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Article

Exploring the Factors That Influence K-12 Teachers' Use of Open Educational Resources

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Abstract: The features of open educational resources (OERs) have the potential of enhancing teaching effectiveness and student learning experiences in K-12 education. Encouraging K-12 teachers to use OERs requires an understanding of the factors that have an influence on teachers' decisions to adopt or use OERs in their teaching. In this regard, this study explored the factors related to how teachers perceived their use of OERs, including the perceived ease of use of OERs, perceived usefulness of OERs, intention to adopt OERs, attitudes, OER self-efficacy, and so on. The relationships of several proposed factors were explored. The participants were teachers from a university in the northeastern United States. Both quantitative and qualitative approaches were applied to analyze the collected data. The results indicated that teachers' perceptions of using OERs were positive overall. Their perceived ease of use and usefulness were two significant predictors of teachers' adoption of OERs. Other factors that addressed teachers' willingness and challenges with the use of OER were re-ported and discussed.

Keywords: open educational resources (OERs); self-efficacy; K-12 teachers' perceptions; factors; challenges

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1. Introduction

The use of open educational resources (OERs) has been increasing in K-12 and higher education [1,2]. Open educational resources (OERs) are free and open-licensed educational materials and resources [3]. OERs enable the creation of free and universally accessible educational materials that can be used by anyone for teaching or learning purposes [3]. UNESCO defined OERs as "The open provision of educational resources, enabled by information and communication technologies, for consultation, use and adaptation by a community of users for non-commercial purposes" [4] (p. 24). The formats of OERs vary across a wide range, including courses, textbooks, music, videos, simulations, test items, journal articles, and other resources that are usually available online and without access fees [3,5]. The use of OERs provide users with permission to engage in the 5 R activities, which include retaining, remixing, revising, reusing, and redistributing the resources [5,6].

The demand for OERs in K-12 is on the rise [1]. OERs have the potential to shift instruction from a one-size-fits-all model to a well-versed differentiated model in K-12 schools [7]. Traditional textbooks, although the primary sources of learning materials, fail to accommodate teachers' preferences, teaching styles, and students' learning needs [8,9]. Other issues related to the use of textbooks include teachers' lack of control of content presentation, high subscription fees, copyright restrictions, and the lack of the capability for instant content updates [10]. With the features of no cost and easy access, OERs are suggested to be a cost-effective alternative to traditional textbooks which helps to achieve differentiated instruction [11,12]. OERs provide teachers with adaptable and free learning

resources that are accessible to all students, especially to those who cannot afford expensive textbooks [10,12]. The use of OERs may also help alleviate the issues of digital divides and promote social justice [7].

The adoption and use of OERs have become a trend in K-12 education [13]. The use of OERs has the potential to enhance students' academic achievement and learning motivations [11,14]. Through initiatives and professional development training, school teachers are provided with opportunities to not only learn of the potential of OERs in facilitating teaching, but also are encouraged to implement OERs in their class [12,14]. With more K12 teachers introduced to OERs, it is important to understand their perceptions of adopting and using OERs in teaching, especially the factors related to the intention of teachers towards OER adoption [12,13,15]. Few studies have investigated K-12 teachers' perceptions of adopting OERs [12]. To increase our understanding in this regard, this study aims to investigate teachers' perceptions of using or adopting OERs, with a focus on several proposed factors, such as their intention to adopt OERs, perceived usefulness, ease of use, etc.

2. Literature Review

2.1. Teachers' Perceptions of Using OER: Technology Acceptance Model and Other Related Variables

Based on Fishbein and Ajzen's [16] Theory of Reasoned Action (TRA), Davis [17] developed a Technology Acceptance Model (TAM) to describe individuals' adoption of information technology. The TAM has been widely applied to understand how individuals adopt or use a new technology tool in various fields, such as management, information systems, psychology, and education [18,19]. Individuals' desire to use or adopt a new technology is influenced by several variables related to their beliefs or attitudes [20]. In the TAM, perceived ease of use and perceived usefulness are two important factors that explain individuals' intention to adopt or use technology [17]. Perceived ease of use is defined as "the degree to which a person believes that using a particular system would be free of effort" [17] (p. 320). Perceived usefulness refers to "the degree to which a person believes that using a particular system would enhance his or her job performance" [17] (p. 320).

