents. The barriers that could be classified as barriers related to candidates and barriers related to the instructional environment.

The research focused on the e-portfolio, where it aimed to monitor and analyse the barriers faced by candidates when applying the e-portfolio effectively, and to examine the possibility of applying the e-portfolio. It is known that when implementing any new idea, 50% of users (laggards & late majority) have a negative impact on adoptions for various reasons (Kaminski, 2011). We encountered this in the College of Education when trying to incorporate e-portfolio as a new practice. Therefore, the current research suggested using the stages diffusion of innovation theory to support the adoption of integrating e-portfolio into the teacher preparation program at the College of Education, SQU.

The first section of this research deals with the literature review to what is the e-portfolio, its advantages, its components, the barriers that prevent its smooth implementation. The second section of this paper describes the methodology used and an analysis of the difficulties from the candidates' point of view. The final section of the research deals with the findings, conclusions, and recommendations on how to face the barriers of applying the e-portfolio in the College of Education. Specifically, this paper addressed the following research questions:

- What are the barriers that candidates of the College of Education face when applying the e-portfolio?
- Are there statistically significant differences facing candidates while applying the e-portfolio and are attributable to the following variables: (gender, disciplines, level of technological skills)?

2. Literature review

Many previous studies addressed the issues of the e-portfolio extensively during the previous years (Tosun & Baris (2011); Jenson & Treuer (2014); Beckers et al. (2016); Alajmi (2019); Mahasneh (2020)). Generally, the published research focuses on investigating the following questions:

- What is the e-portfolio?
- What is the importance of the e-portfolio?
- How to implement the e-portfolio?
- What are the barriers to its implementation?
- Is the e-portfolio a learning tool, or education tool?
- Is it an assessment tool or one for evaluation?

In this part of the research, we will shed light on the e-portfolio by summarizing a set of selected literature that the researcher monitored in three dimensions, namely:

- What is e-portfolio and what is the importance of e-portfolio in teacher education programs?
- Barriers to e-portfolio implementation.
- Diffusion of the e-portfolio application culture.

2.1 E-portfolio in teacher education programs

In light of the cognitive explosion, educational strategies were concerned with constructive thinking that depends on the learners' performance, including what is going on in their mind in the learning situation, and the importance of employing it for previous learning, and linking it to new learning. The e-portfolio is one of the educational solutions that focuses on constructive learning and developing students thinking in practice, linking knowledge with life, and paying attention to developing all aspects of the learner's growth. It provides a platform for students to reflect on their learning experiences, showcase their achievements, and assess their own progress, promoting metacognitive skills (Chen & Crook, 2020; Jafari & Ghavifekr, 2021). They can develop digital literacy skills and foster essential 21st-century skills such as critical thinking, communication, creativity, and collaboration (Ardito & Costabile, 2021; Huang & Liang, 2021). The e-portfolio provides the educators with a more comprehensive and holistic view of student learning beyond traditional tests or exams (Muñoz-Carril & Fernández-Martínez, 2020; Picciano & Steiner, 2021). Furthermore, it facilitates the feedback and communication between the students and teachers (González-Rivera & Mena, 2021; Huang & Liang, 2021).In addition, an effective learning tool contributed to creating new learning outcomes through achieving what is called meaningful learning (Butler, 2006). The studies conducted by Buyarski & Landis (2014); Tubaishat & Lansari, (2013) confirmed that the e-portfolio provides strong physical evidence of the occurrence of learning through the various activities

necessary to build it. They require candidates to organize their learning process and define their educational goals in different stages of its construction. It helps candidates have a deeper understanding of the topics they have studied and to reveal their talents and creativity. It also reflects the candidates' learning style, the way they approach various educational topics and ideas, and their ability to organize, arrange and create (Chang et al., 2013).

The concept of the e-portfolio is the development of a document portfolio as it allows students to collect and display their work in digital format (Barrett, 2007); (Basu, 2015). The e-portfolio is distinguished from a document portfolio by the multimedia available in it, including pictures, animations, videos, and sounds. In addition, it is different due to the ease of organizing the information contained in it, retrieving it through hyperlinks, and the ease of sharing or sharing parts of it with others on a large scale. This helps to form Personalized-learning networks PLNs that support lifelong learning (Oakley et al., 2014). E-portfolios use techniques that allow students to collect and organize evidence in a variety of formats to produce it. Using an e-portfolio has several advantages: (1) Increased technological knowledge and skills; (2) ease of publishing, distribution and sharing; (3) storage of many professional documents; and (4) increased accessibility. It also shows its role in the professional development of candidates associated with the use of technology (Kocoglu, 2008); (Ngui et al., 2020). Harun and others (2021) added that the e-portfolio does not need a long time to be developed compared to the traditional portfolio, which development requires reproduction or the production of large part of it. However, its development requires an integrated design to facilitate the process and avoid the formation of impractical effort for both teachers and candidates.

The definition of the portfolio according to Shulman (1998) is the "…structured documentary history of a set of coached or mentored acts of teaching, substantiated by samples of student portfolios, and fully realized only through reflective writing, deliberation, and conversation" (Cited in Pennington, 2011, p. 37). In another definition, Lorenzo and Ittelson (2005) defined the e-portfolio as "personalized, Web-based collections of work, responses to work, and reflections that are used to demonstrate key skills and accomplishment for a variety of contexts and time periods" (p. 2). Also Butler (2006); (Matra & Rukmini, 2017) confirmed that the e-portfolio is a set of evidence that is collected systematically to show candidates through their learning journey, and to demonstrate the abilities they possess in a particular discipline or those that they have acquired in their lifelong learning, which would contribute to the development of their cognitive management behaviour. The e-portfolio should contain the candidates' reflections on the evidence gathered, the reasons for selecting them, and what they learned from it. This evidence indicates learning over time by demonstrating the knowledge and skills that the candidates possess (Sherman & Byers, 2011). The researcher agrees with Matra & Rukmini (2017) definition of an e-portfolio.

The importance of the e-portfolio lies in identifying the acquired and interrelated experiences that the candidates have accumulated. It can be used as a tool for assessment and evaluation, documenting learning, determining the level of

progress to enhance personal growth, as well as in marketing the candidates themselves to obtain job opportunities (Butler, 2006); (Sipacio, 2015); (Shepherd & Bolliger, 2011); (Strudler & Wetzel, 2005). It is beneficial in identifying previous learning linking it to new learning, and identifying their strengths and weaknesses. It also allows them the freedom to think and express themselves by including them in the works that they prefer to include in it. In addition to the above, the e-portfolio is expected to increase students' ability to self-organize and monitor their learning, thus developing their meta-cognitive awareness, abilities, and aptitudes for lifelong learning and learning how to learn (Butler, 2006); (Robles, 2012).

In light of the above, the goal of the e-portfolio is to use it as a learning tool as it relies on candidates to build their learning and experience. In addition, it is an evaluation tool as one of the alternative evaluation methods for candidates' activities, and a tool in which candidates document their works and experiences. It allows them to access their works anytime and anywhere (Yastibas & Yastibas, 2015); (Buyarski & Landis, 2014).

