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Adopting the GHOSHEH Model to Create Innovative Open Educational Resources Based on Rogers' Process for Diffusion of Innovations

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Abstract: The current study aims to adopt a new model for creating innovative OERs. The model, called 'GHOSHEH', supports OERs through multiple learner-centered strategies with authentic assessments, and focuses on practice and reflection. The model is internally validated based on international experts' reviews. Rogers' process for diffusion of innovations is followed in order to introduce and adopt the GHOSHEH model based on a sample of 117 teachers and experts from different states in the Arab world, including Palestine, Jordan, Saudi Arabia, Oman, Kuwait, UAE, Iraq, and Yemen. Mixed methods research is used: qualitative data are collected from a descriptive case study, and quantitative data are collected from the responses of the participants to a questionnaire about adopting the GHOSHEH model. Results reveal that the model involves four main processes: The first is analysis of content and context. The second is implementing sequenced activities that promote reflection, problem solving, and collaboration. The third is a formative assessment followed by providing continuous feedback. The fourth is peer sharing of the created OERs. Moreover, results show that teachers and experts from different states in the Arab world overwhelmingly adopted the model, and there is evidence of the model's advantages, simplicity, compatibility, trialability, and observability.

Keywords: open educational resources (OERs); instructional design; models for creating innovations; GHOSHEH model; theory for diffusion of innovation (DOI)

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1. Introduction

One of the most important purposes of education is to build human capacities by preparing learners to cope with accelerating global changes. This can be managed by teachers who are responsible for helping learners to create their own innovations that benefit their societies and others [1]. In order to do so, teachers should consider the essence of sustainable development that focuses on preparing learners to be able to improve life's quality and preserve the world for all generations [2].

Sustainable development can be achieved by adopting open educational resources (OERs) that provide opportunities for learners to engage with others and innovate globally at no cost. OERs are defined as free learning, teaching, or research materials, that promote lifelong education; OERs are shared via a public domain to be used, reused, revised, remixed, or redistributed freely, in order to benefit and empower learners regardless of different barriers [3–5].

Researchers have revealed that using OERs has the potential to enhance teaching by developing teachers' professional competencies, including knowledge, skills, attitudes, and values [3,5,6], in addition to enhancing teachers' open practices and digital literacy [7]. However, others have found that some teachers were not aware of OERs, and had negative

attitudes towards them [8,9]. Thus, adoption of the OERs has been limited because teachers, who are considered pivotal actors in the adoption of OERs, were not engaged [9], and preferred to use traditional resources, such as textbooks, rather than OERs [8]. In order to engage teachers, it is necessary to provide them with clear insights about the sequence and different contexts of OER implementation in education and using appropriate technologies to teach any content [3,9,10]. This provision should be supported by what are called instructional design (ID) models. An ID model is a representation, order, or structure that translates theory into practice by simplifying complex events, thus providing visualization and explanation for an intended plan [11].

The impacts of OERs and the lack of an ID model that focuses on adopting or creating innovative OERs led the first researcher to develop a new model called the GHOSHEH model for creating innovative OERs. This model incorporates OERs with learner-centered strategies that enable learners to practice, reflect on their practice, solve problems, and create innovative OERs [12,13].

The GHOSHEH model is considered an innovation based on the definition of innovation as an idea, practice, or object that is perceived as new [14]. Thus, there is a need to first introduce this new model in order to have teachers adopt it. Adopting innovations requires following an appropriate theory for diffusion of innovation. One of the leading theories is Rogers' theory for diffusion of innovation (DOI). Rogers outlined that it is dangerous to consider all innovations as equivalent, because some innovations fail and others succeed [14]. Therefore, innovations, as with any new topic, have to be introduced and adopted before taking the responsibility of implementing them [15]. Rogers' theory includes a process that enables an examination of innovations from clients' perspectives. The current study includes details about the GHOSHEH model construction and validation, and aims to adopt the model based on Rogers' theory. In order to do, the study will answer three questions:

- What are the processes that are involved in the implementation of the GHOSHEH model for creating innovative OERs?
- What are the attributes of the GHOSHEH model regarding Rogers' process for diffusion of innovations?
- To what extent has the GHOSHEH model been adopted by experts and teachers based on Rogers' process for diffusion of innovations?

To answer the third question, the **following** null hypotheses will be tested:

- There are no significant differences at $\alpha \leq 0.05$ in the means of the responses of participants on the questionnaire for adopting the GHOSHEH model attributed to the participant's gender;
- There are no significant differences at $\alpha \leq 0.05$ in the means of the responses of participants on the questionnaire for adopting the GHOSHEH model attributed to the participant's state (e.g., Palestine, other states in the Arab world).

1.1. Literature Review

A literature review yielded the following themes:

1.1.1. OERs

OERs are defined by UNESCO as any teaching, learning, or research materials, located in the public domain, in any format and medium, under a copyright released under an open license, which permit free access, reuse, repurpose, adaptation, and redistribution by others [16]. OERs enable users to retain (make one's own copy after downloading an original OER), revise (edit, adapt, and modify the original OER), remix (create a new OER by revising or combining the original OER with other materials), reuse (use the original or newly remixed OER publicly), and redistribute (share the original OER or a new remixed OER with others) [3,17].

Analysis of the literature revealed the impacts of OER on both teachers' and learners' competencies [5,18,19]. On the one hand, OERs are expected to develop teachers' digital

literacies and open practices [7,10] and socio-cultural competencies [17]. On the other hand, OERs increase the opportunities for users to exchange educational experiences [4,5,7,18], and encourage improvement of users' technological skills [3], since most OERs depend on technology, which is considered the main driver of innovation. Furthermore, OERs facilitate scaling up of educational resources, and thus promote globalization and internationalization of education [3,20].

Despite the positive impacts of OERs on teachers' and learners' competencies, some studies revealed that teachers in some schools have negative attitudes towards using OERs, such as those in Kenya's primary and secondary schools [8] and at universities such as the Dutch University of Applied Sciences [9], due to poor infrastructure, lack of access to devices for both teachers and students, lack of basic technological skills among teachers, and absence of administrative support and appropriate training programs to create awareness about the existence and benefits of OERs [8].

Negative attitudes of teachers could also be related to the claim that OERs may decrease innovation opportunities for individuals, due to the ease of copying others' work, and plagiarism or other dishonest activities [17,18]. Nevertheless, if people are educated about digital ethics, they will preserve people's intellectual rights [18]. Therefore, the responsibility of teachers has increased due to the intention of education to instill ethical values in students besides developing cognitive abilities and creativity [17]. This has increased the teachers' need to use guides that assist them to prepare learners for the modern world. These guides include ID models.

ID models consist of representations and structures that translate theory into practice by simplifying complex events and providing visualization and explanation of an intended plan. Some ID models represent the steps that are recommended to implement a design process, which simplifies practice. However, these models require some interpretation in order to provide details for specific applications. Richey [11] classified ID models into two types: The first is called a conceptual model, and it identifies and shows the interrelationships of variables that impact a design process. The second type is called a procedural model, and it addresses the selection and ordering of learning activities, such as Gagne's Events of Instruction model. This study focused on a procedural ID model that specializes in creating innovations.