In K-12 education, the TAM has been considered as an important model that helps describe teachers' perceptions of using or adopting new technology [12,18,21]. Teo et al. [22] conducted a study that involved pre-service teachers and found that perceived usefulness and perceived ease of use had a significant effect on their intention to use technology. Granić and Marangunić [21] conducted a systematic review and found that both perceived ease of use and perceived usefulness determine teachers' intention towards technology adoption, and that perceived usefulness has a stronger effect on teachers' intention to adopt technology, compared to perceived ease of use. In terms of OERs, limited research has been conducted to examine users' perceptions of OER adoption based on the TAM. Kim et al. [20] investigated students of the Open University in Korea and found that perceived ease of use was a significant predictor of their intention to use OERs, but perceived usefulness was not a significant predictor of their intention of OER adoption. Tang et al. [12] investigated 68 teachers' intentions to adopt OERs in K-12 settings in the United States, and found that both their perceived use of ease and perceived usefulness significantly predicted their intention to adopt OERs.

In addition to perceived ease of use and perceived usefulness, Kim et al. [20] proposed other variables that help to address users' perceptions of using OERs. These variables include attitudes, subjective norms, and OER self-efficacy. Attitudes is defined as "a belief in the expected outcomes of such behaviors" and subjective norms as "a belief in how other people think of the behaviors" [20] (p. 5). OER self-efficacy refers to users' confidence level in using OERs for required tasks [20] (p. 5). In this study, we included these three variables to describe teachers' perceptions of adopting OERs in addition to the three variables in the TAM (i.e., perceived ease of use, perceived usefulness, and intention).

2.2. Technology Self-Efficacy and Technology Integration Self-Efficacy

Self-efficacy was defined by Bandura [23] as "People's beliefs about their capabilities to produce designated levels of performance that exercise influence over events that affect their lives" [23] (p. 71). Self-efficacy is related to several outcomes, such as goal setting, striving for learning tasks, and achievement [23]. People with higher levels of self-efficacy are more likely to set higher goals and be persistent compared to those with lower levels of self-efficacy [24]. The concept of self-efficacy has gained attention in and been applied to various fields, such as management, information systems, education, etc. [25].

Self-efficacy is linked to teachers' perceptions of their ability to provide meaningful learning experiences to their students, and their willingness to explore and experiment with new instructional strategies or technology tools [26]. Technology self-efficacy and technology integration self-efficacy are important factors that may have an influence on teachers' intention to adopt new technology tools [18]. In the context of this study involving teachers, technology self-efficacy refers to the degree to which teachers are confident in their ability to use computers to perform various tasks [27]. Technology integration self-efficacy refers to teachers' belief in their capabilities to successfully integrate technology into their teaching [18,26].

Teachers' technology self-efficacy is associated with teachers' technology use behavior in the classroom [28]. Teachers with higher levels of technology self-efficacy are more likely to show positive attitudes towards integrating new or innovative technology tools into their teaching [28,29]. Teachers with higher levels of technology integration self-efficacy are more willing to explore or try out new ideas or experiments with technology when developing teaching materials compared to their counterparts [18]. In our study, we assume that teachers with higher levels of technology self-efficacy and technology integration self-efficacy are more likely to possess higher levels of self-efficacy in using OERs.

3. Research Questions

1. What are teachers' perceptions of using OERs?
2. Do teachers' perceived ease of use of OERs and perceived usefulness of OERs predict their intention to adopt OERs?
3. Is OER self-efficacy correlated with technology self-efficacy and technology integration self-efficacy?
4. What are the factors that influence teachers' willingness to use OERs?
5. What are teachers' perceived challenges of using OERs in teaching?