Literature has identified many characteristics of the e-portfolio (Yastibas & Yastibas, 2015), which we summarize in the following:
Authentic: Candidates are responsible for their learning and improvement, and for organizing their e-portfolios, reflected in their learning and results.
Controllable: Candidates can organize e-portfolios, make the necessary adjustments to them continuously through their learning, and assess processes according to their reflections and in light of the supervisors' evaluations.
Communicative and interactive: Candidates communicate and interact with their peers, supervisors, and co-teachers to improve their learning.
Dynamic: The self-assessment, self-reflection, and improvement of learning processes that are done continuously work to continuously restructure the e-portfolios in terms of organizing content, collecting, and selecting evidences.
Evaluative: It also includes their self-assessments, peer reviews, co-teachers, and supervisors. Through it, teachers evaluate their teaching performance. Moreover, educational institutions can evaluate their courses, programs, and departments through it.
Inclusiveness: The e-portfolio includes candidates' works in all courses during their learning journey.
Integrative: E-portfolios make connections between candidates' lives and what has been studied.
Motivational: It gives candidates ownership of their learning and improvement of their performance and skills.
Multi-purposed: It can be used for learning and creating experiences, teaching, assessment, evaluation, and organizing the learning process and its activities. It is also useful in maintaining the impact of learning, professional development, documenting achievements, lifelong learning, and in marketing candidates to themselves for obtaining job opportunities in the future.
Multi-sourced: The candidates' work includes texts, pictures, graphics, audios, videos, and hypermedia (Robles, 2012).

Personalized: Candidates depend on themselves to innovate their own e-portfolios.
Reflective: The e-portfolio requires candidates to apply reflective, critical and creative thinking skills in their learning processes.
In light of what was presented about the concept, importance, and characteristics of the e-portfolio, and to emphasize the necessity of its application, it was necessary to identify the barriers that stand in the way of the candidates applying it.

2.2 Barriers to e-portfolio implementation
Attitudinal Barriers, is "are pervasive negative perceptions and value systems that focus on a person's disability rather than their ability and other valued characteristics. Attitudinal barriers may exist in societies, communities or specific individuals" (Preedy & Watson, 2010, p. 4150). The research describes attitudinal barriers as the situations, events, systems, or attitudes that prevent a person from actively engaging in learning or training. Based on this definition, determined the number of barriers for the application of the e-portfolio. The first barrier is that the students and teachers need to adapt and deal with cloud storage media to store artifacts. The second barrier related to develop the students' skills in collecting, storing, uploading, and downloading artifacts. These two barriers are similar to what was mentioned by (Ochola et al., 2015). There are also other barriers facing students and teachers related to the availability of hardware, software, and web applications needed to produce the e-portfolio, the necessary maintenance to solve the problems facing them, and the weakness of the infrastructure and the consequent poor internet coverage. In addition, the production of the e-portfolio requires a large amount of time for its production and follow-up by the teacher (Poole et al., 2018). To overcome these barriers, various forms of training must be available for the students to know how to use technology in the production of the e-portfolio. Smith & Tillema (2003); Darling (2001) confirmed that the lack of specific instructions and structure needed to produce the e-portfolio along with examples lead to confusion and concern from students about the nature, importance, value, and how to implement it. Recently, research have pointed out other types of barriers. For example, Paulson and Campbell (2018) mentioned that students lack knowledge of the rules and laws related to storing and displaying digital content. Poole et al. (2018) stated that the lack of time required following up intellectual property rights in what students quote from the Internet and the lack of feedback from teachers to improve their learning are also barriers that need to be considered.

In spite of the many barriers mentioned, studies confirm that there are vigorous efforts to use and integrate it into learning, presentation, evaluation, and employment (Alajmi, 2019); (Nasseif, 2021); (Händel et al., 2020). Some of these barriers are due to the inability to adopt a new idea or technology. Many studies Blevins (2013); (Nasseif, 2021) have sought to rely on the diffusion of innovations theory, which seeks to understand the social process that community members engage in to adopt or reject an innovation, which contains a number of stages explaining how to integrate the e-portfolio into the College of Education, SQU.

The next section shows this theory and explains how to apply it in producing the e-portfolio.

2.3 Diffusion of the e-portfolio application culture

Diffusion of Innovation theory is one of the theories used when adopting a new technology (June Kaminski, 2011). It is a term that refers to the process that occurs as people adopt a new idea, practice, or technology. Sahin (2006) confirmed that diffusion of innovation is the most appropriate for investigating the adoption of technology in education. Rogers defined Diffusion as "the process by which an innovation is communicated through certain channels over time among the members of a social system" (p. 14). We find that innovation, communication channels, time, and social system are the components of the diffusion of innovations. Rogers (2010) presented the stages of the innovation-decision process and described it as "an information-seeking and information-processing activity, where an individual is motivated to reduce uncertainty about the advantages and disadvantages of an innovation" (p. 15). This process consists of five steps: knowledge, persuasion, decision, implementation, and confirmation (Rogers, 2010). Figure 1 show the five stages of the diffusion of innovation theory.

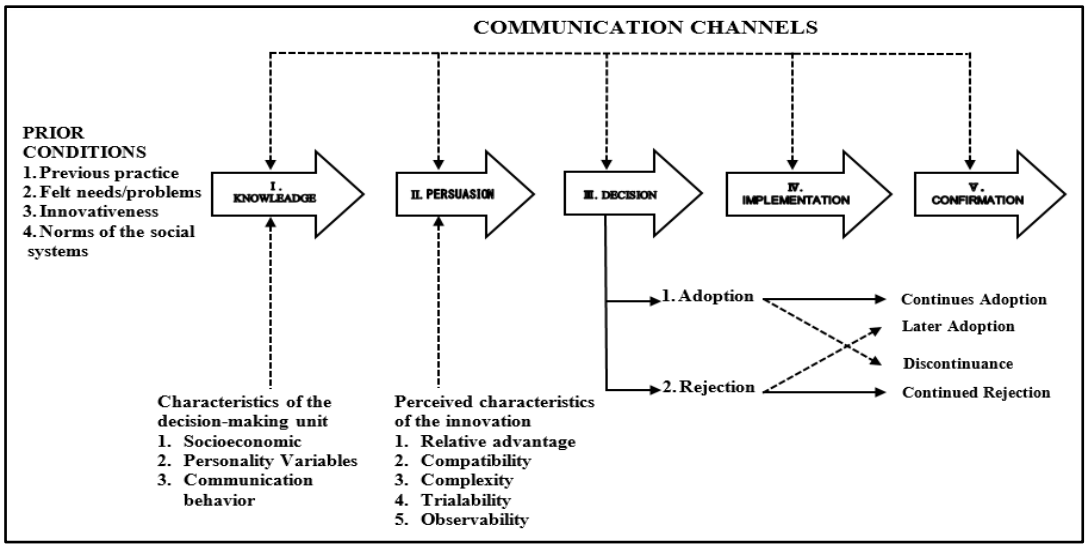

Figure 1: A Model of Five Stages in the Innovation-Decision Process
Source: Diffusion of Innovations, Fifth Edition by Everett M. Rogers, 2003 (Sahin, 2006)

The Knowledge Stage: In this step, the individual knows about innovation and seeks information by trying to answer the following questions: "What is the innovation?" "How does it work?" and "Why does it work?'' These are the main concerns of an individual once he is aware that innovation exists, Rogers identified three types of knowledge on innovation.

