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MODELING THE EFFECTS OF SELF-LEARNING AND KNOWLEDGE SHARING IN OER COURSES AMONG COLLEGE STUDENTS

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ABSTRACT

The purpose of the study was to investigate whether Boisot's (1998) Social Learning Cycle was applicable in describing the effects of Self-Learning and Knowledge sharing on Transformation of the learner in an OER environment. Also investigated were whether there were significant differences by demographic factors for gender and year of study for Self-learning, Knowledge sharing and Transformation of the learner. This study employed the survey research method and a questionnaire comprising 37 Likert-scale items involving seven factors was adapted for this study and administered online. 144 respondents from colleges that actively employed OER courses in Palestine completed the survey. Data was analyzed using SmartPLS to verify the proposed model and ANOVA to compare learning engagement scores by the demographic factors. The findings showed that the hypothesized model derived from Boisot's Social Learning Cycle model fitted the data with Self-Learning having significant direct effects on Transformation at $\beta = 0.359$ and on Knowledge Sharing at $\beta = 0.665$. Also, Knowledge Sharing reported a significant direct effect on Transformation with $\beta = 0.472$, giving an indirect effect of Self-Learning on Transformation at $\beta = 0.314$. In addition the findings showed that Knowledge Sharing reported a partial mediation effect of 46.60% and the effect size of Self-Learning on Transformation was at $f^2 = .159$ or of medium effect size while the effect size for predictive relevance was large at $q^2 = .378$. The ANOVA findings reported that there was a significant difference in knowledge sharing by Year of Study with 4th year students reporting significantly higher scores than 1st year students, but there were no significant differences for other factors of the model and by Gender. These findings indicated that students in Palestine were actively involved in knowledge sharing when engaging in OER courses and the students benefitted more when they participated in knowledge sharing than by studying alone.

Keywords: *Self-Learning, Knowledge sharing, OER, Social Learning Cycle, Palestine*

1. INTRODUCTION

Over the last fifteen years, the use of the Internet in Palestine has accelerated and recorded a significant increase in the number of users. [1] reported that the usage of Internet was at 63.2 % penetration, while a decade earlier in 2010 it was only at 14.2% penetration. The percentage of persons 10 years and over who use the Internet is at 92.3% of the population, Palestinian Central Bureau of Statistics, 2022 and The Portland Trust, 2022 [2],[3] reported that The Palestinian ICT sector has registered impressive growths over the last few years. The well-educated and the young population are the main factors that have helped contribute to this growth and the number of people who work in the ICT sector that has increased from 2,200 in 2000 to 9,472 in 2022.

The use of internet facilities such social media and games by gender and age has also followed their growths on the web and in parallel to the growth and sophistication of smartphones and tablets as reported by Pew Research Center 2022 [4]. Like the rest of the world, in Palestine, the social, local, artistic, and parental-oriented websites have a higher ratio of female users, and professional and games-oriented sites have a higher ratio of male and younger users [5].

The past few years have seen increasingly rapid development and use of open educational resources (OER) in higher education institutions (HEIs) in developing countries. OECD 2007 [6] defined the OER as "digitized materials offered freely and openly for educators, students and self-learners to use and reuse for teaching, learning and

research". OER includes learning content, software tools to develop, use and distribute content, and implementation resources such as open licenses. These resources are believed to be able to widen access, reduce the costs, and improve the quality of education [7]. These resources are freely and openly available, widen access, digitized resources that can be adapted, modified, and re-used for teaching, learning, it's reduce the costs, and improve the quality of education [6].

UNESCO [8] also reported that in Palestine, where computer laboratories and LANs are less common, ICT support services are almost universal. This suggests that Palestine is prioritizing the effective use of ICT in education, despite challenges in terms of developing and maintaining the infrastructure components related to ICT equipment. Palestine also faces challenges in establishing infrastructure to support Computer-assisted instruction (CAI) and Internet-assisted instruction (IAI) across the entire educational system. Because of many constraints, the main provider of information and learning and teaching resources is the Internet with OER courses offered by top universities in the world such as MIT, Yale, etc., and by online entities such as Khan Academy and w3school being very popular. However, currently more boys than girls use OER because they need to get jobs and be as up to date and relevant as their peers in the free world.

2. BACKGROUND OF THE STUDY

Learning in OER is designed to be used on an individual basis and without the need to register or subscribe to the service. It involves the viewing of a series of video recordings of actual classroom lectures and reading of notes, sample documents, or books suggested in the course outline at the convenience of the learners. For those who are genuinely interested, they may also register for the courses through the distance learning mode, sit for examinations and gain recognized credits for the courses when successfully completed. Because the resources are online, some OER providers, such as ocw.um.edu.my that is based on MOODLE require the users to register and allow them to submit and share their comments using blogs and emails. The learning in OER thus involves individual learning for mastery of concept as well as collaborative learning.

The traditional approach to explain learning is to invoke systems, cognitive or constructivist paradigms. However, Habibian and Abbas [9] argued that for analyzing learning from OER and learning in general among adults at institutions of higher learning the more appropriate paradigm is the knowledge management paradigm. Knowledge management is the field of study involving information technology-enabled and expert supported processes of knowledge creation, production, and integration for the development of individual and organizational expertise. For learning on the web Cleveland [10] differentiate information from data by emphasizing that information is what an observer will extract from data as a function of his or her expectations or prior knowledge and that data and information are freely available on the web. The synthesis of the sets of data and information becomes knowledge or deep understanding of various phenomena that later leads to the acquisition of expertise and wisdom. The emphasis of learning is the successful transformation of data to information to knowledge and to wisdom.

Wiig 1994 [11] proposes a hierarchy of knowledge that defines knowledge into three levels, namely, a) Public knowledge which comprise of explicit or objective knowledge that is routinely shared knowledge in the public domains and taught in school; b) Shared expertise that is coded and shared exclusively between the team members or embedded in technology and is inaccessible to the public; and c) Personal knowledge which is tacit or subjective in nature that acquired by an individual through experience and reasoning and is least accessible to others. Nonaka & Takeuchi [12] extended these ideas and propose the SECI model describes the four conversion modes from tacit to tacit (Socialization), tacit to explicit (Externalization), explicit to explicit (Combination) and explicit to tacit knowledge (Internalization), under the guidance of an expert to drive the processes expertise development in individuals, teams or organizations. Socialization refers to the process of sharing tacit knowledge from one person to another. This must consist of creation of tacit knowledge, the key to understand others method of thinking and feeling is Sharing experiences. In a certain sense, sharing of tacit knowledge can occur if the self becomes part of a larger self. Externalization is the next step in the process, it involves translating tacit into explicit knowledge so that can be understood by others, and this level holds the key to create the knowledge. Externalization also can be considered as the result of hard cooperative work. Externalization is followed by Combination that the process of organizing and assembling an existing explicit concepts and knowledge into a systemic

knowledge. The final step is Internalization, which involves the conversion of newly created explicit knowledge into tacit knowledge of individuals. The embodiment of explicit knowledge can occur by doing, training and exercises.