4. Methods

4.1. Participants

The participants included 23 teachers enrolled in a graduate-level educational technology course (see Table 1). This course was offered online through the College of Education at a northeastern university in the United States. There were more female teachers (69.6%) than male teachers (30.4%). Most of the teachers were aged between 20 and 30 (47.8%) or 31 and 40 years old (43.6%). About 8.6% were teachers at or above the age of 41 years. About 52.2% of the teachers had taught for 1–5 years, and 26.1% had for 6–10 years. There were a few teachers (21.7%) who had taught for 10 years or more. As for teachers' self-rated technology skills, more than half of the teachers (56.5%) described themselves as technology experts. About 34.8% of them indicated that they possessed substantial technology skills. Only a few of them (8.7%) had moderate technology skills.

Table 1. Background information.

Characteristics	*n*	%
Gender		
Male	7	30.4
Female	16	69.6
Age		
20–30	11	47.8
31–40	10	43.6
41–50	1	4.3
51–60	1	4.3
Years of teaching experiences		
1–5	12	52.2
6–10	6	26.1
11 and above	5	21.7
Technology skills (self-rated)		
Moderate	2	8.7
Substantial	8	34.8
Expert	13	56.5

4.2. Data Collection

Data were collected using an online survey. This study was approved by the university's Institutional Review Board (IRB), and informed consent forms were obtained from the teachers who participated in the survey. The online survey was provided to teachers at the end of the semester. The survey questionnaire consisted of sections such as student background information, their perceptions of using OERs (i.e., perceived ease of use of OERs, perceived usefulness of OERs, intention to adopt OERs, attitude towards OERs, subjective norm regarding OERs, and OER self-efficacy), self-efficacy related to technology use and technology integration (see Table 2), and reflection. Student background information included gender, age, years of teaching experience, and technology skills.

Table 2. Instruments.

Scales	Number of Items	Range	Cronbach's Alpha
Perceived ease of use of OERs	3	1–7	0.91
Perceived usefulness of OERs	3	1–7	0.91
Intention to adopt OERs	2	1–7	0.90
Attitude towards OERs	3	1–5	0.92
Subjective norm regarding OERs	3	1–5	0.80
OER self-efficacy	2	1–5	0.80
Technology self-efficacy	12	1–7	0.83
Technology integration self-efficacy	6	1–6	0.94

The three scales, including the perceived ease of use of OERs, perceived usefulness of OERs, and intention to adopt OERs, were adapted from the scales developed by Teo [29] that were used to measure teachers' technology acceptance, and were tested with good reliability (i.e., composite reliability values larger than 0.93) and validity (i.e., convergent validity and discriminant validity). The scales measuring teachers' perceived ease of use of OERs and usefulness of OERs have three items each. The intention-to-adopt-OERs scale has

two items. All of these three scales were 7-point Likert scales. The three scales including the attitude towards OERs, subjective norm regarding OERs, and OER self-efficacy were adopted from the instrument developed by Kim et al. [20] that measured adult learners' adoption of OERs. These three scales were established with good reliability (Cronbach's alpha values larger than 0.80) and content validity. They were 5-point Likert scales. The items for these three scales included, for example, "I am positive towards OER", "What OER stands for is important for me as a learner", and "I have the necessary skills for using OER".

The technology self-efficacy scale adopted for this study is a 7-point Likert scale that includes twelve items measuring users' confidence in performing computer-related tasks [30]; for example, "I can always manage to solve difficult computer problems if I try hard enough". The technology integration self-efficacy scale that we adopted for this study has six items to measure how confident the teachers are in integrating technology into teaching. This scale was developed by Moore-Hayes [26] and it is a 6-point Likert scale. One item, for example, is "How well prepared are you to evaluate software to support teaching and learning?" Table 2 provides an overview of each scale. Both scales were established with good reliability and validity (through exploratory factor analysis). The reliability values of the scales in this study ranged from 0.80 to 0.94.