1. Awareness-knowledge is the information that an innovation exists.
2. How-to-knowledge consists of the information necessary to use an innovation properly?
3. Principles-knowledge consists of information dealing with the functioning principles underlying how the innovation works (Rogers, 2010).

The persuasion stage: This follows the knowledge stage in the innovation-decision process. The knowledge stage is centered on cognition (or knowing), while the persuasion stage is more focused on the affective (or feeling). The degree of uncertainty about the innovation performance and social reinforcement from others (colleagues and peers) affects the individual's views and beliefs about the innovation. The self-assessments done by close colleagues on the innovation usually reduces the uncertainty about the innovation outcomes and are more credible for an individual.

The decision stage: Individuals choose to adopt or reject the innovation. Rogers (2010) defined the adoption process as the mental process through which an individual pass from first hearing about an innovation to final adoption. An individual may choose to adopt "full use of an innovation as the best course of action available," (Rogers, 2010, p. 21) or rejection that means, "Not to adopt an innovation" (Rogers, 2010, p. 21). Sahin (2006) referred that if there were previous attempts to innovate, then it would be quickly adopted and vice versa. Rogers (2010) indicated two types of rejection: active rejection, which means that the individual thinks about adopting the innovation, but decides not to adopt it; and passive rejection means not adopting the innovation at all.

The implementation stage: When an innovation is put into practice, there is still uncertainty about the innovation outcomes (Lin, 2008). According to Rogers (2010), the implementer needs help to reduce uncertainty about innovation outcomes, and the innovation decision process may end negatively. Re-innovation is an important part of the implementation stage and it means "the degree to which an innovation is changed or modified by a user in the process of its adoption and implementation" (p. 35).

The confirmation stage: A decision is made to innovate. The individual may seek support for his decision and move away from destructive views of adopting innovation. Rogers (2010) indicated that an individual might reflect upon his decision about adopting innovation in two cases: the first refusing innovation to adopt another better innovation, and the second, refusing innovation due to an unsatisfactory performance, as it does not meet needs.

To summarize the literature review, it is worth mentioning that many studies have dealt with the e-portfolio from different perspectives. Most of the reviewed literature have explored its concept and importance in teaching, learning, assessment, and evaluation. Some other research studies addressed the e-portfolio as a means of storing and retrieving students' data and assignments. Another research concluded that the e-portfolio impacts retaining and employing the learned experiences in new learning situations and in professional growth. Moreover, the necessity of integrating the e-portfolio into the higher education was emphasized, and many professional organizations included the it in their standards as The International Society for Technology in Education (ISTE).

Many studies have addressed the barriers that face the application of the e-portfolio. Although some of the barriers were shared among several studies, but

there are other barriers differed according to the educational institution in which the e-portfolio is applied. This situation applies to the College of Education, SQU, where the candidates are facing other barriers in implementing the e-portfolio due to the way of the application as well as the mechanism of preparing candidates and academics for the application of the e-portfolio.

This situation stimulated the researcher to identify the barriers facing the candidates in the College of Education at SQU. The research suggests ways to overcome by following the diffusion of innovation theory stages, which concerns with spreading modern innovations, as a basis for applying the e-portfolio in the College of Education.

3. Methodology

3.1 Research Design

The research utilized a descriptive analytical method. This approach was selected as it is the most appropriate to answer the questions of this research. It depends on designing a questionnaire aimed at identifying the barriers facing the candidates during the application of the e-portfolio. The barriers have been classified into two dimensions, barriers related with the candidates and those related to the instructional environment. The diffusion of innovation theory has been followed in the research methodology. The diffusion of innovation theory consists of five stages: (1) The Knowledge Stage, (2) The persuasion stage, (3) The decision stage, (4) The implementation stage, and (5) The confirmation stage. The researcher adopted the use of the theory of innovation diffusion when there is a need to spread a new idea, practice or technology such as the e-portfolio. The "A proposal for Implementation of the e-portfolio" section explains in detail the application of the diffusion of innovation theory at the College of Education, SQU.

3.2 Participants and Settings

The research community consists of all final-year candidates at the College of Education at SQU for the second semester of the 2020 academic year, because the e-portfolio is applied in the final year, second semester based on the study program. The sample used in the current research is a random sample of candidates in all departments at the College of Education, consisting of 122 out of 233 students, 28 males and 94 females (see Table 1), from two different cohorts, 2015 and 2016. This was emphasized because the employment of graduates of teacher preparation programs in the Sultanate of Oman in schools is done according to gender. The small sample size of participants was a result of the exceptional circumstances of the Covid-19 pandemic that have affected education in the world. The epidemiological situation has negatively affected the interaction of the candidates. That was the reason for their non-response to the questionnaire, despite repeatedly urging them to respond to and interact with it to identify the barriers that impede their application of the e-portfolio. The sample students included eight different majors (Islamic Education, Arabic Language, English Language, Science Education, Math Education, Physical Education, Art Education, Instructional and Learning Technologies) in the College of Education, SQU. They registered in Student Teaching course because it is an essential requirement in the College of Education.

Table 1. Shows the distribution of the research sample.

Islamic Education (IE)	Arabic Language (AL)	English Language (EL)	Science Education (SE)	Math Education (ME)	Physical Education (PE)	Art Education (AE)	Instructional and Learning Technologies (ILT)
22	21	17	11	11	14	10	16

3.3 Instrument

In light of the literature reviewed, in particular e.g. (Butler, 2006); (Paulson & Campbell, 2018); (Alonso et al., 2019); (Payne et al., 2020); a research instrument was self-developed by the author of this study as questionnaire entitled "Barriers of Application of the e-portfolio". The instrument was designed using Google Forms and it was based on a five-point Likert scale measurement (coded as 'strongly disagree=1', disagree=2', to some extent=3', agree=4', strongly Agree=5'). The instrument consisted of two sections. The first section consisted of two dimensions, dimension of "the barriers related to candidate" has 31 items (self-developed), and dimension of "the barriers related to the instructional environment" has 8 items (self-developed). The total items in the instrument is 39 items (see appendix 1 for instrument's items). In addition to participants' demographic variables, the first variable is gender (1='male' and 2='female'). The second variable was related to the discipline (1='Islamic education', 2='Arabic Language', 3='English Language', 4='Science education', 5='Math Education', 6='Physical Education', 7='Art Education', 8='Teaching and learning Technology'). Moreover, the third variable is technological skills level (1= 'Weak', 2= 'Medium', and 3= 'Good') These variables were included in the instrument to identify the barriers that candidates face while applying the e-portfolio. The second section consisted of two open-ended questions, and was devoted to provide more freedom to the candidates in expressing their perspectives and thoughts regarding the implementation of the e-portfolio. The first question was about the barriers related to candidates and the second one was about the barriers related to the instructional environment (see appendix 1).

The content and criterion validity was judged by five experts specialized in teaching methods and educational technology with several years of teaching experience. All experts were asked to check the correctness of the dimensions and the items, the relations between the items and dimensions, and the appropriateness of the questionnaire items to the Omani context. The experts' notes included reformulating some words and phrases, deleting repeated phrases, deleting phrases related to the supervisor, and transferring some phrases from the dimensions of barriers related to the instructional environment to the dimensions of barriers related to the candidate. Then the instrument was modified accordingly. The agreement between the experts was measured and it was 90%. The instrument was tested in a pilot study and the reliability was calculated using the coefficient of Cronbach alpha (α). The value of α= 0.82 was acceptable, meaning the instrument is reliable.