Boisot & Cox 1999 [13] developed the Information-space (I-Space) knowledge management model that considers knowledge within an organization as either codified or uncodified and as diffused or undiffused, The I-Space model takes information structuring as being achieved through two cognitive activities, namely, codification and abstraction. This model incorporates a theoretical foundation of social learning and serves to link together content, information, and knowledge management in a very effective way [14]; [15]. Earlier, Boisot 1998 [16] proposed a Social Learning Cycle (*SLC)* to describe the dynamic flow of experience as the learner undergoes the processes of developing meaning and understanding through a series of phases from data to internalized knowledge as they are experienced by the learner *(Figure 1*).

The Social Learning Cycle involves six factors of engagement in learning, namely, scanning, problem solving, abstraction, diffusion, absorption and impacting that can be classified into three phases, namely:

- Self-learning or individual learning phase that involves activities employed by the learner to gain insights from the presentation. The contents are scanned, read and reviewed to identify the main ideas and codify them. The new ideas are tested, verified and applied in new contexts as students in put into problem solving exercises to gain new insights. The new insights allow the ideas to be abstracted into their schemas and be ready to be generalized and applied in other situations that will extend the range of their useful application.

- The acquisition of the new knowledge and capability allows the learner to share, diffuse, and spread the knowledge to others and help them to understand the ideas on a voluntary basis.

- The repeated sharing of the new and other knowledge by a learner increases the internalization of the newly created knowledge to the point that the knowledge becomes implicit or part of the learner's way of thinking or responding. When the knowledge becomes embedded in mental and physical practices, the learner would have been changed or transformed by the knowledge.

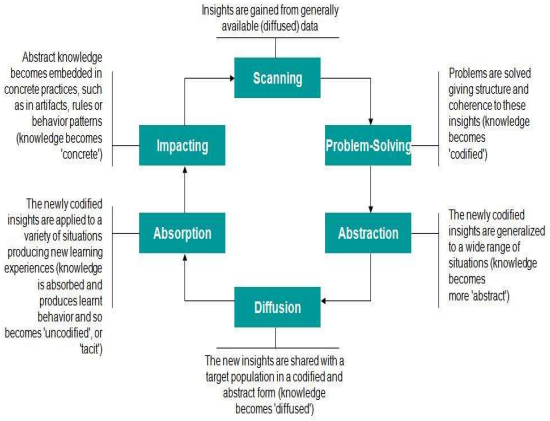

Figure 1: Social Learning Cycle (Boisot, 1998)

3. PROBLEM STATEMENT

Students in Palestine are very actively pursuing OER courses and lessons and other online courses because of the economic situation [17]. Smith 2023 [18] indicated that the students have a passion and love for learning through modern electronic media and so they are interacting with these programs, and they appreciate cooperative learning, as well as self-learning. OER courses are helping to address the global demand for education, especially in higher education, by expanding access to experts and materials such as audio, video, multimedia, hypermedia lessons, courses and programs [19]; [20] that are very much appreciated in Palestine. The online resources offer up-to-date and advanced knowledge and skills in all areas that are lacking even in top institution of higher learning there. These courses enhance the learning experiences and offer an efficient and personal way of promoting lifelong learning [21]. Online educational resources offered in youtube, for example, draw a large number of global viewers and have been shown to induce engagement, critical awareness and deep learning that collectively improved student performance [22]; [23]. However, the levels of engagement in learning within the courses and among the learners are not known. Following Boisot 1998 [16], acquiring knowledge at personal level is only the first phase of learning. It is after internalizing the knowledge that the learners acquire a commodity that can be shared, sold, traded or given away or hidden away. But according to Boisot, it is the sharing of that

knowledge that further deepens mastery and understanding of a given set of knowledge and skills.

The situation in Palestine is very competitive with jobs and other opportunities such as scholarships being very limited and difficult to get. In Singapore, where the environment is very competitive, students are deeply engaged in individual learning but are not engaged in knowledge sharing [24]. In Malaysia, however, everyone is sharing his/her knowledge, understanding, as well as notes and documents extensively [25]. Following Boisot 1998 [16] knowledge sharing which is the exchange of tacit and explicit knowledge that promotes the creation of new knowledge and ideas is a valuable stage in learning by which students learn from one another and develop intellectually and enhance academic their performance collectively. Students in Palestine are reported to employ OER resources to enrich their mastery of specific areas. However, no study has investigated how deeply they engage in learning at the individual level, whether they openly and generously share their knowledge and understanding, and whether that knowledge has a transforming effect on the sharer as predicted by Boisot 1998 [16]. As Boisot's model has not been empirically verified in the context of higher learning, this study also begins with the verification of this model. Boisot's Social Learning Cycle is simplified to create latent variables that consist of Self-Learning that comprised Scanning, Problem solving and Abstraction, Knowledge-Sharing that comprised Diffusion and Sharing, and Transformation that comprised in Absorption and Impacting. Following Boisot, it is hypothesized that Self-Learning will have significant direct effects on Knowledge sharing and Transformation of the learner and Knowledge sharing will have a significant direct effect on Transformation of the learner. The hypothesized model retains the six elements of the learning cycle but employs them as indicators for the latent constructs defined by the hypothesized model (*Figure 2*).

The hypothesized reduces the number of paths of the Social Learning Cycle to capture the outcomes based on the phases of learning rather than intensity of engagement by the individual processes of the learning cycle. The five existing paths of the learning cycle are reduced to two, namely, Self-Learning → Knowledge Sharing and Knowledge Sharing → Transformation while a new path of Self-Learning → Transformation is added to complete the model-based literature review. The original learning cycle suggests that learner transformation occurs through the completion of all the elements of the learning cycle and this is retained by presenting Knowledge Sharing is the mediator variable for the effects of Self-learning on Transformation. Additionally, the hypothesized model suggests that learner transformation may occur after completing the three elements of Self-learning.

