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# Exploring the Need for Using Digital Repositories to Enhance Teaching and Learning in Omani Schools: Teachers' Perceptions

Walid Aboraya 

Faculty of Graduate Studies of Education, Cairo University (Egypt)  
Faculty of Education, Arab Open University (Sultanate of Oman)

**Abstract.** The current study aims to investigate teachers' perceptions regarding the need to employ digital repositories (DRs) in Omani schools to enhance teaching and learning using interactive e-learning content. The study employed a mixed method approach and was carried out in two phases. Firstly, a survey was adopted to 120 teachers from 15 different schools in Muscat to explore the extent of the need for DRs. Secondly, semi-structured interviews were conducted with 9 teachers to validate the results and develop a deeper understanding. The research methods addressed three aspects: (1) the need for using DRs to support teachers, (2) to support students' learning, and (3) to enhance curriculum. The results of both methods were consistent and revealed that most teachers expressed the need for employing DRs in the educational process. Teachers believe that DRs are needed to support themselves and students' learning and to enhance the curriculum. Moreover, the interview analysis yielded an emergent theme related to some conditions raised by teachers to effectively use digital repositories. These conditions include (1) training, (2) educational content, (3) ease of use, (4) and developing a community for teachers and students. Based on the findings, the study introduced a framework for a dynamic DR to be used in Omani schools then proposed a plan to ensure the quality, effectiveness of usability, sustainability, and systematic implementation of DRs in Omani schools. Future studies are recommended to evaluate the use of systematically implemented DRs from the perspectives of all stakeholders, including students.

**Keywords:** digital repositories; learning objects; teachers' perceptions

## 1. Introduction

Online learning has grown in popularity because of its capacity to enable more flexible access to e-content and instruction at any time, from any location (Istambul, 2021; Castro & Tumibay, 2021). Many teachers and mentors become interested in online learning and use e-content to increase and improve students' learning despite a lack of resources, facilities, and equipment in their institutions.

Within the Mishra and Koehler (2006) TPACK framework, the problem with the current e-learning model in educational institutions can be identified in the lack of technological knowledge (TK) in general, technological content knowledge (TCK), and technological pedagogical knowledge (TPK) in particular. This relates to the ability to design learning situations depending on the use of technology (Heitink et al., 2017). This involves the creation of appropriate educational materials and learning objects (LOs), as well as the challenge of making them available to the intended students in the absence of a defined method for accessibility and utilization (Luís & Marcelino, 2022). There is also a gap in institutional and leadership conviction with attempts and efforts to introduce a clear-cut strategy to capitalize on this new situation, such as designing and producing LOs and learning materials under the supervision of government institutions, and then making them available in digital repositories (DRs) under a system of availability and support.

Digital repositories (DRs) are data storage systems designed to preserve and secure data for future use. When used in educational institutions, they are extremely useful. Teachers and students can use them to save and retrieve educational resources, whether face-to-face or online, to improve teaching and learning processes and make it simpler to attain desired learning results (Maldonado et al., 2016). Teachers may enhance their teaching techniques by depending on a variety of learning resources kept in repositories, and students can rely on them to suit their various learning needs.

The Omani experience in the field of DRs can be described as novel. By tracing the DRs in Oman, one can find that the most recent project launched is the Omani research repository "Shuaa" which was adopted by the Scientific Research Council in cooperation with Sultan Qaboos University (Main Library) to serve higher education level and above (Shuaa, 2022). Another project was done based on cooperation between the public and private sectors called "Masader". It aims to connect Oman's academic community to some of the world's best digital resources and support critical research activities across the country. This repository includes the latest books and research materials, with a number of links established with publishers, and the repository seeks to expand those links with other repositories as well (Masader, 2022).

In the field of pre-university education, the "Wathiq" portal is a private repository that support self-learning. It includes learning resources such as video lessons, summaries of lessons, and self-assessment tools. Students can access this portal using any device (Wathiq portal, 2022). However, this portal is limited to the eleventh and twelfth grades and requires an annual subscription. There is also the "Zawiti" portal which is affiliated to the Ministry of Education in Oman. It serves school education at all levels and includes a question bank in which all inquiries about the courses are collected and sorted according to each subject. Students use this platform to practice exams and to ascertain the nature of questions (Ministry of Education, 2022). However, this portal lacks different types of e-content and activities that can facilitate learning different school subjects.