4. Analysis

The researcher distributed the instrument to all candidates in the College of Education in the 2020. The data were collected using electronic means and analysed using SPSS to provide answers for research questions. The following briefly shows the statistical methods used in the research methodology:

1. To determine whether there are barriers facing the candidates when applying the e-portfolio, the mean, standard deviation of the barriers, the mean scores of the questionnaire as a whole and each dimension of the questionnaire were calculated. Then, the means were compared to the mean values for each scale by increasing 0.5 to the starting value for each rank to rank (1.5, 2.5, 3.5, 4.5).
2. To determine whether there are barriers facing students when applying the e-portfolio that are attributable to the gender variable, the T-test was applied for two independent groups of different numbers.
3. To determine whether there are barriers facing students when applying the e-portfolio that are attributable to the variables of Discipline and the level of technological skills, the one-way analysis of variance (ANOVA) test was applied.

Regarding the open-ended questions part in the instrument, which represents the qualitative analysis, the main objective of this part was to provide more freedom to the candidates in expressing their perspectives and thought regarding the implementation of the e-portfolio. The following steps were followed to perform the qualitative analysis:

1) Placing the interview transcripts into MS word in two-column format, one column for the transcript and one column for coding.

2) Using line-by-line technique to define and categorize the codes of the transcripts.

3) Using the AntConc corpus analysis software package to create frequency list of words, which is a two-column table, the word and the number of times each word occurred. The word frequency list identified the most frequently occurring words in the transcripts.

4) The words were grouped into eight categories based on the data. The following table (2) summarizes the candidates' perceptions and insights that resulted from the analysis of their feedback

Table 2. Feedback Categorization

Category	Feedback example
General e-portfolio feedback	"the e-portfolio is a good idea; it has many positives and barriers"
Purpose and motivation	"lack of persuasion of the e-portfolio, because it is not in the interest and needs of the candidates as its goal is to meet the requirements of academic accreditation"
Training and skills	"the necessity of training them in the technological skills necessary to implement the e-portfolio early and avoid the delay in training skills on the application of the e-portfolio until the final semester"

Knowledge and understanding	"the limited knowledge provided to them about the e-portfolio and what the e-portfolio is" "lack awareness of the necessity of preserving their works for inclusion in the e-portfolio, that has resulted in the loss of many evidences"
Reflective papers	"there is no prior knowledge of how to write specialized and general reflective papers, and the delay in writing them until the last semester"
Evaluation and scoring	"the score assigned to evaluate the e-portfolio is insufficient"
Time management and workload	"feeling of overload due to some supervisors requesting a hard copy and e-copy of the e-portfolio, and the lack of support and encouragement by some academic supervisors"
Collaboration and alumni support	"the candidates affected by the alumni' negative opinions and desire to reduce the work included in the e-portfolio, but that they lacked collaboration with the alumni and exchange of knowledge and skills related to building the e-portfolio"

5. Results

The initiative of current research dealt with the barriers that candidates faced in the College of Education at SQU during the implementation of the e-portfolio. These barriers prevent candidates from applying the e-portfolio, which leads to poor assessment, lack of integration of knowledge, inability to identify previous learning and link it to new learning, and loss of many professional documents. The barriers identified in the research could be classified as barriers related to candidates, and others related to the instructional environment.

The first question: What are the barriers that candidates of the College of Education face when applying the e-portfolio?

The questionnaire was applied to the research sample and the mean scores of the students' responses were calculated for the questionnaire as a whole as well as for the first and second dimensions of the questionnaire. The value corresponding to the value of each mean score was determined consequently. Table (3) shows the mean scores of the students' responses and the corresponding values

Table 3. Shows the descriptive statistics for the barriers that candidates face during the applying of the e-portfolio that related candidates.

(2.A) Barriers related to candidate					
Barrier's N.	Mean	Std. Deviation	Barrier's N.	Mean	Std. Deviation
1	2.8689	1.19192	18	2.7951	1.30440
2	3.1230	1.17535	19	3.2623	1.22510
3	3.0902	1.33611	20	3.5738	1.27867
4	3.3033	1.08246	21	3.6148	1.25604
5	2.6721	1.30126	22	3.8770	1.16830
6	2.6885	1.17186	23	4.2705	1.01262
7	3.4590	1.09957	24	3.7213	1.24158
8	3.2623	1.36547	25	3.2951	1.19702
9	3.4180	1.32266	26	3.8525	1.11097

10	3.7541	1.18748	27	3.4180	1.08209
11	3.1557	1.11356	28	4.0082	1.10966
12	3.2869	1.32665	29	3.8607	1.15934
13	3.4426	1.16455	30	3.7623	1.19263
14	3.3525	1.14215	31	3.5902	1.29688
15	3.1311	1.08293	32	2.9836	1.25299
16	2.8852	1.25439	33	3.6639	1.15430
17	2.7049	1.31544	**Total**	**111.1475**	**24.11394**
(2.B) Barriers related to the instructional environment					
34	3.6885	.91887	38	3.9098	.98756
35	3.4016	1.11088	39	3.9918	1.10218
36	3.5328	1.12216	40	3.9754	1.12421
37	3.6148	1.14594	41	3.8197	1.17843
			Total	**29.9344**	**6.11425**

The results shown in Table 3 indicate that all means values of the responses of the sample members suggest that there are barriers facing the candidates when producing the e-portfolio. The means of responses on the first dimension related to the barriers facing the candidates was 111.147 out of 155. As for the second dimension of the barriers related to the instructional environment, the mean was 29.934 out of 40. Moreover, from the result is the first dimension barriers 10, 20, 21, 22, 24, 26, 29, 30, 31, 32, and 33 each has obtained means of the responses with a "high" degree. The notable means were obtained by the barriers 23 and 28 where the values reached 4.27 and 4.00 respectively. In addition, the second dimension barriers 34, 36, 37, 38, 39, 40, and 41 where each obtained a mean above 3.5 as well. Based on that, all the means obtained by the barriers in the first and second dimensions confirmed that there were high level barriers facing candidates when implementing the e-portfolio.

The results confirm that there are a number of barriers candidates face when implementing an e-portfolio. This might be derived from the results of 16 barriers of the first dimension that have obtained means equal or greater than 3.0. These barriers are 2, 3, 4, 7, 8, 9, 11, 12, 13, 14, 15, 19, 25 and 27 from the first dimension and barrier 35 from the second dimension. The barriers 1, 5, 6, 16, 17, 18, that obtained means above 2.5 which refers to an “average” score, also supported the fact that there are barriers facing candidates when implementing the e-portfolio.

In the open-end questions of the questionnaire, the candidates emphasized the following:

- The e-portfolio is a good idea; it has many positives and barriers.
- The necessity of training them in the technological skills necessary to implement the e-portfolio early and avoid the delay in training skills on the application of the e-portfolio until the final semester.
- The limited knowledge provided to them about the e- portfolio and what the e-portfolio is. In addition, how to build it in light of the conceptual framework of the College of Education, INTASC standards, Discipline standards, and the outputs of the teacher preparation program.
- There is no prior knowledge of how to write specialized and general reflective papers, and the delay in writing them until the last semester.