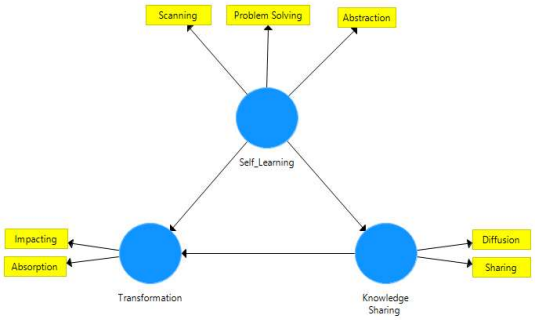

Figure 2: The hypothesized model derived from Boisot's (1998) Social Learning Cycle

The research focuses on modeling the impacts of self-learning and knowledge sharing in Open Educational Resources (OER) courses among college students. This choice is justified by the shifting educational paradigms towards OER, the growing importance of self-directed learning, the collaborative learning opportunities offered by OER, the pedagogical implications of understanding these dynamics, and the practical significance for educators and policymakers. Investigating these effects holds both academic and practical relevance for enhancing online education and improving student learning outcomes.

4. OBJECTIVES OF THE STUDY

The objectives of this study are:

1. To investigate whether the hypothesized model derived from Boisot's Social Learning Cycle model fits the data;
2. To investigate whether there are significant direct and indirect effects of Self-learning on Knowledge Sharing and Transformation;
3. To investigate the strength of mediation of Knowledge Sharing on Transformation, and
4. To investigate whether there are significant differences by gender and year of study for

Self-learning, Knowledge sharing, and Transformation of the Learner.

5. RESEARCH QUESTIONS

Following the objectives of the study, the research questions for this study are:

1. Does the hypothesized model derived Boisot's Social Learning Cycle fit the data?
2. Are there significant direct and indirect effects of Self-learning on Knowledge Sharing and Transformation?
3. What is the strength of the mediating effect of Knowledge Sharing on Transformation?
4. Are there significant differences by demographic factors by gender and year of study for Self-learning, Knowledge Sharing, and Transformation of the Learner?

6. RESEARCH CONSTRUCTS AND HYPOTHESES

Self-Learning in OER

For the testing of the hypothesized model the following hypotheses are presented (*Figure 3*). Alternative hypotheses are used following the conventions of path modeling. Factors of Boisot's (1998) The Social Learning Cycle that involves six levels of engagement was classified into three phases, namely, Self-Learning, Knowledge Sharing, and Self-transformation. Self-learning is defined as the phase that involves the processes of scanning, problem solving and abstraction. In the online and OER environments, students initially learn individually by surveying the offerings and engaging with the contents of the web lessons and resources that include video clips, power-point slides and e-books. This is the scanning process of learning cycle. They then apply the newly acquired knowledge to solve practice problems in the exercise and also integrate this knowledge to solve other problems related to the topic. The successful completion of the application of the new knowledge in solving problems in various contexts enabled the newly acquired knowledge to be abstracted or integrated into the knowledge schemas. Rumelhart & Norman [26] explain that new knowledge is processed by the learner at three different levels, namely,

- Accretion, where the new knowledge is added or accumulated into to existing memory because the incoming information is consistent with already available schemas;
- Tuning, when the new knowledge refines an existing schema but does not change its overall structure. This happens when sub-categories are introduced or knowledge items are merged into a more efficient structure to describe the new understanding, and
- Restructuring when "existing memory structures are not adequate to account for new knowledge" and the discrepancy is large. Restructuring refers to creation of a new schema based on an existing schema or combining recurring patterns of existing schemata. Through restructuring new schemas are created.

The activities at the self-learning stage generate learning outcomes that involve schema enrichment, refinement, and creation. Landa, 1983 [27], however, argues that knowledge becomes skills and these skills later become abilities that in turn collectively combine to create the learner's new personality complex. For Landa, the outcomes of learning are unobservable complex psychological phenomena of interconnected knowledge, skills and abilities that can be manifested through specific actions and that their successful acquisition would generate personality traits such as industriousness, confidence, and having positive outlooks towards the self and the field. Cobern [28] too offers a wider scope for the roles of knowledge in arguing that conceptual change or the change in the learner's perspective towards reality are the major goals of science education but they do not automatically occur after the learner has comprehended the topics. Change is driven by epistemologies and worldviews held by the learners as well as the processes of knowing and apprehension that lead to the acceptance or rejection of the concepts or new knowledge that have been comprehended as true or valid. Cobern concludes that conceptual change or transformation will happen if the new concept or knowledge is central to the learner's thinking and has relevance to the learner over a wide range of contexts.

The review of literature indicates that when new concepts and knowledge gained by learners are important and useful to them, they will be integrated into the new schema or complex psychological constructs that in turn would bring

about conceptual and personal changes. The OER students are in similar situations, thus the following hypothesis was proposed:

H_1: Self-Learning has a significant positive direct effect on Transformation of the learner.

According to Boisot, Self-learning in OER, using scanning, problem solving and abstraction provide students with deep understanding or codified knowledge that can later be kept as self-achievement or shared for free or sold in the form of books, notes or training. Van Den Hooff & De Ridder [29] found that the more knowledge a person collects or acquires knowledge, the more he is willing to donate/share his knowledge with others. Also people with expert knowledge are willing to help other neophytes [30]. Kucharska & Erickson [31] too reported that individuals with higher educational level are more willing to share their knowledge. Zaqout & Abbas [25] found that the students in a leading university in Malaysia showed a positive approach towards knowledge sharing at local levels but there was a need for enhancing knowledge sharing on a global platform. This review indicated that in general those who have acquired more knowledge were willing to share their knowledge with others. The OER students are self-learners and are seeking new knowledge individually but would willing to share them with others, therefore the following hypothesis was proposed:

H_2: Self-learning has a significant positive direct effect on Knowledge sharing.

Knowledge sharing in OER

D'antoni, 2008 [32] reported that in the OER communities where knowledge is more widely shared, experts and beginners are learning from each other and discussing related issues on many levels and contexts with the result that the beginners would quickly gain valuable insights and knowledge to be transformed into experts themselves. In addition, Chen, Zhou, & Lv, 2023)[33] reported that the quality of the knowledge shared, as well as knowledge sharing and social interaction activities influenced individuals' satisfaction in open educational communities. The review indicated that sharing the knowledge keeps the individuals in touch with experts and gave them the opportunity to practice and discuss their knowledge, therefore creating more opportunities for new understanding and refining their knowledge structures. The OER courses consist of freely available specialized contents that attract like-minded users who can readily enrich each other's understanding through various also freely available online knowledge sharing facilities. For this reason, the following hypothesis was proposed:

H_3: Knowledge sharing has a significant positive direct effect on Transformation of the learner

Indirect and Mediation Effects

The hypothesized model also shows that the factor of Knowledge Sharing is a mediating variable that has potential to produce an indirect effect of Self-Learning on Transformation. With the establishment of H_1, H_2 and H_3 as direct effects, further analysis from the model allows for the computations of the magnitude of the indirect effect of Self-learning on Transformation through Knowledge Sharing and the strength of mediation of Knowledge Sharing on Transformation. It was thus hypothesized that:

H_4: Self-Learning has a significant positive indirect effect on Transformation of the learner through Knowledge sharing.