1.1.2. Models for Creating Innovations

A model for creating innovation is defined as an ID model that includes a systematic teaching and learning plan to provide guidelines for teachers to organize teaching and learning processes based on principles of creative problem-solving, to promote the creation of educational innovation [1]. One of these models was developed by Seechaliao in 2018, based on the principles of creative problem-solving and social media in real-life situations [1]. Implementation of the resulting model revealed that it could effectively promote the creation of educational innovation for pre-service teachers. However, social media that is included in the model should be updated continuously in order to select that which is most appropriate for learning activities, students' learning styles, and their behaviors [1].

Another instructional model for creation innovation was published in 2018. The model, called the 'C2I model', was designed by Jirasatjanukul and Jeerungsuwan (2018) and was based on both connectivism and constructivism theories for creating innovations in real world experiences. Connectivism theory emphasizes digital eras and the learner's abilities for communication and cooperation, with a focus that learning takes place both inside and outside the learner—it is not just an internal activity [21,22]. Recently, the Internet has allowed for the connection of a learner to the outside world by enabling him to use the needed resources to construct his own knowledge and manage relationships with experts all over the world. Constructivism explains learning by construction of new knowledge in real-life situations. The design of the model depends on connectivism theory to provide a real-world problem, and on constructivism theory to provide opportunities for learners

to construct new knowledge based on practice and communication. Moreover, the C2I model includes another component, which is the innovation of learning products in the real world. Teaching and learning activities of the C2I model are based on the AAA model. AAA is an abbreviation for an ID model which consists of three main processes: analysis, activities, and assessment. The analysis process centers on the learner, the learner's needs, content, and context. As for the activities process, it consists of what the facilitator will do to reach objectives, and this includes teaching and learning strategies. Finally, the process of assessments depends on oral testing, practice, training, tests, and authentic assessment [21].

A comparison of the Seechaliao model and C2I reveals that both designs focus on creative problem-solving and social media to address real situations. However, the C2I model provides opportunities for learners to connect to the digital world and includes clear processes that could develop learners' innovation skills.

1.1.3. The GHOSHEH Model for Creating Innovative OERs

The impacts of OERs and the gap that exists in having a model that focuses on creating innovative OERs or adopting them, led the first researcher to construct the GHOSHEH model for creating innovative OERs. The model was constructed based on the processes of the AAA model and the main principles of the C2I model, including creative problem-solving and connection to the digital world, as shown in Figure 1.

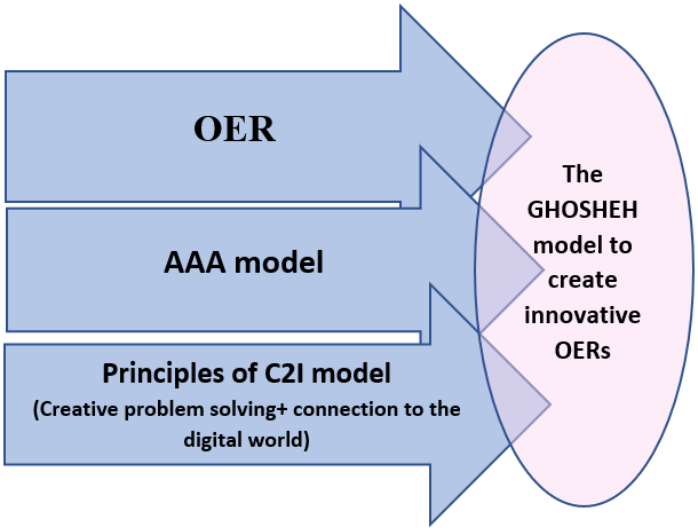

Figure 1. The principles on which the GHOSHEH model is based.

Figure 1 reveals that the model is mainly based on OERs, creative problem solving, and the AAA model. Therefore, it comprises the three main processes of AAA, in addition to a fourth process that focuses on peer sharing of OERs, as follows:

- Analysis: the base of the model includes analysis of content, learners' needs, resources, contexts, and time, in addition to educational objectives and related OERs;
- Activities: The model's activities are organized hierarchically to assist learners in using OERs to solve a problem that leads to the creation of other innovative OERs. In addition, the model's activities encourage learners to share their innovative OERs both locally and globally;
- Assessment: the model focuses on a formative assessment followed by feedback;
- Peer sharing: A new process called peer sharing was added to this model. This process requires sharing the created OER with peers all over the world. Peers can provide feedback and repurpose the resulting OER to create another OER based on the first one.

Furthermore, the GHOSHEH model was developed after analyzing Palestinian teachers' needs to benefit from OERs and to have a guide for adopting OERs and assisting learners to create innovative OERs. The researcher depended on literature, in addition to

her more than 11 years' experience in the domain of ID. The first version of the model was constructed in 2020 [12,13]. After that, the model was validated and developed further based on the results of internal validation.

1.1.4. Validation of the GHOSHEH Model for Creating Innovative OERs

ID model validation is either internal or external. The role of internal validation is to confirm the components and processes of a proposed model. This type of validation could be considered formative evaluation. Internal validation of ID models could be tested by a process called expert review, in which experts critique the proposed model in terms of its structure, components, and use. Moreover, internal validity can be tested using another approach called usability documentation, which involves systematic documentation of model implementation procedures, including the time, resources, and challenges that can be described within a case study. External validation focuses on the impact of the proposed model's products and is mostly tested by field evaluation during the implementation process [11]. The validation of the GHOSHEH model was conducted according to the processes in Figure 2.

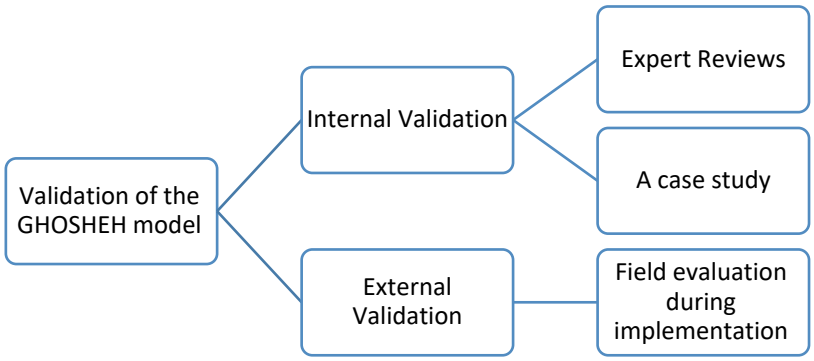

Figure 2. The processes of validation for the GHOSHEH model.