Despite the efforts carried out in the field, learning objects repositories are still not a vital part of the educational system. Teachers do not often use these repositories and students do not rely on them much to enhance their learning.

Given the benefits of DRs, as well as the global consensus on their benefits for educational institutions and the growing demand for educational e-content in Omani schools, it is necessary to investigate the feasibility of designing and developing DRs to store LOs serving Omani curricula.

However, the decision to deploy technology in the classroom is frequently influenced by the views of each teacher (Boonmoh et al., 2021). Teachers' perceptions about the usefulness of DRs for them or their students can be key to better implementation (Yalcinalp & Emiroglu, 2012; Tang, 2020). Teachers tend to develop low perceptions surrounding the value of using technological tools in teaching if they feel that their needs are not met throughout the implementation process (Harrell & Bynum, 2018). As a result, the tools will not be used to their maximum potential, creating an internal barrier (Francom, 2020).

Although the Ministry of Education in the Sultanate of Oman is doing its best to develop teaching and learning, teachers' voices seem absent in regard to their perception of DRs and the benefit of using them in enhancing teaching and learning. The researcher could not find any study addressing this issue in the Omani context. That is why this study came to cover this gap in approaching teachers and understanding their perceptions of utilizing DRs.

Thus, the current study investigates teachers' perceptions about the need for DRs for use in teaching and learning in Omani schools.

To achieve this aim, the study tried to investigate teachers' perceptions from three aspects constituting the need for DRs. These aspects are as follows: supporting teachers, supporting students' learning, and enhancing the curriculum. Accordingly, three research questions were formulated, as follows:

1. What are teachers' perceptions about the need for using DRs to support teachers?
2. What are teachers' perceptions about the need for using DRs to support students' learning?
3. What are teachers' perceptions about the need for using DRs to enhance curriculum?

## **2. Literature review**

DRs are greatly beneficial when they are used in educational institutions. They can enhance teaching and learning processes and facilitate achievement of the intended learning outcomes. Teachers can depend on different LOs stored in the repositories to improve their teaching methods and students can change their learning styles to achieve their objectives. This part introduces DRs and general learning objects and addresses teachers' perceptions of DRs.

## 2.1 DR concept and advantages

In recent years, digital content has developed significantly. The availability of information and the exchange of ideas via the internet has become one of the most important issues that professionals are concerned with. As a result, several recommendations emerged regarding the necessity for constructing DRs that ease the process of searching, retrieving, and managing e-content.

In the context of education, a DR is defined as a database that collects and stores LOs with specified descriptions and metadata to make them available to beneficiaries (Bogucki, 2021). It can also be defined as a database that retains research work done by researchers in all scientific fields and can be accessed and searched using the web (Nayana & Pai, 2018). In the context of this study, DRs can be viewed as a large-scale database available on the internet that can be accessed and searched through an easy mechanism to enable both teachers and learners to reach and utilize the needed LOs in an easy and accurate way.

Nowadays DRs play an important role in providing users with easy and unconditional access to knowledge through the internet free of charge (Kati, 2021). They use indexing systems based on international coding standards which allow users to easily browse and find required content with the possibility of integration through content management and learning systems (Kati & Stukes, 2021).

One of the advantages of DRs is the possibility of providing access to all scientific output stored in it with the ability of preserving this scientific output for a long time. Also, they encourage communication between researchers from different specializations by providing access to the latest scientific output (Knight, 2018). In addition to this, they contain multiple patterns of knowledge and data that can be displayed in different ways. This knowledge is cumulative and is preserved and controlled through the policy of retention and accessibility set by the institution that owns the DR (Esquivel et al., 2021). DRs address the challenge of limited storage capacity in libraries, as they are distinguished by accommodating large data in a small storage space. The diversity of this data ranges from articles, conference works, reports, educational materials, multimedia and much more (Kati et al., 2019).

In general, researchers deal with DRs as a central archive for their intellectual production, increasing the chances of publication and accessibility. In turn, this increases the impact factor for this production, as well as informal arbitration through the possibility of publishing that which is difficult to publish through traditional means, such as videos, podcasts, or e-content (Esquivel et al., 2021).