Engagement by demographic factors

Findings regarding learning and knowledge sharing by gender are mixed. Yukselturk & Bulut, 2009 [34] indicated that in online self-learning activities, there were no significant differences between males and females in the strategies used. Ul Ain Baig, Khan, & Chaudhry, 2014 [35] too pointed out that there were no significant differences by gender in online knowledge sharing behaviors. Rahimi et al., 2011 [36] also found that for all the SECI factors (Socialization, Externalization, Combination and Internalization), there were no significant differences by gender. However, Ahmad et al., [37], reported that in the online learning process, male students reported higher scores for socialization while female students reported higher scores for combination and internalization. Boateng, Shi, Chen, & Zhou, 2023 [38] also reported that male teachers shared more of their knowledge than female teachers.

The review indicated that for self-learning, no significant differences by gender were recorded, in contrast for knowledge sharing, some shows significant differences by gender, while others stated no differences by gender for knowledge sharing. As male and female students learn

differently when engaging in OER the following hypotheses is proposed:

H_5: There are significant differences for a) self-learning, b) knowledge sharing, and c) transformation by gender.

Tan, Wei, & Tu, 2023 [39] found that in online learning, the seniors rated self-learning higher than freshmen, sophomores and juniors. Furthermore, Cho, Ellinger, & Hezlett (2006) stated that self-learning increased according to level year of study, in addition the junior students are more self-learners than freshmen students. Boateng, Dzandu, & Agyemang [40] pointed out that the first-degree holders sharing their knowledge more than the higher Diploma holders. But (Ul Ain Baig, Khan, & Chaudhry, 2014 [35] reported out that there were no significant differences by year of study in the online knowledge sharing behaviors.

The review indicated that seniors reported significantly higher scores than freshmen, sophomores and juniors in self-learning. On the other hand, for knowledge sharing behaviors, studies show different results by year of study. The OER platforms are used differently by students of various levels. For this reason, the following hypotheses is proposed:

H_6: There are significant differences for a) self-learning, b) knowledge sharing, and c) transformation by year of study.

7. RESEARCH METHODOLOGY

The survey method was chosen for the study. It would be better to analyse the learning behavior through the use of web analytics data but the web analytics data available to the researcher were incomplete. They only report the activities in the MOODLE LMS from the colleges by not other behaviours on the web. Thus, the survey research design that involves gathering of the data on a one-shot basis and generating numerical data which provides descriptive, inferential and explanatory information was employed. The survey method generates accurate instruments through piloting and revision activities and the gathered data can be processed statistically [41]. For this study, data was analyzed using SmartPLS to test the hypothesized the model and later determine the strengths of relationships between the constructs from the resulting structural model. ANOVA in SPSS was employed to compare learning engagement by the demographic factors. The SmartPLS software was chosen because it could perform robust modeling for simple and complex models with relatively smaller sample sizes and provide the necessary results in the form of direct and indirect effects as well as the strength of mediation effects that are important for this study. The analyses begin with the evaluation of the measurement model to establish the final or structural model.

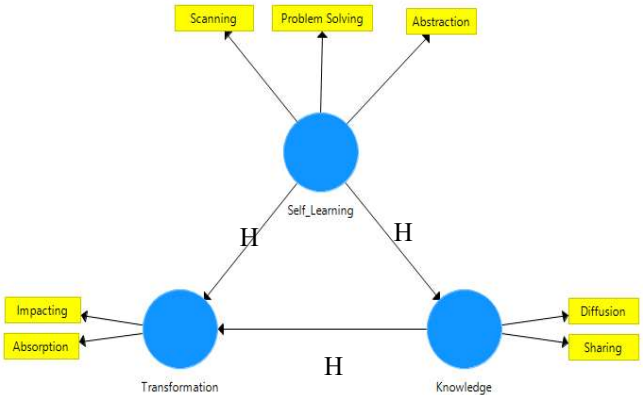

Figure 3: The hypothesized model following Boisot's Social Learning Cycle with hypotheses

The model fit requirements for the measurement model summarized from Hair, Hult, Ringle, & Sarstedt (2014) are presented in *Table 1*. For model fit, the convergent validity of the factors were tested according to the three criteria proposed by (Fornell & Larcker, 1981) [42], namely that a) all indicator loadings should be significant and be larger than 0.7, b) the Construct reliability (CR) should be above 0.7, and c) the average variance extracted (AVE) for each construct should be above 0.5. Two additional conditions suggested by (Hair Jr et al., 2021) [43] are also observed, namely that when an indicator's weight is significant or the loading is relatively high (> .5), there is support to

retain the indicator, and that VIF must be < 5 to indicate that there was no collinearity issue among the indicators.

Once the structural model is established, further statistical analyses for unobserved homogeneity, testing of the hypotheses, predictive relevance, and mediation effects are conducted. Table 2 summarizes the statistical measures to be analyzed from the structural model suggested by Hair et al (2021).

the 5% significance level is 110 (Hair et al, 2021). Thus, from this group 160 student were selected for the study based on their major and from colleges that have good computer laboratories and internet access, and to accommodate for possible attrition, incomplete submission or non-participation. These students were also selected because their colleges actively promoted the use of the OER materials, blended learning and e-Learning.

Table 1: Model fit requirements for the measurement model (Hair et al, 2021)

	Measures	Level	Exceptions
Collinearity (Overlap of indicators)	Variance Inflation Factor (VIF)	No collinearity when VIF < 5	
Indicator reliability	Indicator Loadings	> .7	Delete loadings between 0.40 and 0.70 to increase CR & AVE; Retain if loadings are sig. and >.5
Internal consistency	Cronbach's Alpha	> .7	CR between .6 - .7 acceptable for exploratory research
	Composite reliability (CR)	> .7	
Convergent validity	Average variance extracted (AVE)	> .5	
Uniqueness of construct	Discriminant validity	AVE > the squared correlation of the constructs	

7.1 Population and sample

According to the Ministry of Higher Education [44], enrolment in 17 public and private Universities in Gaza strip is 29,071 students (13,426 Males and 15,645 Females). However only 9.6% are in ICT programs that involve the use of OER courses employed in this study. The minimum sample size recommended for a PSL-SEM analysis at a statistical power of 80% with the maximum number of arrows pointing to a construct of 2 and at

7.2 Variables

The variables of the study are as follows: the Independent Variables are the use of OER resources and the use of social media. The Dependent Variables are Transformation or changes of the learner while the mediating variables the levels of engagement and knowledge sharing employed by the students and the Moderating Variables are the demographic factors.