As shown in Figure 2, the internal validation of the initial version of the GHOSHEH model focused on a case study that will be described later. Moreover, it focused on expert reviews that were done in order to verify the components and processes proposed in the GHOSHEH model. Expert reviews were accomplished by having two panels of international experts review the model: the first panel consisted of six Palestinians, and the second had ten international experts from the United States, China, Spain, India, Sweden, Jordan, Algeria, and Egypt. All the experts were selected due to their specific backgrounds and specialty in open education, ID, OERs, and teacher training. Eight experts have an academic background as educators in these international universities: Delaware, Suqian, Columbia Quindío, UNIR, Wawasan Open University, Al-Aqsa University, Amman Arab University, and Nour Bachir University Centre. Two experts are independent educational consultants who have experience in the Palestinian context, and the other four experts are trainers of teachers who work in the National Institute for Educational Training (NIET) in Palestine. All the participants are researchers: six of them conduct research in the area of ID, five in the area of open education and OERs, and the others in the area of teaching and learning in general. In addition to expert reviews, this study includes a case study that provides systematic documentation of model implementation, which ensures accurate results of expert reviews. The developed model is shown in Figure 3.

Figure 3 shows that the base of the GHOSHEH model includes analysis of content, learners' needs, context, and time. In addition, it focuses on determination of educational objectives and selecting appropriate OERs. This process is conducted before designing activities to be considered in the design. Activities are arranged hierarchically, as each activity is a requirement for the next one. Assessment is formative, continuous in line with activities, and followed by feedback. After sharing the innovative OERs, the OERs can be

retained, revised, remixed, reused, or redistributed by learners and teachers all over the world, which maintains sustainability.

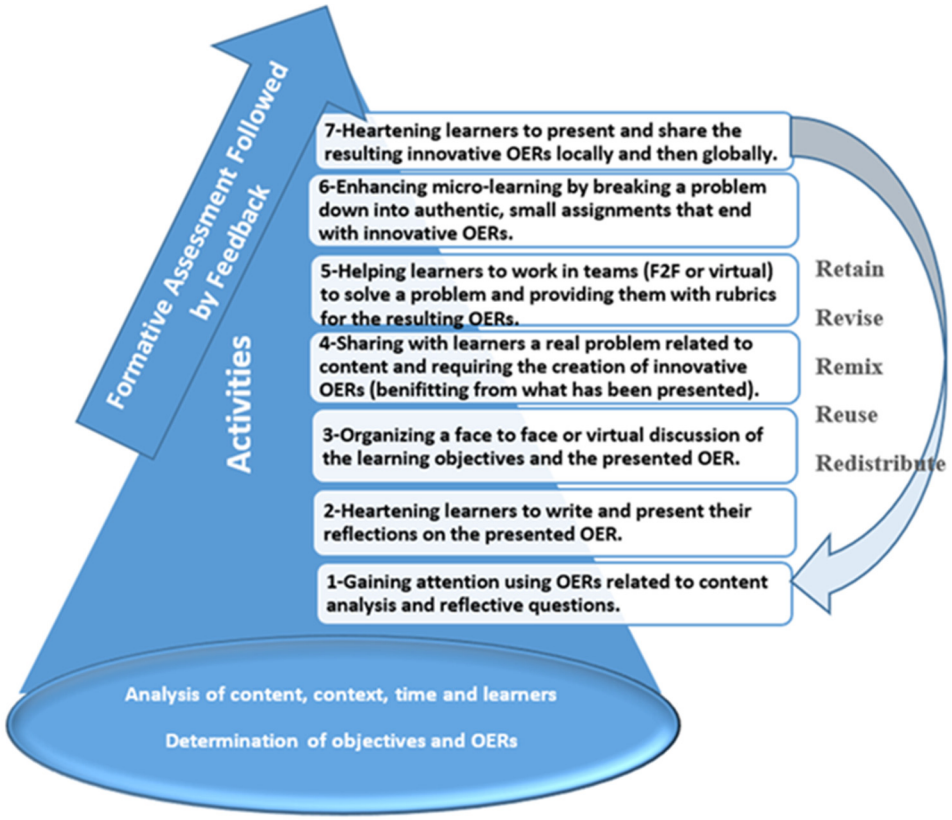

Figure 3. The sequence of steps of the GHOSHEH model for creating innovative OERs.

The impact of the GHOSHEH model is based upon the validity of the theories that it is based on. A review of the literature on these theories was conducted in order to determine the elements that might be incorporated into the proposed model. The GHOSHEH model consists of the following theories.

First is Kolb's experiential learning theory. This theory emphasizes the central role of experience in combination with perception, cognition, and behavior, in the learning process. Many educational institutions offer experiential education programs, such as classroom experiential learning exercises, to add direct experience components to traditional academic studies. Kolb's theory is widely considered a useful framework for learning-centered educational innovation, including ID and life-long learning [23,24]. However, designing experiential learning activities requires an instructor who can assist in performing these activities using instructional models that enable learners to practice what they learn on real-life problems [25].

Second is the sociocultural theory [26], which is combined with the experiential theory. The sociocultural theory focuses on the role of social interactions in learning, and is executed by dividing students into groups to cooperate, support each other, discuss reflections, and share experiences. This enables learners to do many tasks in a short time, while the teachers scaffold the learners through continuous assessment and constructive feedback. Third is the cognitive constructive theory, which is reflected by challenging learners with a problem that requires bridging previous experiences to new ones. The included problem is expected to cause the disequilibrium state described by Piaget [27].

Fourth is Gagne's theory. The GHOSHEH model is composed of small tasks arranged hierarchically according to complexity, the same way tasks are arranged in Gagne's events—especially in the first levels of the model. However, the model aligns tasks according to the context of learners who aim to reuse, reproduce, and redistribute OERs in order to

solve real-life local or global problems. This is in addition to the opportunities—for practice, reflection, working in groups, and communicating with peers all over the world—that are gained from the previous three theories.

The fifth is connectivism. It focuses on both the internal and external aspects of learning that take place among learners. The combination of the five theories is presented in Figure 4.

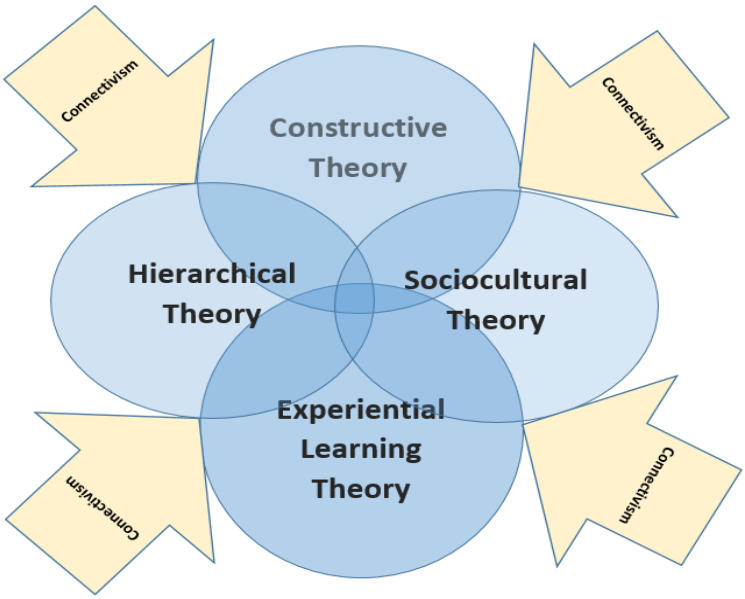

Figure 4. Integrations of theories that form the GHOSHEH model.