- Lack of knowledge of how to select evidences related to the college's conceptual framework.
- The score assigned to evaluate the e-portfolio is insufficient.
- Feeling the lack of time and the large number of tasks involved in the e-portfolio.
- There is no prior knowledge of how to write specialized and general reflective papers, and the delay in writing them until the last semester.
- Lack awareness of the necessity of preserving their works for inclusion in the e-portfolio, that has resulted in the loss of many evidences.
- The candidates affected by the alumni' negative opinions and desire to reduce the work included in the e-portfolio, but that they lacked collaboration with the alumni and exchange of knowledge and skills related to building the e-portfolio.
- There are not enough e-portfolio forms to guide candidates.
- Feeling of overload due to some supervisors requesting a hard copy and e-copy of the e-portfolio, and the lack of support and encouragement by some academic supervisors.
- Lack of persuasion of the e-portfolio, because it is not in the interest and needs of the candidates as its goal is to meet the requirements of academic accreditation.

The second question: Are there statistically significant differences facing candidates while applying the e-portfolio that are attributable to the following variables: gender, disciplines, level of technological skills?

Gender variable: To identify the significance of the existence of statistically significant differences facing candidates that are attributable to gender; the degree of the responses of the male and female members of the research sample was monitored, and the T-test was applied to two independent groups of different numbers.

Table 4. Descriptive statistics and (T) values for the sample according to the gender variable

Dimension	Mean		Std. Deviation		T	Sig.
	Male	Female	Male	Female		
Barriers related to candidate	110.357	111.383	26.387	23.54	0.197	0.844
Barriers related to the instructional environment	28.535	30.351	7.12	5.758	1.384	0.169
Total	138.892	141.734	32.896	28.118	0.451	0.653

The results shown in Table 4 indicate that the means of the responses on the first dimension were 110.357 and 111.383 for males and females respectively. As for the second dimension, the means of the responses were 28.535 and 30.351 males and females respectively. It also shows the (T) value of the difference between the average responses of males and females were 0.197 on the first dimension, 1.384 on the second dimension, and 0.451 to the questionnaire as a whole.

This result confirms that the difference between the mean of the males' responses and the mean of the females' responses on the first and second barriers dimensions, and the total of the responses on all the questionnaire barriers are not

statistically significant. The value of (T) in both the first and second dimensions, and the total of the questionnaire barriers, are not statistically significant at the level of (0.05), and this means that there are no differences attributable to the gender variable when determining the barriers of applying the e-portfolio of the candidate or the instructional environment.

Disciplines variable: To identify the significance of the existence of statistically significant differences faced by candidates that are attributable to the disciplines variable, the responses of the research sample were collected for each discipline. Then, the equation of the one-way analysis of variance (ANOVA) was applied. Table 5 shows the results of the analysis.

Table 5. Results of ANOVA test for first dimension

Disciplines	N	Mean	Std. Deviation	F	Sig
IE	22	115.8636	17.30757	5.648	0.00
AL	21	114.7619	23.80106		
EL	17	123.8235	18.89522		
SE	11	116.4545	22.37572		
ME	11	93.9091	23.53064		
PE	14	117.2143	25.41102		
AE	10	116.7000	20.59153		
ILT	16	85.8750	20.25792		
Total	122	111.1475	24.11394		

Table 5, indicate that the value of (F) for the first dimension of the questionnaire is 5.648, which is statistically significant (0.00). To reveal the reasons for the significance (F) among disciplines, the Scheffe test was used for the post comparisons, and the results of the test are shown in Table 6.

Table 6. Scheffe test for post comparisons according to the disciplines variable of first dimension

(I) Discipline	(J) Discipline	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
ILT	IE	-29.98864-*	7.03365	.016	-56.8976-	-3.0797-
	AL	-28.88690-*	7.10382	.027	-56.0643-	-1.7095-
	EL	-37.94853-*	7.45646	.001	-66.4751-	-9.4220-
	SE	-30.57955-	8.38467	.076	-62.6572-	1.4981
	ME	-8.03409-	8.38467	.996	-40.1117-	24.0435
	PE	-31.33929-*	7.83424	.032	-61.3111-	-1.3675-
	AE	-30.82500-	8.62953	.089	-63.8394-	2.1894

*. The mean difference is significant at the 0.05 level.

The results shown in Table 6 indicate that there are statistically significant differences in the barriers facing candidates when producing the e-portfolio according to the variable of disciplines. The directions of differences were between groups ILT and IE in favour of IE, between ILT and AL in favour of AL, between ILT and EL in favour of EL, and between ILT and PE in favour of EL. PE. It be concluded that the barriers identified by IE, AL, EL and PE disciplines were of greater statistical value and significance than the barriers identified by ILT. As for the other disciplines, there are no statistically significant differences.

Table 7. Results of ANOVA test for second dimension

Disciplines	N	Mean	Std. Deviation	F	Sig
IE	22	31.5455	4.73817		
AL	21	29.0000	7.08520		
EL	17	34.3529	5.08602		
SE	11	32.4545	4.84487		
ME	11	26.8182	3.76346	5.350	0.00
PE	14	31.0714	5.46970		
AE	10	28.9000	5.34270		
ILT	16	24.3125	5.73549		
Total	122	29.9344	6.11425		

As in Table 7, indicate that the value of (F) for the second dimension of the questionnaire is 5.350, which is statistically significant (0.00). To reveal the reasons for the significance (F) among disciplines, the Scheffe test was used for the post comparisons, and the results of the test are shown in Table 8.

Table 8. Scheffe test for post comparisons according to the disciplines variable of second dimension

(I) Discipline	(J) Discipline	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
ILT	IE	-7.23295-*	1.79566	.030	-14.1027-	-.3632-
	AL	-4.68750-	1.81357	.468	-11.6258-	2.2508
	EL	-10.04044-*	1.90360	.001	-17.3231-	-2.7577-
	SE	-8.14205-	2.14057	.053	-16.3313-	.0472
	ME	-2.50568-	2.14057	.986	-10.6950-	5.6836
	PE	-6.75893-	2.00005	.134	-14.4106-	.8927
	AE	-4.58750-	2.20308	.739	-13.0159-	3.8409

*. The mean difference is significant at the 0.05 level.

The results shown in Table 8 indicate that there are statistically significant differences in the barriers facing candidates when producing the e-portfolio according to the variable of disciplines. The directions of differences were between ILT and IE in favour of IE, and between ILT and EL in favour of EL. It be concluded that the barriers identified by the IE and EL disciplines were of greater value and statistical significance than those identified by the ILT. As for the other disciplines, there are no statistically significant differences.

This difference confirms the importance of raising awareness of the e-portfolio in advance and uniformly among all disciplines to avoid the barriers that some candidates were exposed to.

Technological skills level variable: To identify the significance of the existence of statistically significant differences facing the candidates due to the technological skill level variable, the responses of the research sample were collected at the level of technological skills (weak, medium, and high). Then the

equation of the one-way analysis of variance (ANOVA) was applied. Table 9 shows the results of the analysis.