Table 2: Statistical Measures for the Structural Model (Hair et al, 2021)

	Measures	Level
Homogeneity of data (Group equivalence)	Unobserved heterogeneity	p> 0.05 between path coefficients
Size and significance of path coefficients	β, T-statistics	t > 1.96 for β sig. at p < .05
Coefficients of determination / Predictive accuracy	R^2	0.75 = substantial, 0.50 = moderate 0.25 = weak
Effect size	f^2	0.02 = small, 0.15 = medium, 0.35 = large
Predictive relevance	Q^2	> 0 indicates predictive validity exists
Relative measure of Predictive Relevance	q^2 effect size	0.02 = small, 0.15 = medium, 0.35 = large
Mediation effects (Exist when path coefficients & indirect effects are significant)	Variance Accounted For $VAF = \frac{\beta_{Indirect}}{\beta_{Total}}$	VAF > 80% = Full Mediation 20% ≤ VAF ≤ 80% = Partial Mediation VAF< 20% = No Mediation

7.3 Instruments

A 30-item survey with a reported Cronbach's Apha of .90 developed by Habibian Naeini & Abbas [45] that measures the dimensions of the Boisot (1998) Social Learning Cycle was used in this study. However, the dimension of Diffusion which comprised of five general statements of collaboration was enlarged to incorporate seven specific items regarding knowledge sharing from Majid & Chitra [46]. The enlarged dimension was renamed Knowledge Sharing and in total the questionnaire of the study comprised 37 items. The questionnaire also surveyed Demographic Factors such as age, Gender, Major and year of study.

7.4 Pilot Tests for Validity and Reliability of the questionnaire

A pilot study was conducted to reestablish the validity and the reliability of the questionnaire because of changes to location and language used. The questionnaire was first checked by a senior lecturer in Information technology from Palestine. He recommended five changes and corrections to be made and these were completed accordingly. An Arabic version of the questionnaire was translated by a lecturer in the linguistics department and was later checked again by the senior lecturer and another lecturer in Palestine. Further refinements to the wording of the items were made according to recommendations from these lecturers. The questionnaire was then uploaded to the web with the English and Arabic versions for the pilot study.

33 OER users were invited to participate in the pilot study. Of these 26 were completed in full and were suitable for analysis while 3 were incomplete. The overall reliability index of the questionnaire was α = 0.833. Two respondents gave comments to improve the wording for 17 items in the Arabic version of the questionnaire and 13 were found to be with merit and were changed accordingly.

8. PROCEDURES OF THE STUDY

The questionnaire URLs were put on the network account by the server admin and will be automatically available when the students log on to

this account. The questionnaire will be available in the network for two weeks. To prevent students from submitting multiple entries the questionnaire requires every student to key in the student ID number. Instructors in the selected classes were informed of the study and encourage and remind students to participate.

9. DATA ANALYSIS AND RESULTS

a) descriptive analysis

In preparing the data for analysis, incomplete responses and outliers were removed to obtain a normal distribution for the data. A total of 160 students were invited to respond to the questionnaires in either English or Arabic and 158 were returned. Of these 10 were incomplete and 4 were outliers, giving the final sample at 144 students. The skewness and kurtosis for the factors are reported in *Table 3*, and as all the respective values were within the required ±2 range, the normality of the data was met [47]. *Table 4* presents the distribution of the respondent by gender, year of study, and major. *Table 5* presents the percentage of students engaging in selected OER resources with W3School and Microsoft Virtual Academy being the most popular sites and Khan Academy being the least popular. *Table 6* presents the preferred platforms for sharing with Facebook and emails being the most popular platforms.

Table 3: Normality of the data

	N	Mean	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
Scanning	144	21.2708	-.948	.202	1.425	.401
Problem Solving	144	20.9792	-1.000	.202	1.750	.401
Abstraction	144	20.8681	-.696	.202	1.312	.401
Absorption	144	20.9375	-.503	.202	.141	.401
Impacting	144	20.6806	-.700	.202	.458	.401
Diffusion	144	21.0764	-.530	.202	.667	.401
Knowledge Sharing	144	28.6806	-.651	.202	.046	.401

Table 4: Distribution of the respondents

Classification	Number	%
Gender		
Male	84	56.0
Female	60	44.0
Age		
18 yrs. or younger	12	10.4
19-25 yrs.	99	79.3
26-32 yrs.	22	8.6
More than 33.	11	1.7
Year of study		
1st year	45	38.8
2nd year	56	44.9
3rd year	6	3.4
4th year	37	12.9
Major		
Multimedia Technology	51	44.0
Data Base and Programming	18	14.7
Geographic Info. Systems	11	7.7
Smartphones Programming	13	11.2
Others (Engineering, Ed. Tech., Info. security)	51	22.4
Total	144	

Table 5: Use of OER Resources

OER Resources	Percentage of users
W3School	65.5
Microsoft Virtual Academy	64.6
Code school	61.2
Code Academy	57.8
Udemy	55.2
Lynda	52.6
Code.org	50.0
Khan Academy	46.5

Table 6: Use of sharing platforms

Sharing platform	Percentage of users
Facebook	99.1
Email	87.9
Google+	84.4
Moodle	82.8
Twitter	69.0

valid. With the full fit measures having met, the measurement model is now accepted as the