There are numerous advantages to using DRs in the educational field. They help to enrich and enhance the exchange of knowledge across curricula, ease access to courses, facilitate the development process, and contribute to the possibilities of using inquiries and critical thinking-based learning strategies (Bakker & Rowan, 2018). Kovyazina (2019) added that repositories are of great importance to the educational field, as they contribute to saving time, cost and effort in the development and production of e-courses. They encourage teachers to employ guided discovery and different e-learning patterns, participate in creating content,

and reuse LOs in educational situations.

Several studies have focused on building DRs so that they simulate the capabilities of the semantic web (Arabshian et al. 2009; Drozdowicz et al., 2012). Among the recent studies in this area is the study of Poulakakis et al. (2016) who established a system to enhance digital learning resources with metadata and semantic data to facilitate the semantic search for the required resources in line with the education system in primary and secondary schools. Also, Zervas et al. (2016) developed a model for a metadata schema that reflected the learning resources present within the digital repositories. This model was built to support science, technology, engineering, and mathematics teachers in (STEM) schools so that they can share their lesson plans. The model was used to easily and effectively reach the resources that the teacher requires.

## **2.2 Learning objects repositories**

LOs are considered the main component of educational digital repositories. They aim to formulate the educational content into miniature elements that can be used individually to simulate an educational goal or be combined with other objects to simulate other goals. They work to meet learners' needs for knowledge and skills in a more effective and less costly manner. (Sek et al., 2012; Zimudzi, 2012; Turel & Gürol, 2011). They are also used to support exploration and problem-solving ability according to the educational goals the teacher wishes to achieve (Çakiroğlu et al., 2012). Therefore, digital LOs are considered an effective and economical tool in supporting learners in various educational situations.

Such LOs need to be stored in DRs so that they can be organized, accessible, and retrieved, otherwise they might be lost (Boté & Minguillón, 2012). There are many DRs that contain LOs, as reported by Vrana (2021), such as the Merlot repository in the United States, which includes links to metadata repositories and is considered an interface to other repositories; the Edna repository in Australia, which stores various forms of LOs such as images, text, presentations, and videos, and also contains links to other repositories; the Jorum repository in Britain and the CAREO repository in Canada, which contain a wealth of educational, training, and research resources, as well as LOs. Further, Mering (2019) mentioned other repositories such as the Encore repository, which encompasses a large number of educational materials provided with free access for teachers and learners, and the Maricopa repository that can be browsed by topic, author, publication date, or title and contains articles, periodicals, university theses, various presentations, images, and videos. Guan et. al. (2019) also referred to the LOs in the Wisconsin repository of educational materials, which includes hundreds of thousands of LOs such as presentations, images, and texts.

## **2.3 Teachers' perceptions of DRs**

Although much progress has been made in the design and implementation of DRs, the effectiveness of these repositories remains debatable. Many researchers argued that DRs and included learning objects would most likely become outdated if the functional use of such systems was not realized, or if the engagement of their dynamic users was not considered (Granić & Marangunić, 2019; Tang et al., 2020; Tang, 2020).

Teachers' perceptions can be defined as their ideas or mental images regarding their professional activities and students, which are influenced by their previous knowledge and life experiences and determine their professional behavior (Papadakis & Kalogiannakis, 2022). When teachers have limited knowledge about using a new technology in teaching and learning, they automatically generate opinions about it, some of which may be based on stereotypes. This inclination might lead to misunderstandings or misperceptions surrounding that technology.

The knowledge of teachers' views on the important aspects in repositories are supposed to aid designers, developers, and users of DRs in focusing on the primary concerns linked to improving the usefulness and efficiency of these repositories (Yalcinalp & Emiroglu, 2012). In order to successfully implement DRs in the educational system, Yalcinalp and Emiroglu (2012) surveyed 75 teachers to investigate their views about DRs after using learning objects repositories. Results yielded that DRs will only be used efficiently if some structural and usability factors are considered in designing DRs so that they reflect teachers' requirements, such as the usage of ontologies and the Semantic Web.

Further, Tang et al., (2020) attempted to gain a thorough knowledge of teachers' intentions for using OER in K-12 classrooms. Based on the teachers' view they recommended the following: to reinforce instructors' perceived ease of utilizing OER, repository designers must improve the design and function of the repository. Also, educators must help teachers engage in the production of open-licensed resources for K-12 students to ensure sustainability.