Figure 4 shows how the model is rooted in the last five theories—four of which focus on learning as an internal process. However, the fifth one—connectivism—permeates all theories because it focuses on both the internal and external aspects of learning.

As mentioned before, the GHOSHEH model is also based on creative problem-solving. However, it integrates this strategy with the cooperative learning strategies. Moreover, it focuses on practice and reflection, authentic assessment, and learning differentiation, as shown in Figure 5.

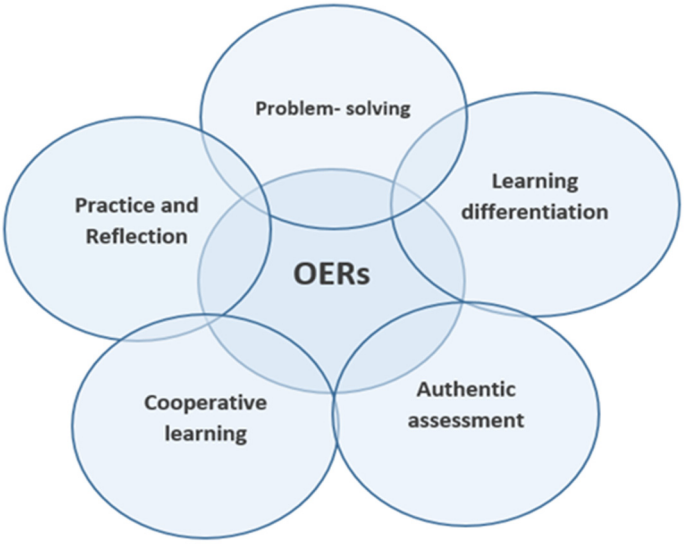

Figure 5. Strategies and approaches of the GHOSHEH ID model.

Figure 5 reveals that the GHOSHEH model benefits from the potential integration of OERs, cooperative learning, and problem-solving. This integration was mentioned by Thakur and his colleague, who reviewed 52 articles and concluded that PBL is an instructional approach that allows learners to practice cooperative learning by working in small collaborative groups, on realistic and open-ended problems. This empowers learners to develop their creative thinking and reasoning, decision-making, scientific skills, communication, self-regulated learning, teamwork, leadership, and lifelong learning skills [28]. Moreover, Kavrayici pointed out the positive and significant relationships among problem-solving, communication skills, and classroom management competency of teachers [29].

Learning differentiation is a part of cooperative learning that is supported by authentic assessment of the outcomes. Moreover, this is also represented by providing chances for learners to cooperate in developing rubrics used to evaluate the students' performances. In addition, the model focuses on reflection in the learning process from the beginning, as it organizes the teaching process to start from describing an OER, then gradually asks each student to reflect and write his reflection in the presented OER. This reflection contributes to deepening learners' knowledge, identifying strengths in what they have learned, and pointing out what needs to be developed, thus leading to self-evaluation and personalization of learning [30].

1.1.5. Rogers' Process for Diffusion of Innovations (DOI)

As shown in Figure 2, the external validation of the GHOSHEH model depends on the implementation and evaluation of the model. Before implementing the model, there is a need to follow a process for introducing it. Rogers' process for diffusion of innovation was followed. This process was selected after considering the GHOSHEH model as an innovation according to Rogers' definition, in which he referred to an innovation as any new idea, resource, tool, process, or model [14].

Rogers' process includes providing users with sufficient knowledge about an innovation, forming attitudes about the innovation, making a decision to adopt or reject it, and implementing an idea to confirm this decision [15]. The process includes introducing and adopting innovative ID models. Rogers' process relies on these five stages [31]:

- Knowledge: this stage includes creating an awareness of the innovative model by providing descriptions that enable adopters to answer the question: Why should we use this model?;
- Persuasion: this stage encourages the decision to adopt the innovative model and can be facilitated when the instructional designer provides knowledge about the model rationale and fulfilment of real needs;
- Decision: This stage leads to a decision by adopters who will either adopt or reject the innovative model. Instructional designers can facilitate this phase by providing opportunities for adopters to try out the model before committing to it;
- Use: This stage includes actual usage of the new model after a period of continuous education and professional development associated with the model's adoption. An instructional designer can support adopters' use of the model by providing instruction and showing adopters how to use the ID model's features;
- Confirmation: This stage occurs because of adopters' evaluations of their decision to implement the innovative model and their satisfaction with the results. Therefore, instructional designers should assist adopters to understand how to integrate the model into their professional practices, and support them by providing appropriate training that decreases challenges and fixes problems of experiencing the model [14,32].

Besides the previous stages, Rogers identified the following five attributes of successful models [14]:

- Relative Advantage: the advantages of the innovative model should be clear to adopters and have a value that exceeds that of the current models they use;

- Compatibility: The alignment of an innovative model to adopters' beliefs, interests, concerns, needs, and internal conditions related to social, cultural, ideological, and pedagogical aspects. To ensure a high compatibility, the innovation must meet with the clients' needs [31];
- Complexity: the difficulty of using an innovative model makes it complex and can negatively impact adopters' desires to use the model;
- Trialability: the ability of an innovative model to be tested on a limited basis;
- Observability: This is related to the visibility of an innovative model's results. Adopters should observe the outcomes and outputs of an ID to adopt it.

Rogers' process for DOI requires implementation of innovations before committing to them; this implementation allows users to practice using the new model and to reflect and develop it according to feedback from real learners and teachers. Without implementing the model, educators' work would be wasted [32]. As an innovation in education, the GHOSHEH model should follow Rogers' process. Adopting the GHOSHEH model includes adopting OERs in teaching. Therefore, it will provide solutions for any participants reluctant to fully create, adopt, or use OERs due to the complexity and the lack of trialability of OERs [33], and the challenges related to time consumption, lack of training, support, awards, and funds to create OERs [34,35].

2. Materials and Methods

Mixed methods of quantitative and qualitative approaches were used in this study by incorporating quantitative statistical results with qualitative ones. This design is used to provide a clear understanding of findings [36].

2.1. Design of the Study

The study is based on a convergent parallel design, which required collecting quantitative and qualitative data concurrently, analyzing them separately, and combining two databases for merging results during interpretation. The design is shown in Figure 6.