Table 9. Results of ANOVA test for the technological skills level variable for the first dimension of the questionnaire.

Technological skills level	N	Mean	Std. Deviation	F	Sig
Weak	62	122.8387	20.92390	23.947	0.00
Medium	20	109.0000	17.54393		
High	40	94.1000	21.25161		
Total	122	111.1475	24.11394		

As in Table 9, indicate that the value of (F) for the first dimension of the questionnaire according to the technological skills variable is 23.947, which is statistically significant (0.00). To reveal the reasons for the significance (F), the Scheffe test was used for the post comparisons, and the results of the test are shown in Table 10.

Table 10. Scheffe test for post comparisons according to the technological skills variable of first dimension

(I) Technologica l skills level	(J) Technological skills level	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Weak	Medium	13.83871*	5.28002	.035	.7501	26.9273
	High	28.73871*	4.16403	.000	18.4166	39.0609
Medium	High	14.90000*	5.62303	.033	.9612	28.8388

*. The mean difference is significant at the 0.05 level.

The results shown in Table 10 indicate statistically significant differences in the barriers of the first dimension facing candidates when producing the e-portfolio according to the variable of technological skills. The directions of differences were between groups weak and medium in favour of weak, between weak and high in favour of weak, and between medium and high in favour of medium. It concluded that the barriers related by candidates with low technology skills were of greater statistical value and significance than those related by candidates with medium and high technology skills. In addition, the barriers related by candidates with medium technology skills were of greater statistical value and significance than the barriers related by candidates with high technology skills

Table 11. Results of ANOVA test for the technological skills level variable for the second dimension of the questionnaire.

Technological skills level	N	Mean	Std. Deviation	F	Sig
Weak	62	32.4839	5.45546	14.70	0.00
Medium	20	28.9000	4.51780		
High	40	26.5000	6.04258		
Total	122	29.9344	6.11425		

Table 11 indicates that the value of (F) for the second dimension of the questionnaire according to the technological skills variable is 14.70, which is statistically significant (0.00). To reveal the reasons for the significance (F), the

Scheffe test was used for the post comparisons, and the results of the test are shown in Table 12.

Table 12. Scheffe test for post comparisons according to the technological skills variable of second dimension

(I) Tech	(J) Tech	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Weak	Medium	3.58387*	1.41975	.045	.0645	7.1033
	High	5.98387*	1.11967	.000	3.2083	8.7594

*. The mean difference is significant at the 0.05 level.

The results shown in Table 12 indicate statistically significant differences in the barriers of the second dimension that face candidates when producing the e-portfolio according to the variable of technological skills. The directions of differences were between groups weak and medium in favour of weak, and between weak and high in favour of weak. It concluded that the barriers related by candidates with low technology skills were of greater statistical value and significance than those related by candidates with medium and high technology skills.

Finally, it was confirmed that candidates decided to apply the e-portfolio in light of the positive experiences presented to them, and that it is a mandatory requirement. Therefore, they avoided destructive opinions that indicate the existence of barriers that hinder their implementation of the e-portfolio. However, some candidates refused to apply the e-portfolio according to the ideas presented to them in previous experiences and adopted a new method for applying it based on the dimensions of the conceptual framework.

6. Discussions

This research explored the perceived barriers that face candidates of the College of Education during the implementation of the e-portfolio. In addition, it explored if these barriers are related to variables gender, disciplines, level of technological skills. The researcher discussed the results according to the study questions, as follows.

The first question: "What are the barriers that candidates of the College of Education face when applying the e-portfolio?"

The results in Table (3) showed that the research sample agreed on all the barriers included in the questionnaire are 41 barriers (as shown in Appendix 1). The number of barriers that got a mean of more than 3.00 were 35 barriers, while the number of barriers that got a mean of more than 2.5 were 6 barriers, which confirms that the candidates agreed upon all the barriers included in the questionnaire on the e-portfolio. The candidates indicated that the e-portfolio is a good idea and it has many positives, but they agreed that there were some barriers to the implementation process; this was confirmed by Aldhafeeri (2017).

In the following, we will discuss the expected barriers to implementing the e-portfolio in light of the stages in the diffusion of Innovation theory.

From the candidates' responses to the questionnaire, there are barriers related to: **At the knowledge stage**, in their responses, the candidates emphasized in statements 1, 9-14 in the questionnaire the ***limited knowledge provided to them about the e- portfolio and how to build it in light of the conceptual framework of the College of Education, INTASC standards, specialization standards, and the outputs of the teacher preparation program.*** They also emphasized in the open part lack of knowledge of how to write reflective specialized and general papers and how to select evidences related to the college's conceptual framework, and the inadequate score assigned to e-portfolio evaluation. This result could be explained by the need for introducing the e-portfolio concept, its content, and how to build and link it the standards to the candidates through including these subjects in some courses that related the e-portfolio before producing it. This is consistent with the e-portfolio application success criteria indicated by Steele (2009) such as familiarizing candidates with the concept and rationale for creating an e-portfolio as well as briefing them with the types of evidence selected and how to evaluate this evidence. Aldhafeeri (2017) confirmed that the e-portfolio was imposed on the students without introducing them to it or providing any training on its use.

Candidates in statement 29 identified the lack of time required to produce the e-portfolio as one of the barriers due to the delay of knowledge related to the implementation of the e-portfolio until the last semester that was confirmed by candidate responses in statement 21. Other barriers identified by the candidates are the large number of tasks involved in e-portfolio and the unavailability or loss of many evidence/works that should be included in the e-portfolio as in candidates' responses for statements 23 and 14 respectively. Moreover, the delay in writing the specialized and general reflective papers is also identified by the candidates as a barrier in the open part of the questionnaire. These results might be due to the candidates' lack of awareness of knowledge related with producing the e-portfolio.

In light of the above, it is important to overcome the numerous barriers that the candidates face related to the knowledge stage due to its important role in educating the candidates with the knowledge necessary to apply the e-portfolio. This was confirmed by Fong et al. (2014) in that prior knowledge of the e-portfolio plays an effective role in shaping perceptions of usability and effectiveness. This research suggests defining a special course for the e-portfolio in which knowledge is presented. Another option would be to specify a number of courses in the student's plan to provide knowledge, and to implement the application of the e-portfolio gradually so its application is not delayed until the final semester and work accumulates on the candidates.

As for the barriers related to the persuasion stage, the candidates confirmed in the open part of the questionnaire that they were affected by the opinions of the graduates. This extent of influence is revealed through the candidates' desire to reduce the work included in the e-portfolio even before starting any implementation steps, and this may be due to the effort made by graduates during the implementation of the e-portfolio. Additionally, statement #17 indicated that

they lack cooperation and exchange of knowledge and skills related to building an e-portfolio. In this regard, Syzdykova et al. (2021) emphasized that candidates should improve their collaborative skills as their cooperation with graduates may contribute to giving them positive attitudes towards the e-portfolio. The difference in the e-portfolio components among candidates of same discipline, and other disciplines, is one of the barriers identified by the candidates, which is expected to prevent them from being persuaded to implement the e-portfolio. This could be justified by inconsistency of the evidence produced in the academic curricula because of the differences of the faculty members who teach them, as stated in statement 38. Aldhafeeri (2017) indicated that some instructor interested to apply the e-portfolio while others not interested, and this difference between instructors is one of the reasons for the resistance of students the e-portfolio.