The above exhibits why the knowledge of teachers' perceptions about using DRs in education is an important factor that will help to implement DRs in the educational system in an effective way.

### **3. Methodology**

The current study employed a mixed method approach to explore the need for using DRs to enhance teaching and learning in Omani schools. This was achieved by mixing quantitative and qualitative data collection and triangulating the data to go beyond the limitation of a single method study by raising the level of credibility.

#### **3.1 Research Design**

To achieve the study objects, data was collected about teachers' perceptions regarding the need to use DRs from the following three aspects: to support teachers, to support students' learning, and to enhance the curriculum. The study was conducted in two stages, the first of which involved delivering the questionnaire to a group of 120 teachers. The second part involved the conduction of semi-structured interviews with a group of nine teachers selected from the questionnaire sample. The nine teachers were interviewed about the same constructs to gain a deeper understanding to the research constituents measured by the questionnaire.

### 3.2 Participants

First: the questionnaire sample consists of teachers from different disciplines distributed between 15 schools in Muscat. The questionnaire was available online and thus easily accessible for any teacher to fill it out. 120 teachers who returned the questionnaire in a complete form were considered the sample of the study. The research sample is characterized by certain features, including the following: all are teachers with various teaching experiences; mixed genders; teaching different subjects; and working in different districts in Muscat.

Second: the criterion for selecting the interview sample was derived through an evaluation of the questionnaire replies and a selection of the diverse rich responses to aid in the comprehension of the anomalies revealed by the questionnaire analysis. To begin the sample selection process, a postscript was added to the questionnaire asking participants to provide their contact information if they agreed to be interviewed. Nearly one quarter of the questionnaire sample (n=29) distributed over five schools expressed interest in conducting an interview and provided their contact details. Following this, a purposive “information-rich” sample was chosen from the available participants who varied according to their responses and characteristics. The final sample came to nine participants.

### 3.3 Research Methods

Using mixed methods to answer the research questions aids in triangulating the data, adding rigor, validating and reinforcing the findings, adding an additional dimension, and assisting with approaching the research questions from different angles and in greater depth. That is why the current study employed two methods: a questionnaire and semi-structured interviews.

#### 3.3.1 Questionnaire

Based on the literature review and the researcher’s experience, a questionnaire was constructed to elicit information regarding the three research questions. The questionnaire was designed based on a five-point Likert scale and was divided into three sections. Each section constitutes six items, as follows: section one relates to “Supporting teachers” in items 1 to 6; section two is about “Supporting students’ learning” through items 7 to 12; and section three relates to “Enhancing curriculum” over items 13 to 18.

#### 3.3.2 Semi-structured interviews

Based on the argument that using qualitative methods can help with the analysis of quantitative findings (Taguchi, 2018), so that the statistical analysis can examine different effects on a certain phenomenon and then explore the grounds and the reasons behind these effects by using other qualitative methods (Dixon-Woods et al., 2021), interviews were used as a second method of data collection.

The interview guide began with more generic questions regarding the three research questions, after which the rest of the questions were developed during the interview sessions, based on several issues raised throughout the discussion and connected to the key topics. The interview questions were piloted with two teachers before administering the main study.

### 3.4 Procedures

Before administering the survey to the targeted sample, the validity and reliability of the questionnaire were measured. The validity was checked by asking the opinion of experts in the field, who recommended to provide teachers with the definitions of the terms “Digital repositories” and “Learning Objects” before asking them to fill in the questionnaire. Thus, the meaning of both constructs was clearly written for participants to read in the introduction section of the survey. To check for reliability, the questionnaire was piloted on 20 teachers from different subject areas with different years of experience. Cronbach alpha coefficient was found to be (0.85), which means that the scale is reliable. Finally, the questionnaire was administered to 120 randomly selected teachers from 15 different schools in Muscat.

## 4. Results

The purpose of the results section is to present the research key findings from both quantitative and qualitative research methods. This presentation will assist in determining whether the quantitative and qualitative findings are consistent or inconsistent.