4.3. Context

Teachers enrolled in the course were required to work on an assignment about OERs. This assignment provided teachers with opportunities to learn about the concept and potential of OERs in teaching, as well as to explore available OERs, such as OER platforms, websites, or tools that can be useful for teachers in K-12 settings. Teachers were asked to review existing OER lessons and teaching materials that were developed by others, share their viewpoints with classmates about the OERs that they had explored, and how they felt these free OERs or materials would benefit their teaching by participating in online discussion boards.

4.4. Data Analysis

Data were analyzed using a quantitative approach via SPSS 28. The quantitative approaches included descriptive analysis, and correlation and regression analyses. Data were analyzed using quantitative and qualitative approaches. SPSS 26 was used for data analyses. A qualitative approach was adopted to analyze the open-ended questions related to factors that teachers considered when using or adopting OERs, and challenges that teachers encountered when using OERs. Descriptive analyses were performed to answer research question one. A regression analysis was performed to answer research question two about the prediction of two proposed variables on intention. Correlation analyses were conducted to answer research question three about the correlation of OER self-efficacy with technology self-efficacy and technology integration self-efficacy. Content analysis was performed to answer research questions four and five, to further understand the potential factors that influence teachers' use of OERs and the challenges they may encounter.

5. Results

5.1. RQ1: What Are Teachers' Perceptions of Using OERs?

Table 3 shows the teachers' average scores for the six instruments that measure their perceptions of OER use. The average score of teachers' perceived ease of use of OERs was 6.29, which is above the midpoint 4. The average score of teachers' perceived usefulness of OERs was 6.49. Teachers had a slightly high average score of their intention to adopt OERs (M = 6.52, SD = 0.67). The average score for teachers' attitudes towards OERs was moderately high (M = 4.19, SD = 0.47). The average score of teachers' subjective norm regarding OERs was 3.9, slightly above the midpoint 3. Teachers had a moderate average score for OER self-efficacy (M = 4.41, SD = 0.51).

Table 3. Descriptive information.

Scales	Range	Midpoint	*M*	*SD*
Perceived ease of use of OERs	1–7	4	6.26	0.69
Perceived usefulness of OERs	1–7	4	6.49	0.61
Intention to adopt OERs	1–7	4	6.52	0.67
Attitude towards OERs	1–5	3	4.19	0.47
Subjective norm regarding OERs	1–5	3	3.90	0.55
OER self-efficacy	1–5	3	4.41	0.51

5.2. RQ2: Do Teachers' Perceived Ease of Use of OERs and Perceived Usefulness of OERs Predict Their Intention to Adopt OER?

The multiple regression model (see Table 4) was significant: F (2, 20) = 20.55, $p < 0.001$. The model explained 67% of the variance in the intention to adopt OERs. The perceived ease of use of OERs (β = 0.294, $p < 0.05$) and perceived usefulness of OERs (β = 0.657, $p < 0.001$) significantly predicted teachers' intention to adopt OERs. Among the two variables, the perceived usefulness of OERs was the strongest predictor of perceived learning.

Table 4. Multiple regression model: perceived learning explained by three predictor variables.

Variables	*B*	*SE B*	β	*t*	*p*
Perceived ease of use of OERs	0.284	0.135	0.294	2.10	0.048 *
Perceived usefulness of OERs	0.716	0.152	0.657	4.70	0.000 ***

Note: * $p < 0.05$; *** $p < 0.001$.

5.3. RQ3: Is OER Self-Efficacy Correlated with Technology Self-Efficacy and Technology Integration Self-Efficacy?

Table 5 indicates the correlations between teachers' OER self-efficacy, technology self-efficacy, and technology integration self-efficacy. OER self-efficacy was positively related to technology self-efficacy (r = 0.42, $p < 0.05$) and technology integration self-efficacy (r = 0.54, $p < 0.01$). Technology self-efficacy is positively correlated with technology integration self-efficacy (r = 0.67, $p < 0.01$).

Table 5. Correlations among variables.