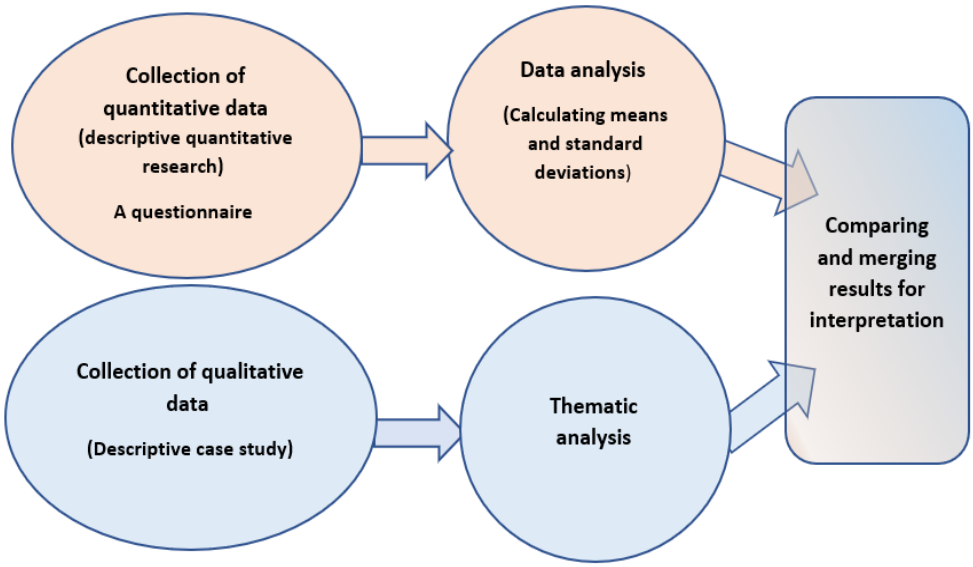

Figure 6. The design of the study.

Figure 6 describes the convergent parallel design of the study. Moreover, the same figure shows that the quantitative approach of this study depended on descriptive quantitative research, and the qualitative approach depended on a descriptive case study.

The procedure of adopting the GHOSHEH ID model relied on the five stages of Rogers' model: knowledge, persuasion, decision, use, and confirmation. Instruments were used within these stages.

The researcher engaged in collecting data, presenting the model, and conducting workshops on how to apply the model and distribute questionnaires. Moreover, the researcher interviewed experts and teachers and facilitated some activities in the training program.

2.2. Study Sample

The study included an intentional and purposive sample from different states of Palestine, Jordan, Saudi Arabia, Oman, Kuwait, UAE, Iraq, and Yemen. The total number of the participants in the sample was 117 teachers and other experts who work in public and private educational institutes. This sample was composed of 87 teachers who enrolled in a training program in NIET in Palestine or in a workshop about the GHOSHEH model, and 30 educational experts who conducted training about the model or participated in a conference where the model was presented by the researcher.

2.3. Research Instruments: Data Was Collected Using the following Instruments

- A questionnaire for evaluating the model based on teachers' and experts' perceptions. This questionnaire was developed based on Rogers' attributes for successful models: relative advantage, compatibility, complexity, trialability, and observability. The total number of the questionnaire's items was 30, based on the 5-point Likert scale;
- A descriptive case study of a teacher who applied the model in class to teach math. Data of the case study were collected from deep interviews of the teacher, in addition to an interview with the trainer of the teacher, and the observation of the teacher's work by one of the researchers.

2.4. Trustworthiness

To enhance the case study's trustworthiness, the researchers provided enough details to assess the credibility of the work [37,38]. The research depended on the triangulation of data sources (data were collected from interviews with the teachers, interviews with the trainers, and observations of the teachers' work) to explore the results of implementing the GHOSHEH model from multiple perspectives. A comparison of the data was done by the researchers in order to confirm findings as described in [37]. To promote consistency of the findings and dependability of the data, a process of double coding was implemented. Data were coded for the first time in May 2022, and after two months the researchers returned to the data, coded them again, and compared the results.

2.5. Reliability and Validity

The content validity of the questionnaire was examined by giving it to six experts in education. Four of these experts hold PhDs and have experience in education, and two have deep experience in teacher development and OERs. The questionnaire was developed by the researcher based on experts' recommendations. The alpha Cronbach scale was calculated for the questionnaire. It was 0.951, which indicates an extremely high reliability.

2.6. Procedures of the Study

The researchers planned to follow Rogers' process for adopting the GHOSHEH model, which was developed according to internal validation based on expert reviews. This process required implementation of the model, which would also serve as external validity testing by field evaluation. Therefore, workshops for teachers were conducted on the GHOSHEH model, to provide opportunities for implementing the model (to follow the stages of Rogers' process). After that, teachers were provided with the questionnaire (which was developed by the researchers and examined to test its validity), to evaluate the model. The researchers then selected a case study of a math teacher who was to implement the model by using an abstract theory to solve real problems. Data were collected from deep interviews with the selected teacher and the expert who trained the teacher to implement the model, in addition to observing the outcomes and outputs of implementation by the first researcher. The GHOSHEH model was then presented in an international conference

for experts from different states in the Arab world, and participants in the conference who agreed to take part were provided with the questionnaire to evaluate the model. Finally, data were analyzed to find the results.

3. Results

3.1. To Answer the First Question, What Are the Processes Involved in the Implementation of the GHOSHEH Model for Creating Innovative OERs?

A descriptive case study on implementing the model was conducted. This case study also served to ensure internal validation of the model. The case study is described below.

3.1.1. Background

This case study focused on a female teacher called (F), who teaches math to juniors (in the eighth grade). Teacher (F) has 17 years' professional experience in teaching math. She works in a public school in Salfit (a town in Palestine). She was enrolled in an educational training program conducted in 2021/2022, where she was trained to employ the GHOSHEH model for creating innovative OERs. During the training period, Teacher (F) implemented the model to teach 30 junior female students math, with a focus on dimensions and the Pythagorean theorem. The case study describes the teacher's implementation of the GHOSHEH model along with a focus on her perspective and her trainer's perspective. The trainer of the teacher is a female expert called (S), who trained Teacher (F) with a group of other math teachers, on how to implement the GHOSHEH model. Trainer (S) read about the GHOSHEH model alone, understood it well, and used training material prepared by the researcher to train teachers on it. Trainer (S) holds a master's degree in curricula and teaching methods, and has more than 26 years of experience in education and teacher training. The trainer delivered online training on the GHOSHEH model for teachers, then followed up with them during the process of model implementation in the class. Trainer (S) selected Teacher (F) after observing the implementation of the GHOSHEH model by Teacher (F) in teaching juniors how to apply math, specifically how to use dimensions and the Pythagorean theorem in designing ramps to facilitate a special needs student's school access. The problem was real—there was a special needs student called (H) who cannot walk and must use a wheelchair. Student (H) would enroll in the school the next year. However, the school was not equipped for wheelchairs—there were no ramps for moving to the upper parts of the school that include the bathrooms and other facilities. Teacher (F) knew that the student would be enrolling the following year, and she realized that Student (H) would face problems because the school environment was not fully accessible. At the same time, there is no other school in the town that is suitable for the student. After this analysis, the problem was summarized by this question: how can the students in grade 8 help their new peer to move easily to the primary facilities in the school?

Teacher (F) started searching for an OER related to the problem. She selected an OER about designing ramps to facilitate getting around in a wheelchair; then she followed the GHOSHEH model processes in order to stimulate students to solve their peer's problem. The teacher worked to scaffold students to design ramps for their friend, and to create OERs about the process of designing ramps for wheelchairs and about the solution to the problem, then share the OERs in order to help thousands of students similar to Student (H), all over the world.