### 4.1 Quantitative analysis

The survey sample consisted of 120 teachers from different schools in Muscat. They represented all subjects taught in schools as well as gender (54% female and 46% male). Also, years of experience range was almost equally distributed among the sample as follows: 25.1% have work experience from 1 to 5 years, 23.6% have work experience from 6 to 10 years, 22.5% have work experience from 11 to 15 years, 28.8% have work experience more than 11 years. Finally, (79.4%) of them have not received any training on employing DRs in teaching.

Participants were asked to respond to 18 statements represented in a 5-point Likert-type scale, where ‘5’ represents the maximum score of the scale, ‘Strongly Agree’ and ‘1’ represents the minimum score, ‘Strongly Disagree’. To produce a meaning from the percentages in the following tables, the total percentage of “SA” and “A” were added together and considered to represent agreement; further, the total percentage of “SD” and “D” were added and considered to represent disagreement.

#### 4.1.1 Perceptions about using DRs to support teachers

The first section of the questionnaire aims to answer the first research question: “What are teachers’ perceptions about the need for using DRs to support teachers?”. Table (1) illustrates the frequencies and percentages of participants’ responses to each statement.

**Table 1. Perceptions about using DRs to support teachers**

<b>SD=Strongly Disagree. D=Disagree. N=neutral. A=Agree. SA=Strongly Agree</b>		<b>Frequencies, (percentages)</b>				
		<b>SA</b>	<b>A</b>	<b>N</b>	<b>D</b>	<b>SD</b>
1	DRs will help teachers to change their teaching approaches and styles to be more technologically based.	38, (31.7%)	59, (49.2%)	10, (8.3%)	7, (5.8%)	6, (5%)
2	Do you think that a repository is needed for promoting technological development and actively contributing to the spread of digital culture among teachers?	48, (40%)	62, (51.7%)	4, (3.3%)	4, (3.3%)	2, (1.7%)
3	Do you think that a repository will open the opportunity to share experiences and good practice among teachers?	47, (39.2%)	64, (53.3%)	6, (5%)	3, (2.5%)	-
4	DRs will encourage teachers to employ atypical teaching strategies.	24, (20%)	72, (60%)	18, (15%)	3, (2.5%)	3, (2.5%)
5	DRs can save teachers' time and efforts in preparing digital LOs to be used in various educational situations.	18, (15%)	64, (53.3%)	23, (19.2%)	13, (10.8%)	2, (1.7%)
6	DRs will enhance lesson planning to meet students' different characteristics.	24, (20%)	69, (57.5%)	20, (16.7%)	4, (3.3%)	3, (2.5%)

It is clear from Table (1) that most of the participants agreed or strongly agreed in the first rank about the ability of DRs to open the opportunity for teachers to share experiences and good practice among each other (92.5%; n=111). This indicates that teachers perceive DR to be a collaborative tool that can help them share their best practices together. This can happen by sharing opinions and discussions about LOs found in the repository for use in teaching to enhance students' learning.

Also, most participants agreed or strongly agreed to view the need for DR to promote teachers' technological development (91.7%; n=110), improve their teaching approaches and strategies (80.9%; n=97), and encourage teachers to employ atypical teaching strategies in the second, third, and fourth ranks respectively. This implies that teachers are aware of the importance of DRs to promote more technologically oriented teaching styles and practices.

The lowest ranked items were two that were related to enhancing lesson planning to meet students' different characteristics (77.5%; n=93) and saving teachers' time and efforts in preparing digital LOs to be used in various educational situations (68.3%; n=82). This indicates how teachers value the benefit of using DRs in improving their own work with less time and effort.

In general, it is obvious from table (2) that the total opinion of the teachers for the whole section tends to agree about the need for using a repository to support teachers in different aspects with (81.81%), total mean score (4), and standard deviation of (0.66).

**Table 2. Total perceptions about using DRs to support teachers**

Theme	Percentage					Mean	St.D
	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree		
Total Teachers' support	27.64%	54.17%	11.25%	4.72%	2.22%	4.00	0.66

#### 4.1.2 Perceptions about using DRs to support students' learning

The second section of the questionnaire aims to answer the second research question "What are teachers' perceptions about the need for using DRs to support students' learning?". Table (3) illustrates the frequencies and percentages of participants' responses to each statement.