	OER Self-Efficacy	Technology Self-Efficacy	Technology Integration Self-Efficacy
OER self-efficacy	—	0.42 *	0.54 **
Technology self-efficacy		—	0.67 **
Technology integration self-efficacy			—

Note: * $p < 0.05$; ** $p < 0.01$.

5.4. RQ4: What Are the Factors That Influence Teachers' Willingness to Use OERs?

Teachers indicated several factors that may influence their willingness to use or adopt OERs in teaching. Many teachers indicated that the ease of use of OERs and that there was no cost were two major factors that had an impact on their decision to use OERs. They felt that it was easy for both teachers and students to use, access, or share OERs with others. Several teachers indicated that the use of OERs would save course preparation time and provide more interactive or enhancing lesson resources that would help increase student engagement, interest, and motivation to learn. In addition, teachers indicated the potential of OERs in tracking student progress and improving differentiated instruction. In addition, other factors that teachers considered when using OERs included standard alignment compatibility, the time spent in searching for OERs, and the capability of the school's technology infrastructure. Below are some of the statements shared by teachers:

"*Free, already created, can see what other people do/how they teach a topic, lessens burden on instructors*."

"*Has a range of applications that improve student's education and learning. Many of these applications have features that track individual student learner which can help the teacher track student's progress*."

"*The main factor would be increasing student engagement and finding activities that interest my students to enhance their learning*."

"*The ease of accessibility for my students, the range of various activities that my students can use, and the relevance of the platform to what I'm teaching*."

5.5. RQ5: What Are Teachers' Perceived Challenges of Using OERs in Teaching?

In terms of the challenges that teachers encountered when using OERs in teaching, the challenges that were most often brought up by teachers included the lack of knowledge or awareness of OERs, lack of training opportunities related to OERs, the reliability/quality of OERs, and the lack of alignment of OERs with content or curriculum standards. Some teachers described that there was a learning curve for them to learn about OERs and then use them in the classroom. It was time-consuming sometimes for them to search and identify high-quality OER content or resources that were aligned with their teaching needs, student needs, or content standards. Other issues that teachers indicated included the lack of technical support for teachers and students, no approvals of the use of OERs by the school district, schools not having an adequate technology infrastructure to handle or maintain the usage of OERs, and students not possessing the ability to use OERs appropriately (e.g., copying the content from the answer keys). Below are some of the challenges shared by teachers:

"*Having to fact-check anything for Social Studies or teaching it can be tedious at times. Also, I would need to make sure the content aligns with learning standards and objectives*."

"*The challenges of using OER is having to make sure they aligned with what you are teaching and not everything found is always factual or correct*."

"*The ability of my school's technology infrastructure to reliably handle the usage of an OER is a challenge. My student's ability to use the OER at home is also a challenge*."

"*One of the biggest challenges that I face is knowing an open educational re-source exists but not being entirely comfortable with how it works*."

"*One challenge I have encountered is students opening accounts for the same resources educators have access to. They then take the answer keys for the worksheets or activities we have used in the classroom. I have seen the same exact answers in my student's work as shown in the answer key, word for word*."

6. Discussion

Overall, teachers' perceptions of using OERs in teaching were quite positive. Most teachers found OERs easy to use, perceived OERs as useful resources, and their intention was to use or adopt OERs in their teaching. Teachers' attitudes towards and belief about the use of OERs were positive. Teachers' OER self-efficacy was moderately high, indicating that most teachers were confident in their ability to find or use OERs.

According to our regression analysis, teachers' perceived ease of use of OERs and perceived usefulness of OERs were two significant predictors of their intention of OER adoption. Teachers' perceived usefulness was the stronger predictor of teachers' intention of OER adoption, compared to their perceived ease of use of OERs. This finding is consistent with previous research TAMs that indicated that teachers' intention to adopt new technology was influenced by the perceived ease of use and usefulness of that specific technology tool [12,21]. Tang et al. [12] also found that teachers' perceived usefulness was

a stronger predictor of their intention to adopt OERs than their perceived use of ease in their study that involved 68 teachers enrolled in an online course.