3.1.2. The Case of Implementing the GHOSHEH Model

A thematic analysis of the observations and interviews of the teacher and trainer revealed that the teacher followed these processes to implement the GHOSHEH model:

- Analysis of content and context: The teacher analyzed the math content and selected the Pythagorean theorem. Then she analyzed context and learners' needs to find a problem related to the students. She discovered that Student (H), who was handicapped and in a wheelchair, would enroll in her school the following year, but the school was not prepared to facilitate the student's movement. Teacher (F) knew that

her students were willing to assist their peer. Therefore, she searched for an OER related to both the problem and to the Pythagorean theorem. Teacher (F) used higher order thinking to connect math to this problem. She reported, "I used to teach abstract mathematics for the eighth grade, thus, when I decided to apply the model, I searched for a resource linking the Pythagorean theorem with real life. I found a video about a young man who designed a ramp for his mother because she has a disability in her feet, so his mother moved by this mobile ramp. At the same time, I knew that a student using a wheelchair would arrive at our school next year, and that the school should be appropriate for her. I asked myself: How could we facilitate her movement and transfer to the basic facilities without climbing stairs?";

- Implementing activities of the GHOSHEH model: Teacher (F) implemented the model according to its sequenced activities. She presented a relevant OER, asked some reflective questions, discussed the questions with students, discussed objectives, shared a problem related to content and to the OER, and followed other steps to create and share OERs. She described her implementation with these words: "Actually, the video encouraged the students to think about the problem, while the reflective questions that I asked helped to connect the solutions of the problem with the math content. I told them that next year a student named '(H)' will come to our school and she is unable to walk and uses a wheelchair. How can we help her to move around the school? How can we use math to do that? We went down to the school garden and determined the location of the classroom of Student (H) in the next year and the basic facilities. Students suggested the locations of the ramps. They began measuring the dimensions, using mathematics, calculating the slope and its relationship to the horizontal and vertical dimensions, and employing the Pythagorean theorem. After that, I classified them in groups and presented some small tasks included creating brochures about the project and marketing them to obtain community support, measuring the dimensions of the slopes, arranging with the carpenter and the blacksmith, and checking that the slopes match the calculations that students did";
- Formative assessment: The teacher provided rubrics for the problem and tried to assist students to evaluate their performances according to the rubrics. The teacher confirmed that the model provided her with opportunities to know her students and assess their performances, in order to align her teaching to their learning styles, varying intelligence, and needs. She said, "I assisted the students by giving samples of brochures (as OERs), distributing the brochures to students in the school and the faculty, communicating with the carpenter and blacksmith, following up on the calculations, and providing them with evaluation criteria and indicators. The students were waiting to solve the problem moment by moment, and from the first moment they were asking me, 'When will we implement the idea? When are we going to do this step?' As a teacher, I started to know my students well, to focus on their learning styles, intelligences, and needs. Actually, I began to look at the details. This model transformed math from an abstract subject to a real-life skill and involved all students in the tasks that increased the students and teacher's affiliation with the school";
- Peer sharing: Teacher (F) encouraged the students to share the created OER, and they did. She said, "After that, students produced another video about the process of using math in solving the problem of disabled students. They shared the new OER to benefit others". However, she did not mention anything about following the OER to know if people benefited from it, repurposed it, or if there was any feedback on the shared OER, so that the OER could be developed accordingly.

3.2. The Same Case Study Was Used to Answer the Second Question

What are the attributes of the GHOSHEH model regarding Rogers' process for diffusion of innovations? A thematic analysis pointed to the following attributes of the GHOSHEH model:

3.2.1. Relative Advantages of the GHOSHEH Model

Both Trainer (S) and Teacher (F) focused on the significance of the model in serving the local community, the country, and even the world. The trainer explained the opportunities that the model provides for learners to apply knowledge in solving actual local and global problems. Trainer (S) considered the model important for maintaining sustainability and enhancing learners' life skills and teachers' planning skills. Trainer (S) said, "I was looking for a model that would not make the student's learning end as soon as he left the school. The GHOSHEH model which includes OERs will impact students' learning and sustain this learning outside the school. Moreover, it benefits the community and homeland. Besides, the sequenced steps of the model facilitated application, speeded up the achievement of educational goals, activated the role of learners, and encouraged the teacher to develop herself technologically. Moreover, the model focuses on life skills and can be applied face to face or online". Teacher (F) also asserted the importance of the model's ability to use one OER to innovate another OER, so as to help sustain learning and enable the growth of knowledge. She described this by saying, "We benefited from the idea of the video as an OER; it enabled us to use math for serving Student (H). After that, students produced another video about the process of using math in solving the problems of disabled students. They shared the new OER to benefit others. I was asking myself, 'Why should one keep his work for himself! Let us share resources to benefit others and accumulate knowledge. Let us share the ideas as far as possible.'"

The GHOSHEH model contributed to achieving a deep understanding of abstract concepts and connecting them to reality. In addition, the model enhanced students' life skills and citizenship, and encouraged communication with peers, parents, and the local community. Teacher (F) said: "The students applied the Pythagorean theorem, measurement, slope, and infinite fractions in different calculations included in the process of designing the ramps. Some of the calculations did not match reality because of the presence of infinite fractions, which affected the length of the main ramps. The calculations were not as simple as those in the book, and we dealt with large numbers and infinite fractions, and this is what highlighted the importance of approximation, and how to link mathematics to reality. Moreover, the model increased communication with parents and some professionals such as the carpenter and blacksmith who were contacted to help produce the ramps. As a result, we were able to make four ramps in the school that would enable Student (H) to move around the basic facilities".

3.2.2. Complexity and Flexibility of the Model

Trainer (S) considered the model to be clear and flexible since she was able to understand it alone, without any training, and because she easily implemented the model and conducted online training for teachers. The trainer said, "Actually, I did not expect that I would be able to train teachers on the model online. However, I was able to do so easily because of the flexibility of the model. In addition, the flexibility lies in the presence of many options for open educational resources".

Teacher (F) also considered the model to be flexible due to its appropriateness for teaching any subject and any student. The model's consideration of the students' intelligence and their learning styles increased its flexibility. The teacher expressed this by saying, "Different small tasks assigned to the students made the model flexible. These tasks were appropriate for all students from the lowest to the highest level of achievement. Tasks can be applied from the first grade to the Tawjihi (grade 12). For example, I applied it with students in the sixth grade and the eighth grade. Moreover, we were flexible in selecting the open resource, as well as in solving the problems. The model did not dedicate any of its steps to a specific thing or specific content or student".

3.2.3. Compatibility

The implementation of the model required the teacher to analyze context and learners' needs so that she could adapt a problem and tasks to the learners' needs, contexts, and

cultures. Furthermore, the model increased communication between the teacher and learners. Therefore, the teacher was able to align tasks to the specific internal conditions of learners. The teacher said: "Communication with students increased through assisting students to solve the problem and do the tasks. For example, we faced a challenge when the problem required a group of students to distribute brochures outside the school to gain support for the idea as some parents objected and refused to let their daughters do that outside. Accordingly, I modified the task to be done inside the school".