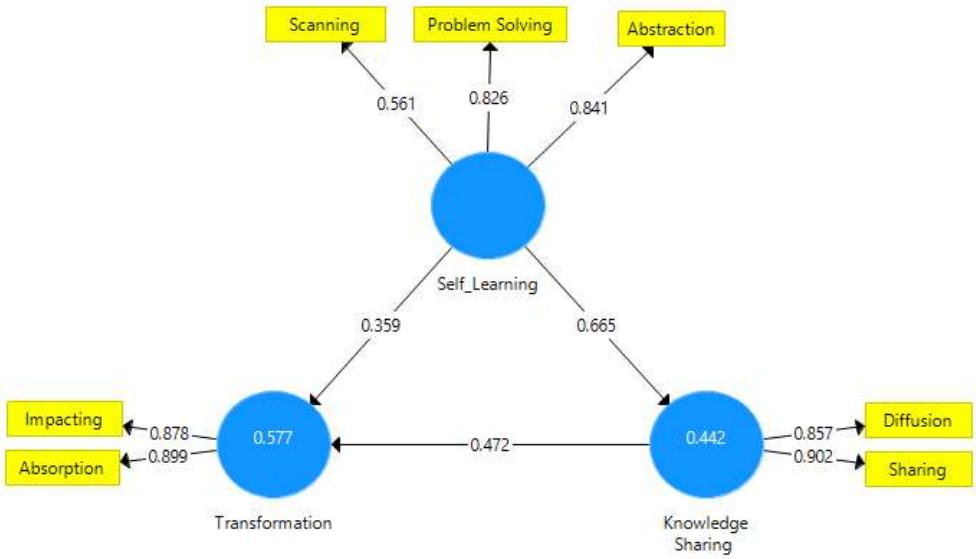

Figure 4: The measurement model

b) Inferential Analysis

RQ 01: Does the hypothesized model derived from Boisot's Social Learning Cycle model fit the data?

The results of the initial analysis from the data in SmartPLS which represents the measurement model is given in Figure 4. Outputs of the analysis for the measurement model reported that all indicator loadings were significant and larger than 0.7 except for Scanning ← Self_Learning which was at .561 *(Table 7)*. However, following Hair (2021) the indicator was retained because its loading was > .5 and was significant. The values of composite reliability (CR) and the average variance extracted (AVE) for each of the latent constructs were also > .7 and > .5 respectively *(Table 8)*. These findings fulfilled the major fit requirements for the model to be assessed as valid or fitting the data. Further analysis for the discriminant validity revealed that the magnitudes of the AVE for each construct was larger than the squared correlation of the constructs *(Table 9)* indicating the uniqueness of the constructs. The indicators were also evaluated for possible collinearity issues. The VIF values obtained for each indicator was < 5 *(Table 10)*, indicating that all the indicators were distinct and there was no collinearity issue for the indicators. These findings indicated that the hypothesized model as expressed by the measurement model fitted the data and was structural model of the study.

RQ 02: Are there significant direct and indirect effects of Self-learning on Knowledge Sharing and Transformation?

Research Question 2 involves the testing for unobserved heterogeneity followed by the testing of Hypotheses 1, 2, 3, and 4 and computing the effect sizes. Unobserved heterogeneity was tested using the Prediction-Oriented Segmentation (POS) feature to sort the sample into equivalent groups, and the Multi-Group Analysis (MGA) feature to test for heterogeneity. The results are presented in *Table 11*. The p-values for all the path coefficients between the two groups are greater than .05, indicating that there is no unobserved heterogeneity issue with the sample.

The second step is to examine the significance of the hypothesized paths in the structural model. The results showed that Self-learning had significant direct effects on Transformation (β = 0.359, p = .000) and Knowledge Sharing (β = 0.665, p = .000), and Knowledge Sharing in turn had a significant direct effect on Transformation (β = 0.472, p = .000) (*Table 12*). Thus H1, H2, and H3 are accepted. The significant direct effects defined by H2, and H3 produced a significant indirect effect of β = 0.314

(p = .000) for the path of Self-Learning → Transformation through Knowledge Sharing. Thus, H4 is also accepted. These findings lend empirical support to Boisot's Learning Cycle model with Self-Learning contributing a total effect of β = 0.673 (p = .000) on Transformation of the learner.

Table 7: Indicator loadings of the measurement model

	Loadings	T Statistics	p Values
Scanning ← Self -Learning	0.561	6.532	0.000
Problem-Solving ← Self-Learning	0.826	30.900	0.000
Abstraction ← Self-Learning	0.841	24.641	0.000
Sharing ← Knowledge Sharing	0.902	52.195	0.000
Diffusion ← Knowledge Sharing	0.857	19.358	0.000
Absorption ← Transformation	0.899	61.706	0.000
Impacting ← Transformation	0.878	38.383	0.000

Table 8: Convergent validity analysis

	Composite Reliability	Cronbach's Alpha	AVE
Knowledge sharing	0.873	0.711	0.774
Self-Learning	0.793	0.611	0.568
Transformation	0.882	0.733	0.789

Table 9: Discriminant Validity: Construct correlations with the square root of AVE along the diagonals

	Knowledge Sharing	Self-Learning	Transformation
Knowledge Sharing	0.880	0	0
Self-Learning	0.625	0.754	0
Transformation	0.710	0.673	0.888

Table 10: Collinearity Statistics for the Indicators

Indicators	Tolerance	VIF
Scanning	.806	1.241
Problem Solving	.559	1.787
Abstraction	.602	1.660
Absorption	.477	2.096
Impacting	.544	1.838
Diffusion	.585	1.708

Sharing	.463	2.158

Table 11: Test results for Unobserved Heterogeneity

	Path Coefficients-diff (GROUP 1 – GROUP 2)	p-Value (GROUP 1 vs. GROUP 2)
Self-Learning → Knowledge Sharing	0.141	0.725
Knowledge Sharing → Transformation	0.181	0.719
Self-Learning → Transformation	0.218	0.220

Table 12: Path coefficients and the Indirect and Total Effects

H		β	t- Statistics	p	Action
H_1	Self-Learning → Transformation*	0.359	4.165	0.000	Accepted
H_2	Self-Learning → Knowledge Sharing*	0.665	11.469	0.000	Accepted
H_3	Knowledge Sharing → Transformation*	0.472	5.643	0.000	Accepted
H_4	Self-Learning →Transformation**	0.314	4.764	0.000	Accepted
	Self-Learning → Transformation***	0.673	14.041	0.000	

*Direct Effects, **Indirect effect, ***Total effect

Table 13: Results of R^2 and Q^2 Values

Endogenous Latent Variables	R^2 Values	Q^2 Values
Knowledge Sharing	.442	.330
Transformation	.577	.436

The impact of a construct on an endogenous construct called the f^2 effect size can be calculated using the following formula given below. The effect sizes for Self-Learning → Transformation (f^2 = .159), Self-Learning → Knowledge Sharing (f^2 = .000), and Knowledge Sharing → Transformation (f^2 = .291) were calculated and reported in *Table 14*. Following Hair et al (2021) the effect sizes on Transformation from Self-learning and Knowledge sharing are in the medium range.

$$f^2 = \frac{R^2_{included} - R^2_{excluded}}{1 - R^2_{included}}$$

Similarly, the predictive relevance for endogenous construct called the q^2 effect size was calculated using the formula given below and reported in *Table 14*. The q^2 effect size for Self-Learning → Transformation (q^2 = .378) is considered large while the q^2 effect size for Knowledge Sharing → Transformation (q^2 = .161) is considered of medium effect size.

$$q^2_{selflearning \rightarrow transformation} = \frac{Q^2_{included} - Q^2_{excluded}}{1 - Q^2_{included}}$$

Table 14: Summary of effect sizes for total effects (f^2) and predictive relevance (q^2)

	Knowledge Sharing			Transformation		
	β	f^2	q^2	β	f^2	q^2
Self-learning	.665	.000	.000	.359	.159	.378
Knowledge Sharing				.472	.291	.161

RQ 03: What is the strength of the mediating effect of Knowledge Sharing on Transformation?