**Table 3. Perceptions about using DRs to support students' learning**

SD=Strongly Disagree. D=Disagree. N=neutral. A=Agree. SA=Strongly Agree		Frequencies, (percentages)				
		SA	A	N	D	SD
Statement						
1	DRs help students to be active learners.	42, (35%)	70, (58.3%)	6, (5%)	2, (1.7%)	-
2	Using DRs will increase the opportunity for students' collaboration.	23, (19.2%)	59, (49.2%)	24, (20%)	9, (7.5%)	5, (4.2%)
3	Using DRs can help students to be engaged to learning	26, (21.7%)	64, (53.3%)	18, (15%)	10, (8.3%)	2, (1.7%)
4	DRs will help students to achieve higher order thinking skills.	19, (15.8%)	55, (45.8%)	28, (23.3%)	12, (10%)	6, (5%)
5	Using DRs will increase students' motivation to learn.	53, (44.2%)	65, (54.2%)	2, (1.7%)	-	-
6	DRs will enhance students' learning.	27, (22.5%)	67, (55.8%)	15, (12.5%)	9, (7.5%)	2, (1.7%)

It is evident from table 3 that the most agreed statement among the participants is item number 5 which came in the first rank. Almost all teachers agreed and strongly agreed that using DRs will increase students' motivation to learn (98.4%; n=118). They believe that such repositories will transform students into active learners (93.3%; n=112) and enhance their learning experience (78.3%; n=94). Also, most teachers reported that there is a need for the use of DRs to assist student engagement with learning (75%; n=90).

Although most teachers perceive the need for using DRs in students' learning, they were less confident about the need to use DRs in increasing students' collaboration (68.4%; n=82) and achieving higher order thinking skills (61.6%;

n=74). These two items were ranked the least among the six items in the whole section.

In general, this section indicates the importance of having DRs in Omani schools, as reported by teachers; it encourages the constructivism approach in teaching students. It is obvious from table (4) that the collective teacher opinion for the whole section tends to agree about the need for the use of a repository to support students in learning (79.17%), total mean score (3.96), and standard deviation of (0.64).

**Table 4. Total perceptions about using DRs to support students' learning**

Theme	Percentage					Mean	St.D
	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree		
Total Students' support	26.39%	52.78%	12.92%	5.83%	2.08%	3.96	0.64

#### 4.1.3 Perceptions about using DRs to enhance curriculum

The third section of the questionnaire aims to answer the third research question "What are teachers' perceptions about the need for using DRs to enhance curriculum?". Table (5) illustrates the frequencies and percentages of participants' responses to each statement.

**Table 5. Perceptions about using DRs to enhance curriculum**

SD=Strongly Disagree. D=Disagree. N=neutral. A=Agree. SA=Strongly Agree		Frequencies, (percentages)				
		SA	A	N	D	SD
1	DRs will enhance the educational content.	43, (35.8%)	74, (61.7%)	2, (1.7%)	1, (0.8%)	-
2	DRs will enable active learning environments by providing various ideas for activities.	30, (25.4%)	50, (42.4%)	25, (21.2%)	11, (9.5%)	4, (3.4%)
3	Do you think that repository is needed for enhancing teaching and learning processes?	40, (33.3%)	65, (54.2%)	11, (9.2%)	3, (2.5%)	1, (0.8%)
4	DRs will encourage the generation of ideas about improving formative assessment and evaluation in the educational situations	23, (19.2%)	48, (40%)	27, (22.5%)	12, (10%)	10, (8.3%)
5	Do you think that a repository is needed for achieving educational objectives in your subject?	32, (26.7%)	54, (45%)	18, (15%)	11, (9.2%)	5, (4.2%)
6	DRs can be used to simplify complex and abstract concepts.	43, (35.8%)	66, (55%)	6, (5%)	4, (3.3%)	1, (0.8%)

As shown in table 5, most teachers agreed and strongly agreed about two items which reflect the need for DRs to enhance the educational content (97.5%; n=117) and simplify complex and abstract concepts (90.8%; n=109). They were ranked as the first two items, respectively. This indicates that teachers need digital content to support students' learning which will positively reflect on the whole teaching and learning processes. The second two ranked items reflected the need to use repositories to enhance teaching and learning processes (87.5%; n=105) and achieve educational objectives (71.7%; n=86). The two lowest ranked items related to enabling active learning environments by providing various ideas for activities (70.8%; n=85) and encouraging the generation of ideas about improving formative assessments and evaluation in educational situations (59.2%; n=71). This indicates how teachers value the benefit of using DRs in supporting the curriculum in terms of providing innovative ideas for activities and better assessment.