The model is also aligned to teachers' professional needs and attitudes. The model provided opportunities for Teacher (F) to engage in planning and applying learner-centered approach strategies. The teacher benefited from this experience and started to focus on students and consider the internal conditions of the learners. The teacher described this by saying, "I used to teach the Pythagorean theorem for 17 years as an abstract theory. However, this model changed my view of teaching and learners. As a result, I enhanced my profession, and this was reflected on the level of the students". This is in addition to the change in the teacher's role. Instead of explaining the math abstracts, the teacher was searching to select the appropriate open resource, asking reflective questions, and presenting the problem. The teacher also started to provide continuous assessment and feedback, support her students, assist them with working in groups and serving the community, and create and share innovative OERs. As a result, the teacher's implementation of these processes increased the model's impact on her competencies.

3.2.4. Observability

The outputs of implementing the model were observable to the teacher. The teacher was able to consider the impact of the model on students' knowledge and skills. This was expressed by both the trainer and the teacher. For instance, Teacher (F) said, "I felt how mathematics was transformed from a theoretical subject into a practical one, and I regret the 17 years in which I did not know how to teach. It was the first time we produced an educational video that linked the Pythagorean theorem with ramps and special needs, and shared the video with others ... Actually, students were working for the happiness of others—specifically, for student (H). Also, their affiliation to their school increased". The teacher also indicated that one measurable and clear result of implementing the model was an enhancement of the school's environment. She expressed this enhancement by saying, "We did something to prepare the school's environment for people with special needs, and the students' parents and inclusive education specialists participated in preparing the school for the student before she moved to it".

3.2.5. Trialability

This case study provides evidence that the GHOSHEH model can be implemented. The study has also afforded an observation of the results of implementation. However, there were some challenges in using the model. Teacher (F) summarized the challenges as a need for extra time, and a difficulty in matching the students' schedules to the schedules of professionals. In addition, students were challenged by the need for support and funds to solve the problem. This challenge decreased when they sought support from parents and the local community. This was expressed by the teacher when she said, "Implementing the model is not difficult because I have experience in the content, and with some research and participation of students, it was not difficult to implement. The difficulty lies in matching our time at school to the times of the carpenter and the blacksmith and providing materials to solve the problem such as wood and iron. But when students told their parents, the participation of parents and their support reduced all challenges". Moreover, both the trainer and teacher agreed with the demand to develop oneself technologically and to learn about how to license resources produced by students using open licenses.

3.3. Answering the Third Question

To what extent is the GHOSHEH model adopted by experts and teachers based on Rogers' process for diffusion of innovations? Data were retrieved from the questionnaire about adopting the GHOSHEH model and were analyzed using the SPSS statistical program by calculating means and standard deviations within and between questionnaire domains. Data showed that the total mean of the questionnaire items was 4.06 and the standard deviation was 0.402, which indicates a high degree of agreement with the attributes of the GHOSHEH model as shown in Table 1.

Table 1. Means and standard deviations of teachers' responses to the domains of the GHOSHEH model adoption questionnaire.

Rank	Domain	Mean	Standard Deviation	Degree of Agreement
1	Relative Advantage	4.23	0.47	Very high
2	Trialability	4.06	0.49	high
3	Compatibility	4.04	0.46	high
4	Simplicity	4.02	0.53	high
5	Observability	3.99	0.43	high

Table 1 reveals that participants very highly agreed on the attribute of the relative advantage of the GHOSHEH model and highly agreed on the other attributes that enable the GHOSHEH model's adoption according to Rogers' process.

An independent-samples t-test was conducted to compare the means of participants' responses regarding to the gender and state. Two hypotheses were tested. The first was that there are no significant differences at $\alpha \leq 0.05$ in the means of the responses of participants on the questionnaire for adopting the GHOSHEH model attributed to participant's gender, and it was tested using an independent-samples t-test. Results showed that there was no significant difference in the responses of males (M = 4.13, SD = 0.55) and females (M = 4.03, SD = 0.37) with t (112) = 1.12, $p = 0.27$, which enables us to accept the first hypothesis. Specifically, the result reveals that both males and females showed close high agreement on attributes of the GHOSHEH model that persuade them to adopt it.

The second hypothesis was that there are no significant differences at $\alpha \leq 0.05$ in the means of the responses of participants on the questionnaire for adopting the GHOSHEH model attributed to the participant's state (e.g., Palestine, other states in the Arab world). This was also tested using an independent-samples t-test to test the differences between Palestinian participants (as the first group), and the other participants from the Arab world states (as the second group). Results showed that there was no significant difference in the responses of Palestinian participants (M = 4.08, SD = 0.39) and other participants from the Arab world (M = 4.01, SD = 0.54), with t (114) = 0.67, $p = 0.52$, which enables us to accept the second hypothesis. Specifically, the result reveals that participants in different states of the Arab world showed close high agreement on attributes of the GHOSHEH model that encourage them to adopt it.

3.4. Summary

In brief, the case study of implementing the GHOSHEH model provided qualitative results that showed how the teacher who implemented the model followed four processes. The first is analysis of content, context, and learners' needs, and then determining the most appropriate OER. The second is implementation of the activities of the GHOSHEH model. The third is a formative assessment, and the final is peer sharing. The qualitative results also provide evidence on the attributes of the GHOSHEH model that enable it to be adopted successfully following Rogers' DOI. These attributes relate to the model's relative advantage, complexity, compatibility, observability, and trialability. Furthermore, the quantitative results provided evidence on the high agreement of participants (teachers

and experts) on the GHOSHEH model's attributes that Rogers proposed for successful models. The results of testing the hypothesis revealed that despite the participants' genders and states, they showed high agreement on the attributes of the GHOSHEH model that enable it to be adopted.

4. Discussion

The current study followed Rogers' process for DOI to provide perspectives about the future of the GHOSHEH model as an educational innovation for creating OERs. The study focused on teachers and educational experts as adopters of the instructional design models. Adopters were provided with sufficient knowledge about the GHOSHEH model, and with opportunities to implement it. Therefore, they were able to form attitudes about the model and decide to adopt it. The key findings describe the processes of implementing the model and provide evidence on the attributes of the GHOSHEH model that enable it to be adopted successfully. Moreover, findings highlight very high agreement of teachers and experts who participated in the study, on the relative advantages of the model, and high agreement on the other four attributes (complexity, compatibility, observability, and trialability). The agreement on these five attributes provides evidence to consider the GHOSHEH model as a successful innovation according to Rogers' DOI [14].