At the decision stage, candidates are expected to make the decision to start implementing the e-portfolio and are positively influenced by the models presented to them by graduates about the e-portfolio. This is matched to Abrami & Barrett (2005) conclusion who confirmed the possibility of accepting candidates to implement e-portfolio by providing examples of previous e-portfolio and demonstrating their effectiveness in achieving learning. However, candidates also revealed there are not enough e-portfolio forms to guide them because the graduates usually cancel sharing their e-portfolio with their supervisor after completing their studies. Based on that, the need for a special platform to produce the e-portfolio and preserve the graduates' work could be confirmed. The candidates agreed in statement 37 of the questionnaire that "the college does not have an electronic platform in which the e-portfolio is produced" is one of the barriers to producing the e-portfolio. Several studies have concluded the importance of using a special platform for e-portfolio implementation such as Chang et al. (2013); Galvin Fernandez et al. (2017); Taylor (2021). In addition, the decision to apply for an e-portfolio is a mandatory requirement for all candidates to achieve the requirements for academic accreditation. This explains why some candidates are not convinced of the e-portfolio as stated in the open part of the questionnaire. Fong (2014), Aldhafeeri (2017) have confirmed the candidates' resistance to applying the e-portfolio increases if they are forced to implement it.

In the implementation stage, candidates may continue to feel uncertain about their ability to implement the e-portfolio as its relevance to previously completed and evaluated work may make them feel bored. Such an undesired feeling might be a result of losing some evidence, not knowing the need to preserve it, and lacking knowledge of the importance of the e-portfolio, which was indicated by statements 14 and 19 in the questionnaire. The negative attitudes towards e-portfolio obtained from some graduates results in feeling of difficulty in implementing the e-portfolio. Statements 3, 5, 8, 25, 33, and 37 of the questionnaire confirm the existence of barriers related to technology among the candidates, and this is due to the fact that the only one technological course dedicated for the candidates in the college of education does not include in-depth knowledge of the production of the e-portfolio. Basu (2015); Oakley et al. (2015) emphasized in this regard that technology is one of the barriers affecting the successful implementation of the e-portfolio. The absence of follow-up and guidance by

supervisors along with their weak feedback provided on the candidates' work are the reasons behind the candidates' feeling of uncertainty about their ability to implement the e-portfolio as statement 16, 26, 32, 36, 40 of the questionnaire. Other reasons confirmed by statements 24 and 28 of the questionnaire are the preoccupation of some candidates with studying other courses accompanying the student teaching and also the low grade allocated to the e-portfolio compared to the amount of work required to complete it. The opinions of the students in the Aldhafeeri (2017) are similar to the opinions of the candidates in the current research, as they confirmed the lack of interest and guidance of some supervisors in the e-portfolio. Moreover, some supervisors demand hard and soft copy of the e-portfolio, which increases the burden on candidates. It could be concluded that the barriers facing candidates in the implementation phase are due to the delay in providing knowledge, the delay in applying the e-portfolio until the final semester, and the lack of support and encouragement for candidates by some academic supervisors. The researcher believes that having a special course for the e-portfolio will solve many of the barriers that the candidates faced during their application.

During confirmation stage, candidates are expected to put a lot of efforts into implementing the e-portfolio and to stay away from the destructive opinions that hinder their implementation of the e-portfolio. The candidates indicated in statements 16 and 18 of the questionnaire that the weak feedback of some supervisors and the candidates' unacceptance of their feedback may remain among the barriers that hinder the e-portfolio. This is consistent with what Steele (2009) emphasized on the need for supervisors to encourage and support their students while implementing the e-portfolio as a new experiment.

Some candidates indicated in their responses to the open part of the questionnaire that the e-portfolio is not needed (no need to innovate) because it conflicts with their needs and interests. Statement 28 of the questionnaire indicated that some candidates were preoccupied with studying other courses accompanying the student teaching course, which reduces the effort expended in implementing the e-portfolio. This agrees with Aldhafeeri (2017), who confirmed that the preoccupation of students with studying other courses is the reason behind refusing the e-portfolio. Therefore, candidates should be urged to avoid studying other courses simultaneously with the student teaching course that the e-portfolio is applied in.

Individuals usually tend not to expose themselves to thoughts that conflict with their interests, needs, or attitudes. According to his research findings, the Individuals rarely expose themselves to innovation-related ideas unless they initially feel the need to innovate. Moreover, if individuals were exposed to innovative ideas, the exposure would have little effect unless they perceive that innovation is closely related to their needs and corresponds to their current attitudes and beliefs (Rogers, 2010; Ozen, & Koc, 2021). The statements 1, 19, and 35 confirmed that the research findings agreed with Rogers' theory that the ambiguity of the purpose for applying the e-portfolio and its insignificance led the candidates to not feel the need for it.

The researcher believes that having a course on the e-portfolio will solve many of the barriers that the candidates will face during the implementation of the e-portfolio as the course includes teaching practical skills required to build the e-portfolio. The supervisor is fully responsible for the course and independent of the partner departments and colleges in regard to the correcting reflective papers.

A proposal for the implementation of the E-portfolio

The implementation of the e-portfolio at the College of Education at SQU has become imperative for two reasons. The first is its importance as a tool for learning, assessment and documentation, while the second is the necessity imposed by CAEP academic accreditation requirements. Figure 2. Shows the stages proposed to implement the e-portfolio in the College of Education at SQU.

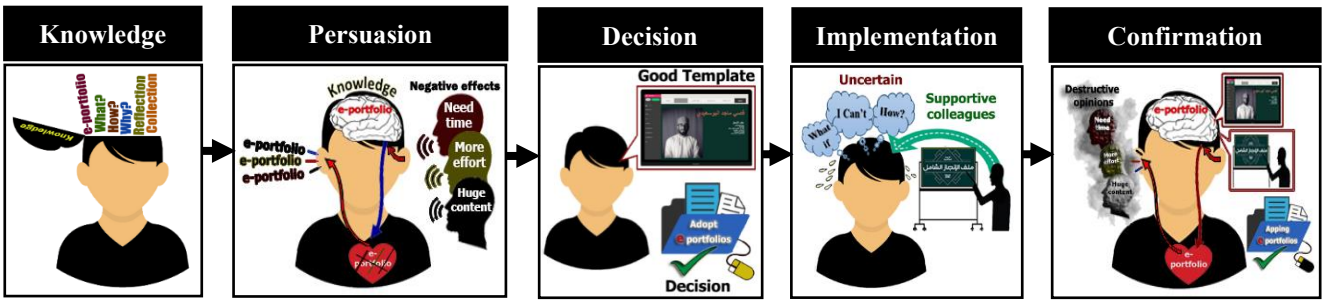

Figure 2. Stages proposed Implementation of the e-portfolio in the Collage of Education at SQU

©The figure was designed by Sameh Said Ismail (The Researcher)

The process begins with introducing different types of knowledge about the e-portfolio (innovation) to answer the first question what is innovation? Students learn about the nature, importance and types of the e-portfolio, and emphasizing the need to include the most important works they produced in it. Then introduces the candidates to another level of knowledge related to the second question: How does innovation work? Where it trains candidates on the sites necessary to produce the e-portfolio, and introduce them with the standards on which it is built, which are the dimensions of the conceptual framework of the College of Education, the InTasc standards, and the outputs of the teacher preparation program. Finally, another level of knowledge is introduced related to the answer to the third question, why we make an innovation? At this level, candidates are introduced to the importance of the e-portfolio, and how they can collect and reflect on their best work. Which proves that they have acquired many experiences.