In general, this section indicates the importance of having DRs in Omani schools to enhance curriculum as reported by the teacher. It is obvious from table (6) that the total opinion of the teachers for the whole section tends to agree regarding the need for use of a repository to support and enrich the curriculum (78.89%), total mean score (3.97), and standard deviation of (0.65).

**Table 6. Total perceptions about using DRs to enhance curriculum**

Theme	Percentage					Mean	St.D
	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree		
Total Curriculum enhancement	29.31%	49.58%	12.36%	5.83%	2.92%	3.97	0.65

#### 4.1.4 Total teachers' perceptions about the need to have DRs in Omani schools

Overall, the total percentage of teachers who agreed and strongly agreed about the need to have DRs in Omani schools from the three aspects (teachers' support, students' support, and curriculum enhancement) is (79.96%), with a total mean score of (3.98) and standard deviation of (0.65). The high total mean scores in the three sections, as well as the overall total, reflects the extent to which teachers believe that there is a real need to use DRs in their schools.

**Table 7. Total teachers' perceptions about the need to have DRs in Omani schools**

Theme	Percentage					Mean	St.D
	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree		
Total Support Teachers	27.64%	54.17%	11.25%	4.72%	2.22%	4.00	0.66
Total support students' learning	26.39%	52.78%	12.92%	5.83%	2.08%	3.96	0.64
Total enhance Curriculum	29.31%	49.58%	12.36%	5.83%	2.92%	3.97	0.65
Total Perceptions	27.78%	52.18%	12.18%	5.46%	2.41%	3.98	0.65

## 4.2 Qualitative analysis

Interviews with nine teachers were conducted, recorded, and transcribed. Following full transcription, data was reviewed word by word and line by line, keywords were assigned as first-level codes beside each paragraph, and labels were assigned to each group of words. Labels were grouped to form categories in the second level of coding. With my research questions in mind, I was able to sort these categories into two themes: those that are directly related to the research questions (main themes) and those that are emergent and can be linked in some way (indirectly) to the research questions (emergent themes).

Results showed three main themes (teacher's support, students' support, and enhancement of curriculum) and one emergent theme (conditions for use), as shown in figure 1.



**Figure 1. Interview Themes**

### 4.2.1 Main themes

The interview analysis yielded three main themes reflecting the research questions: (1) teachers' support, (2) students' learning support, and (3) enhancement of curriculum. Teachers seem to be aware about the importance and benefits of using DRs in general. They believe that using LOs and digital repositories as technological tools will help them overcome many challenges they face with the sudden shift that occurred from face-to-face to online teaching due to the Covid-19 pandemic. They view such kind of practices as an opportunity for them to promote their own technological competencies.

*"I am sure that if that repository was there, I would have taught online in a better way. I heavily depended solely on YouTube videos, and it was not directly related every time."* Interviewee H

Teachers agreed that using DRs and LOs will engage students to learning, increase their motivation, and help them achieve learning outcomes.

*"I am sure that Learning objects designed specially to address the schoolbook will highly engage students in the lessons and facilitate understanding many ideas."* Interviewee H

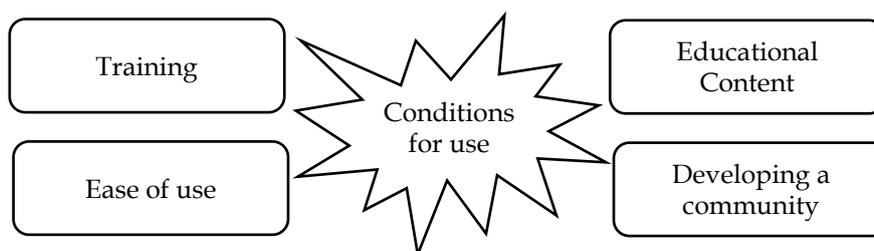
They also believe that using LOs will simplify the complex and abstract concepts in the curriculum and facilitate self-learning for them as they are dependent on multimedia and include many activities.