In terms of self-efficacy, teachers' OER self-efficacy was found to be significantly correlated with technology self-efficacy and technology integration self-efficacy. Teachers with higher confidence levels in using computers or incorporating technology into teaching were more likely to have higher levels of self-efficacy in using OERs. It makes sense that teachers who possess higher confidence levels in handling computer-related tasks or resolving relevant issues related to computer use are more likely to use OERs in teaching, as OERs are accessible through different websites or platforms, and the use of OERs often requires the use of the Internet and computers [3]. Teachers who have higher levels of confidence in incorporating various types of technology tools into teaching are more open to trying out new technology, such as OERs, and using it to enhance their teaching.

Based on the data analysis, factors such as ease of use, no cost, easy access, sharable features, saving course preparation time, etc., were found to be influential on teachers' decision to use or adopt OERs in their teaching. This result corresponds to the findings of an OER study conducted by Tang et al. [12]; teachers perceived OERs as easy to use and easily accessible. Similar to the quantitative part of this study, the ease of use of OERs was also identified as an important factor by teachers in our qualitative analysis. Our study also found that the use of OERs has the potential to improve differentiated instruction, which helps teachers to teach beyond the use of textbooks [10,14]. In addition, schools' technology infrastructure was another important factor that had an impact on teachers' decision to use OERs. Previous research indicated that an unsupportive environment or inadequate support would influence teachers' intention to use OERs [13].

The major challenges identified by teachers in this study included teachers not possessing enough knowledge of OERs, limited OER training opportunities, and issues related to the quality of OERs, the alignment of OERs to content or curriculum standards, technical support, students' ability to use OERs, etc. Similar to Tang's [13] study that investigated teachers' barriers to the use of OERs, quality assurance, technical support, and proficiency in finding OERs were some of the barriers that impeded teachers from using OERs. In our study, the two challenges we recorded, including concerns about OERs in terms of their alignment to content standards, and students not having the ability to use OERs appropriately, were not identified in prior research. Although OERs are free and easy to access, teachers prefer to have OERs that include information about how these resources are aligned with the standards of the content or curriculum they teach. In addition, students may not possess adequate knowledge or skills when using OERs, which may lead to plagiarism issues in students' submissions of assignments or homework.

7. Conclusions and Implications

Overall, in this study, K-12 teachers' perceptions towards the use or adoption of OERs in their teaching were quite positive in all six facets, including the perceived ease of use of OERs, perceived usefulness of OERs, intention to adopt OERs, attitude towards OERs, subjective norm regarding OERs, and OER self-efficacy. Teachers' perceived ease of use and perceived usefulness significantly predicted teachers' intention to adopt OERs. Compared to the perceived ease of use, perceived usefulness was found to be a stronger predictor of teachers' intention to use OERs. Teachers' technology self-efficacy and technology integration self-efficacy were positively related to their OER self-efficacy in a significant way. Qualitative analysis summarized the factors that had an influence on teachers' willingness to use or adopt OERs, as well as the factors concerning teachers' challenges with implementing OERs in their teaching.

The findings of this study provided practical implications for educators, administrators, course designers, and practitioners. First, training or professional development opportunities on OERs should be provided to teachers so that they are aware of OERs as learning resources that they can use freely and that are easy to use. Second, reaching out to teachers with low technology or technology integration self-efficacy, and providing

them with additional support will help increase their confidence in using OERs. Third, course designers should develop OERs that are in alignment with content or curriculum standards and pay attention to the quality of their OERs to motivate teachers to adopt them in their teaching. Last, sharing successful examples or cases may enhance teachers' interest in adopting OERs. There are several limitations of this study. The sample size of this study is small, and we suggest that future researchers include a larger sample in their research to further verify the findings of this study. In addition, we may not have captured all of the factors that had an influence on teachers' intention to adopt OERs in this study. There may be some other factors (e.g., self-efficacy, prior experiences, etc.) that are of importance to teachers from other cultures or countries and worth further investigation.

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