Candidates' application of the e-portfolio is influenced by the opinions of their colleagues who have previously applied it in terms of: (1) Its feasibility, (2) Its usefulness, (3) Ease and difficulty of its application, (4) Adequacy of the knowledge provided to them and necessary for their application, (5) The time available to them to apply it, and (6) The amount of effort expended in its production, and its suitability to the grade assigned to it.

In the previous light, it is necessary to work on providing positive opinions from colleagues who have implemented the comprehensive e-portfolio, as the decision of candidates to adopt the e-portfolio application is influenced by the self-

evaluation of colleagues. If the self-evaluations are positive, the candidates make the decision to implement the e-portfolio (innovation) and vice versa.

Candidates' e-portfolio application is affected by the successful attempts presented to them with the aim of showing good examples of the work of previous colleagues, and encouraging them to apply an e-portfolio. It is difficult for candidates to make a decision to refuse to adopt an e-portfolio application, as it is a mandatory requirement in the College of Education to meet the academic accreditation standards. Accordingly, the decision to adopt has become mandatory and is sought to be supported by good templates.

While implementing an e-portfolio, candidates may feel uncertain about their ability to implement it. This confirms that candidates faced frustrations, challenges, and barriers when creating their first e-portfolio. Candidates may need the help and support of their supervisors and colleagues to overcome the barriers they face during implementation.

To reduce candidates' uncertainty about e-portfolio outcomes (innovation), the graduate students are invited to showcase their e-portfolios and talk about the positive journey of its production. As a result, some candidates may make decisions to re-apply the e-portfolio in a different way than planned. In addition, a praise was given by some academics to the efforts of some graduates in producing the e-portfolio efficiently and presenting their work as models for all college candidates in their different specializations. This praise has helped candidates decide to re-apply the e-portfolio.

The second question: "Are there statistically significant differences facing candidates while applying the e-portfolio that are attributable to the following variables: gender, disciplines, level of technological skills?"

Gender variable: There are no statistically significant differences between the mean scores responses of males and females to the barriers in the first and second dimensions of the questionnaire. One possible explanation for this result is that the candidates have completed all pre-courses required for taking the student teaching course in which the e-portfolio is implemented. This proves that male and female candidates have studied the same content and pedagogical knowledge and skills preceding the e-portfolio implementation. Karami et al. (2018); Alzouebi (2020) confirmed that there is no significant difference between males and females in the use and implementation of the e-portfolio. This result can be explained that the male and female candidates faced same degree of common barriers in the implementation of the e-portfolio, which made the levels of both genders equivalent despite the general permanent female advantage. Moreover, what prompted the current research to study the gender variable is the difference in the work place after graduation, as all of them work in one gender schools. Also, the results of females in all courses are almost higher than the results of males. Accordingly, the research tried to clarify whether there are different barriers identified by females from males according to their academic level.

Disciplines variable: The results of multiple comparisons for the first dimension of the questionnaire shown in Table 6 indicated that there were statistically significant differences between the mean response scores for ILT discipline and the responses of candidates from other disciplines except for SE and ME and AE. In addition, that multiple comparisons for the first dimension of the questionnaire shown in Table 7 indicated that barriers identified by the disciplines of IE and EL were of greater value and statistical significance than the barriers identified by the ILT. As for the other disciplines, there are no statistically significant differences.

This result could be explained by that the ILT and EL disciplines have previously implemented the e-portfolio before other disciplines, which means that they have been exposed to the barriers that candidates face while implementing the e-portfolio before other disciplines. On the other hand, disciplines ILT, SE, ME and AE have technological skills due to the nature of the major that deals with many technological applications. Candidates in the ELT and ME disciplines have the technological skills needed to apply the e-portfolio as they previously designed educational websites on WIX. In addition, the mathematics discipline uses technology to teach subjects. Cahyono & Ludwing (2018) emphasized the use of digital technology to support mathematics teaching and learning.

Technological skills level variable: The results of multiple comparisons for the first dimension of the questionnaire shown in Table 10 indicated that the barriers related by candidates with low technology skills were of greater statistical value and significance than the other barriers. In addition, the barriers related by candidates with medium technology skills were of greater statistical value and significance than the barriers related by candidates with high technology skills. Moreover, the multiple comparisons for the second dimension of the questionnaire shown in Table 12 indicated that barriers related by candidates with low technology skills were of greater statistical value and significance than the barriers related by candidates with medium and high technology skills. This result can be explained by the necessity of training candidates on technological skills in general, and the skills necessary to implement the e-portfolio in particular. In this regard, Barrett (2007) emphasized that the use of an e-portfolio requires a high level of technological skills and a support system.

There are limitations for this research, and these are:

- The study has been conducted in an Arabian country, the Sultanate of Oman. Accordingly, the educational system and the local culture related to the Arabic language were taken into account.
- The participants were only students of one semester registering student teaching course offered at the College of Education, SQU.
- The research sample is not large due to the spread of the Covid-19 pandemic. The response to the questionnaire was not as expected. All schools and universities in Oman were closed. Thus, the researcher suggests replicating the study on a larger sample in various educational contexts to generalize the results.
- The responses are the candidates' personal opinions about the barriers to applying for the e-portfolio. Thus, the researcher suggests a need for

descriptive research that includes interviews with candidates to understand the challenges better.

7. Conclusion

Many barriers that could hinder the application of e-portfolios in the institutions of higher education have been identified in the literature. Obviously, the existence of barriers affects the candidates' construction of the e-portfolio, causes a lack of integration of knowledge among them, and perhaps lead to loss of many professional documents. This research aimed to identify and analyse such barriers in College of Education, SQU, and to implement the e-portfolio in light of the diffusion of innovation theory. To achieve the research goals, the research explained the concept, importance, and characteristics of the e-portfolio. The research designed an electronically distributed questionnaire to identify barriers during the implementation of the e-portfolio related to the candidates and the instructional environment. After applying the questionnaire, it was confirmed that there are two classes of barriers during the implementation of the e-portfolio, barriers related to the candidates such as the specialization and technological skills and barriers related to the instructional environment, such poor supervision and the consequent delay in providing knowledge, skills and feedback related with the e-portfolio.

The contribution of this research is identification of barriers faced by the candidates of candidates of College of Education, SQU during the implementation of their e-portfolio. In addition, the research proposes an approach to implement the e-portfolio and confront the barriers based on the diffusion of innovation theory.

The research recommends integrating the e-portfolio into all courses. However, this requires spreading continuously the knowledge and skills necessary among the candidates to create their e-portfolio. Moreover, following up the creation of e-portfolio, assessing its content, and providing proper feedback to the candidates are very crucial. The research also recommends integrating the e-portfolio into other courses during other semesters rather than making it limited to courses in the final semester. Finally, based on some comments from the candidates, the research recommends the importance of having an e-portfolio and a special platform for its production uniformly.

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