As the direct effect and the indirect effects are significant, the strength of the mediation effects can be computed using the following formula:

Variance Accounted For (VAF) = Indirect Effect/Total Effect

Inserting the values gives VAF = .314/.673

= .466, or 46.6%

As the VAF value is larger than 20% but less than 80% the effect can be characterized as partial mediation.

RQ 04: Are there significant differences by demographic factors by gender and year of study for Self-learning, Knowledge Sharing, and Transformation of the Learner?

Testing of the Hypotheses 5

H_5: There are no significant differences by gender for a) self-learning, b) knowledge sharing, and c) transformation.

Table 15 presents the means, standard deviations and results of ANOVA tests for a) self-learning, b) knowledge sharing, and c) transformation by gender. There were no significant differences self-learning, knowledge sharing, and transformation by gender, hence H_5 is accepted.

Testing of the Hypotheses 6

H_6: There are no significant differences by year of study for a) self-learning, b) knowledge sharing, and c) transformation.

Table 16 presents the means, standard deviations and results of ANOVA tests for a) self-learning, b) knowledge sharing, and c) transformation by year of study. Anova tests reported was a significant difference for Knowledge Sharing by Year of Study were no significant differences for self-learning and transformation, hence H_{5a} and H_{5c} are accepted. Post-hoc analyses revealed that for Knowledge Sharing, the significant difference was only between 4th year and 1st year students with 4th year students reporting

Table 15: Means, standard deviation and results of ANOVA for a) self-learning, b) knowledge sharing, and c) transformation by gender

		N	Mean	Std. Dev.	ANOVA
Self-Learning	Male	84	62.71	5.18	F(1, 142) = 1.51, p = .221
	Female	60	63.68	3.79	
Knowledge Sharing	Male	84	49.66	5.23	F(1, 142) = .071, p = .791
	Female	60	49.88	4.15	
Transformation	Male	84	41.46	4.39	F(1, 142) = .300, p = .584
	Female	60	41.83	3.32	

sharing at significantly mean than first year students.

Table 16: Means, standard deviation and results of ANOVA for a) self-learning, b) knowledge sharing, and c) transformation by year of study

		N	Mean	Std. Dev.	ANOVA	Tukey's Test
Self-Learning	1st year	45	62.02	4.60	F(3, 140) = 1.664 p = .178	
	2nd year	56	63.33	4.84		
	3rd year	6	62.33	7.20		
	4th year	37	64.24	3.82		
Knowledge Sharing	1st year	45	48.04	4.74	F(3, 140) = 3.766 p = .012	4th year > 1st year p = .006
	2nd year	56	49.92	4.70		
	3rd year	6	50.33	6.15		
	4th year	37	51.48	4.27		
Transformation	1st year	45	41.11	3.83	F(3, 140) = 1.114 p = .346	
	2nd year	56	41.35	3.96		
	3rd year	6	41.66	5.78		
	4th year	37	42.62	3.81		

10. SUMMARY OF FINDINGS

1. For the OER courses, W3School and Microsoft Virtual Academy were the most popular sites while Khan Academy was the least popular. The preferred platforms for sharing were Facebook and emails.
2. The hypothesized model fitted the data with Self-Learning having significant direct effects on Transformation with $\beta = 0.359$ and on Knowledge Sharing with $\beta = 0.665$. Also Knowledge Sharing reported a significant direct effect on transformation with $\beta = 0.472$, giving a significant indirect effect of Self-Learning on Transformation at $\beta = 0.314$.
3. In addition the findings showed that Knowledge Sharing reported a partial mediation effect of 46.60% and the effect size of Self-Learning on Transformation was at $f^2 = .159$ or of medium effect size while the while the effect size for predictive relevance was large at $q^2 = .378$.
4. There was a significant difference in knowledge sharing by Year of Study with 4th year students reporting significantly higher scores than 1st year students, but there were no significant differences for other factors of the model and by year of study and gender.

11. DISCUSSION AND RECOMMENDATION

For the OER courses, W3School, Microsoft Virtual Academy and Code School were the most popular with about two thirds of the respondent reporting using them. Other sites visited by more than half of the respondents were Code Academy, Udemy, Lynda, and Code.org. This was not surprising as the sample comprised of IT and ICT majors in various fields of study and these resources were visited because the contents are relevant to the programs offered by the college and the sites offer active discussion forums and also are followed diligently through various content updates and new offerings. The least popular was Khan Academy which offers less IT and ICT courses. Also, almost all of the respondents (99.1%) reported using Facebook as their preferred sharing platform while other platforms such as email (87.9%), Google+ (84.4%), and Moodle (82.8%)

which was the platform for the LMS for all the colleges participating in this study were also used extensively. Twitter reported the lowest use at 69%. These findings indicate that the respondents were technology savvy and were actively sharing with colleagues in their respective classes as well as other friends outside the classroom and outside of Palestine. The heavy participation and use of the sharing platforms were because of easy access and useful features offered but also because of the lack of other facilities due to the sanctions and travel restrictions imposed on Palestine.

The findings of this study that the hypothesized model fulfilled all the fit requirements offered an indication that the knowledge management paradigm, or specifically Boisot's (1998) Social Learning Cycle was suitable in describing learning in the OER environment. From the structural model, Self-Learning reported significant direct effects on Transformation with $\beta = 0.359$ and on Knowledge-Sharing with $\beta = 0.665$. Knowledge-Sharing in turn reported a significant direct effect on Transformation with $\beta = 0.472$. The f^2 effect sizes that measure the strength of contribution of the exogenous variables on the endogenous variables for the direct and indirect effects were in the range of medium effect sizes while the effect size for predictive relevance which is the measure of how well Self-learning predicted learner Transformation was at $q^2 = .378$ or of a large effect size. These values further indicated that the indicators and latent factors have adequately captured the learning processes present in the OER learning environment for the respondents.