Quantitative findings of the questionnaire on adopting the GHOSHEH model that reveal a very high agreement among participants on the relative advantages of the GHOSHEH model, were interpreted by the qualitative findings from the case study. Findings from the case study confirm that adopters considered the model as significant in serving the community, homeland, and even the world, because it is focused on problem- based learning. The model provides opportunities for learners to solve or contribute to providing solutions for actual local and global problems, and this enables the growth of learning; enhances learners' life skills; develops teachers and learners' communication skills, higher order thinking, entrepreneurial, team-working, professional and life skills, and ability to work as a team and have mutual respect, as revealed by the study of Winarti and Putranta [38]. Moreover, the adopters found that the model provides opportunities for teachers to use higher order thinking when analyzing content and context, searching for appropriate OERs, and addressing a real-life problem. These results agree with the findings of Emre and Argün [39], whose study pointed out the positive impact of the instructional design based on problem-solving strategies and on enhancement of learners' performance in solving non-routine problems, which results in empowering learners and developing their creative thinking, reasoning, decision-making, scientific skills, communication, self-regulated learning skills, teamwork, leadership, and lifelong learning, which is supported by the study of Thakur, Dutt, and Chauhan [28]. The findings also agree with the results of Kavrayici's study [29], which revealed positive and significant relationships among problem-solving, communication skills, and classroom management competency of teachers.

Findings pointed to the contribution of the GHOSHEH model in developing teachers' competencies related to planning, thanks to sequenced steps that enable teachers to organize teaching and apply multiple learner-centered strategies. In addition, there was evidence that the model encourages developing teachers' open practices, because it enables teachers to focus on students' learning styles and multiple intelligences, and to assist students in creating OERs and sharing them locally and globally. These results agree with those of Wahbeh, Shwiki, and Sartawi's study [12], which revealed that the instructional design model that combines OERs with multiple learner-centered strategies contributes to the development of teachers' competencies including planning and implementation, and with the results of Van and Katz [10] and Paskevicius and Irvine [7], that revealed the contribution of OERs in developing teachers' open practices.

Another promising finding is that the GHOSHEH model promotes sustainability because it enables adopters to use one OER to innovate another related one, and then share it locally and globally for others to benefit from. Learners who receive the new OERs can retain, revise, remix, reuse, or redistribute them. This continuous process

helps to sustain learning and enables the growth of knowledge. This result agrees with studies [3,20], which showed that OERs facilitate scaling up of educational resources and thus promote globalization, internationalization, and sustainability of learning. All these findings illustrate extremely high agreement with the relative advantages of the GHOSHEH model. All this evidence can explain the high agreement on the relative advantages of the GHOSHEH model.

Furthermore, findings reveal that the adopters highly agree with the simplicity of the GHOSHEH model because of its organized steps and flexibility, which is achieved by the diversity and adjustability of OERs so that the teacher can select any OER related to content. In addition, there is flexibility in developing any actual problem related to content, context, and the presented OER. Moreover, the model enabled the creation of knowledge that can be shared with others as OERs to benefit learners all over the world. Simplicity means that the model is not complex and that increases the rate of adopting the model as mentioned in [14,31].

Additionally, findings show that adopters highly agree with the compatibility of the GHOSHEH model. This can be interpreted by considering the model's processes, which include analysis of context and learners' needs so that teachers can adapt the selected OER accordingly. The same is true for the problem and the tasks that can be fragmented and adapted to the learners' needs, contexts, and cultures. This is in addition to the contribution of the model in increasing communication between the teacher and learners, as mentioned before. Hence, the model promotes the teacher being closer to the students, and this increases her ability to select the most appropriate OER, problem, and reflective questions. The model also encourages the teacher to provide continuous assessment and feedback and to support and assist her students, by making the model adequate to students' needs, beliefs, interests, concerns, and other internal conditions related to social, cultural, ideological, and pedagogical aspects. These factors increased the model's compatibility as mentioned in [31], which concluded that an innovation that meets the clients' needs ensures a high compatibility, and consequently a high rate of adoption.

Moreover, findings provide evidence on the high agreement of adopters on both the trialability and observability of the GHOSHEH model. These perspectives came after the implementation of the model by teachers in real world contexts. Teachers who practiced the model observed its outputs and outcomes. As a result, teachers detected the recognizable benefits of implementing the model, which encouraged them to adopt the model in the future. These findings match with studies [14,31] which showed that innovations customized to suit the needs of adopters are readily adopted, and the obvious impacts of these innovations ensure diffusion.

It seems that adopters of the GHOSHEH model formed positive attitudes about it regardless of their gender and nationality, as shown from testing the hypotheses. These attitudes stimulated them to highly agree with the model's attributes, which persuaded them to adopt it. Consequently, they were encouraged to adopt the OERs that the model is based on. This result contrasts with findings of study [33], in which the participants were reluctant to fully create or adopt OERs for research and teaching, because of the complexity and the lack of trialability of OERs. Additionally, compatibility and observability were barriers to more adoption of OERs. This was explained by the lack of OERs' initiatives to overcome challenges. Therefore, the GHOSHEH model could be considered as an initiative to adopt and create OERs. These results also disagree with studies [34,35], which revealed that faculty were reluctant to use OERs because they are time consuming, and because of a lack of training and funds. It seems that the GHOSHEH model promoted intrinsic motivation for adopters rather than depending on external factors, due to its obvious benefits. However, the same challenges faced the teacher in the case study while implementing the model; the need for extra time, support, and funds to solve the problem and create OERs was a challenge that could decrease the adoption of the model in the future, as revealed in [34,35]. Moreover, these challenges, especially the need for extra time to teach the scheduled content, prevent the teachers and learners from following up on the

created OERs after sharing them, which reduces the benefits of the peer sharing. Thus, it is vital to provide support from the community and government to maintain the adoption of the GHOSHEH model as an initiative to adopt and create OERs, and to train teachers on implementing it and focusing on all the processes of the model.

Finally, it is worth referring to the promising attributes of the GHOSHEH model in the integration of several strategies and theories. Therefore, the strengths of these theories and strategies were combined while their challenges were minimized. This may explain the high adoption of the model that was reflected in the qualitative and quantitative results.

5. Conclusions

The current study aims to adopt a new model called the 'GHOSHEH model to create innovative OERs'. Rogers' process for DOI was followed to introduce the GHOSHEH model. The process included creation of awareness of the model through training programs, workshops, and conferences, followed by provision of opportunities to apply the model and make decisions about adopting it. Results showed that teachers and experts adopted the GHOSHEH model because they firmly agreed with Rogers' five attributes of innovative models: relative advantage, compatibility, complexity, trialability, and observability. The findings of this study also provided evidence that the model is valid internally and externally. On the one hand, the internal validation of the model was tested through both experts' reviews and the case study. On the other hand, the external validation was tested through field evaluation, which includes implementation of the model and focusing on the impact of its products. Expert reviews, a case study, and the positive impact of the model, afforded evidence that the GHOSHEH model is internally and externally valid. However, implementing this model faced some challenges related to it being time consuming, and a lack of motivations for teachers. Therefore, sustainability of adopting the model requires support from the government and the community. Considering all the results, the study has a few recommendations:

- The government should adopt the GHOSHEH model and introduce it to more teachers as an instructional design model for creating innovative OERs;
- Additional research should be conducted on the GHOSHEH model in order to explore the impact of the model on student performance and skills in various disciplines;
- Varied content based on the model should be designed and shared with teachers;
- Parents, communities, and the world should be made aware of the model and its impacts on the digital world;
- Support should be provided from the government and community to reduce challenges related to implementing the GHOSHEH model.

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