The finding for the direct effect of Self-learning on learner Transformation is consistent with the ideas presented by Landa (1983) that basic knowledge meaningfully acquired by the learner becomes skills and these skills later become abilities that in turn collectively combine to create the learner's new personality complex. Besides gaining mastery of the new knowledge that can be applied across various contexts, the success in acquiring and transferring the new knowledge also adds to the learner's confidence and positive outlooks towards the self and the field, and modify or strengthen the existing specific and generic thinking and reasoning skills. This finding is also consistent with Cobern (1994) who asserts that the processes of knowing and apprehension that lead to the acceptance or rejection of new concepts or knowledge that have been comprehended as true or valid change or modify the epistemologies and worldviews held by the learners. The medium regression coefficient and effect size indicate that the OER courses offer new and easy to understand contents that students could acquire on their own. From the heavy use reported in the descriptive section, it also suggests that these courses are followed over an extended period of time until the students were confident that they have adequately mastered the contents.

The study found that Self-Learning had a significant and large direct effect on Knowledge-Sharing. These findings are consistent with that of Hooff and Ridder (2004) and Connelly & Kelloway (2003) who reported that the more knowledge a person collected, the more he/she was willing to share them with others. For the Palestinian students, despite the scarcity of scholarships and job opportunities they were actively engaged in knowledge sharing with their network of colleagues and friends, unlike students in similar situations in Singapore [48]. (Zaqout & Abbas [25] attributed the students' generosity with their hard-earned knowledge to the mutual trust among themselves as well as the constructive and supportive environments that they were in and this appears to apply to the Palestinian situation. Another reason for the active sharing activities may be that the knowledge or documents were obtained free-of-charge from readily OER available sites and the students were merely engaged in comparing notes or correcting each other. More studies need to be conducted to investigate their knowledge sharing behaviours are as generous for topics critical to their grades and for sources that are exclusively obtained.

An interesting finding was that Knowledge Sharing was a strong mediator for the effects of Self-learning on learner Transformation. The direct effect of Self-Learning on Transformation was at $\beta = 0.359$ and while the indirect effect of Self-learning on Transformation was at $\beta = 0.314$, giving total effect of $\beta = 0.673$ and a partial mediation effect of 46.60%. This meant that the combined effects of Self-learning and Knowledge Sharing contributed about half of the total effects of learner transformation. This indicated that individual learning in OER produced significant learning outcomes but the benefits were doubled when the students engaged in knowledge sharing activities. The knowledge sharing activities offered the students an additional rich opportunity to refine and internalize their newly acquired knowledge. Boisot & Cos (1999) explain that the diffusion or knowledge sharing stage involves the exchange and application of the newly acquired knowledge or

insights in the codified and abstract forms in various situations that produce new learning experiences among the learners and result in the creation of more tacit knowledge. OER is generally designed for individual learning but this study indicated that more could be gained when knowledge sharing activities were factored in. It is thus recommended that communities of learners are created to accompany every OER course offered.

Analyses by moderator variables revealed that there was a significant difference in knowledge sharing by Year of study with 4th year students reporting significantly higher scores than 1st year students. This finding is consistent with (Boateng, Dzandu, & Agyemang [40] who revealed that there were variations in knowledge sharing by year of study but contradicted findings by Ul Ain Baig, Khan, & Chaudhry [35] and Hung et al. [49] who reported that there were no significant differences for knowledge acquisition and knowledge sharing behaviors by year of study. For this study, 4th year students were sharing significantly more because they have acquired more advanced understanding of the contents of their courses over the years (Cho et al, 2006), had more friends and colleagues, and therefore were more likely to engage and contribute more than freshmen.

The findings of this study also indicated that there were no significant differences between the means of the Self-learning, knowledge sharing and learner transformation by gender. These findings are consistent with many findings from from literature such as Yukselturk & Bulut, [34], Ul Ain Baig, Khan, & Chaudhry [35] and Rahimi et al. [36]. These findings, however does no support Ahmad et al. [37] who found that in online learning process, male students reported higher scores for socialization while female students reported higher scores for combination and internalization. The findings of this study indicated that male and female students engaged in similar learning and sharing activities and benefitted equally from the OER learning experience.

In conclusion, this study found that Palestinian students in the Gaza Strip were very actively using OER courses that were freely available on the web and they were also very actively engaged in knowledge sharing activities through various online facilities. The structural model reported that knowledge sharing activities contributed almost as much as individual learning for the reported learning gains and further analyses reported that there were no differences to the learning activities and learning gains by gender. It is thus recommended that all OER courses be accompanied by facilities for knowledge sharing to increase or double the learning gains when students engage in them. IT contribution of this study lies in advocating for the integration of collaborative tools and platforms within OER environments to foster seamless knowledge-sharing interactions among students. This addition emphasizes the significance of leveraging information technology to enhance collaborative learning experiences within OER environments, thereby enriching educational outcomes.

12. LIMITATIONS OF THE STUDY

The investigation involved the use of self-reporting questionnaires and samples from three institutions of higher learning in the Gaza Strip, Palestine. Due to the special case of Palestine being an occupied territory and experiencing continuous direct and indirect economic sanctions that may have brought the students closer, the findings may not be generalizable to other countries in the region. Thus, further study is recommended to include samples from different cultures and economic situations and other modes of data collection to confirm the robustness of the KM paradigm and model used in this study.

Future Work:

1. Longitudinal Studies: Conducting longitudinal studies could offer a deeper understanding of the long-term effects of self-learning and knowledge sharing in OER courses, capturing changes in learning outcomes and behaviors over time.
2. Mixed-Methods Approach: Integrating qualitative methods such as interviews or focus groups alongside quantitative analysis could provide richer insights into the experiences and perceptions of students engaging in self-learning and knowledge sharing within OER environments.
3. Exploration of Moderating Variables: Investigating potential moderating variables such as prior knowledge, learning styles, or technological literacy could enhance understanding of the nuanced effects of self-learning and knowledge sharing in OER courses.
4. Comparative Studies: Comparative studies across different educational settings or

cultural contexts could elucidate variations in the effectiveness of self-learning and knowledge sharing strategies, informing tailored interventions and instructional design practices.

5. Technological Innovations: Exploring the integration of emerging technologies such as artificial intelligence or social learning platforms could enhance collaborative learning experiences and facilitate more effective knowledge sharing within OER environments.

Addressing these limitations and pursuing avenues for future research would contribute to a more comprehensive understanding of the dynamics of self-learning and knowledge sharing in OER courses among college students, ultimately advancing educational practices and outcomes in online learning contexts.

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