*"I think such repository was needed to support us in the period of online teaching during the pandemic. We suffered a lot to find e-content matching the schoolbook."* Interviewee H

*"...if there were specially designed learning objects addressing our curriculum, I think teachers will compete to use them."* Interviewee H

#### 4.2.2 Emergent themes

"Conditions for use" is one emergent theme that came out of the interview analysis. This theme was coded and analyzed in the following categories: (1) training, (2) educational content, (3) ease of use, (4) and developing a community. See figure 2.



**Figure 2. Interview emergent issues**

In general, teachers confirmed the need for employing DRs and LOs in teaching and learning. However, they raised many conditions for that use to be successful. Five teachers (55.6%) emphasized the importance of changing their teaching styles and approaches in such new educational settings, which is why they assured that they must be trained on appropriately utilizing LOs and DRs to enhance the teaching and learning process.

*"We have to be trained first how to utilize DRs while teaching."*  
Interviewee H

Most of them (7 teachers, 77.8%) believe that the content of LOs should directly reflect the taught lessons, be presented in the taught language, and always be up to date.

*"We need local content in our language and reflecting the taught topics in the book."* Interviewee B

*"We suffer of the lake of Arabic e-content addressing the schoolbook"*  
Interviewee D

They assured the importance of providing a user-friendly interface and accessible platforms. Four teachers (44.4%) confirmed the need of having small size LOs that can be viewed and downloaded easily because of the poor internet connection they have.

*"Learning objects should be small in size or even used offline as the network here is not fast."* Interviewee A

Also, three teachers (33.3%) highlighted the need for the LOs to be editable and for there to be an option to upload their own objects.

*"I think it will be great If I can edit the learning objects to match my objectives in the lesson and focus on a certain part only."* Interviewee C

Finally, most of the teachers (8 teachers, 88.9%) raised the issue of developing a community within the DR so that teachers as well as students can communicate their experiences with the use of LOs in teaching and learning, and to also share good practices.

*“Allowing teachers from the same discipline to share best practices will be a great addition, I need to see some examples from my colleagues to build on.” Interviewee A*

*“We have some experienced teachers here in using technology, they can help us to make model lessons.” Interviewee H*

*“Allowing students to communicate with each other, rate the learning objects, comment, and reflect on their experience, will engage them in learning without they even realize that.” Interviewee E*

## 5. Discussion

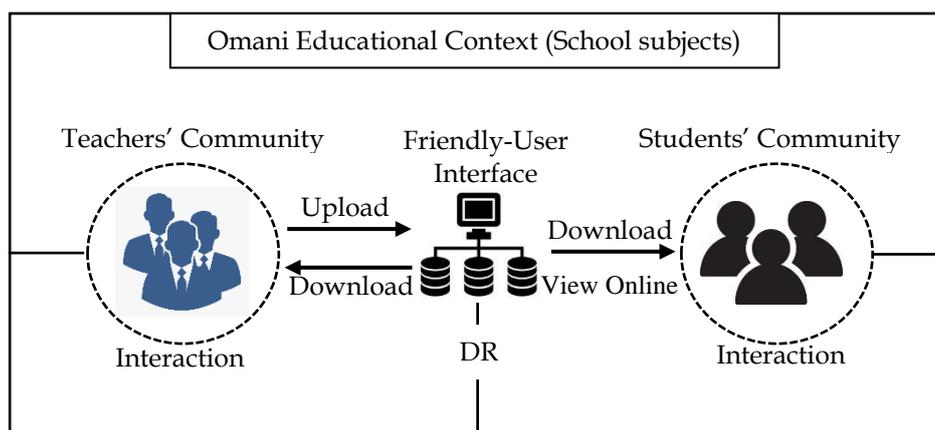
The findings of the questionnaire and the interviews were both compatible. They have shown a clear need to use DRs to enhance teaching and learning in Omani schools. Needs were reported on three levels; needs to support teachers, needs to support students' learning, and needs to enhance curriculum. Teachers believe that such a repository will raise both their technological and pedagogical skills. The response of the teachers in general implies that if we put a DR in use, including LOs related to the curriculum taught in Omani schools, it will be accepted from the teachers' side. Further, it can promote teaching and learning if conditions raised in interviews related to training, educational content, ease of use, and development of a community are implemented.

The responses on both research methods shed the light on the design and implementation of digital repositories. In the questionnaire, the highest ranked statement in the teachers' needs was that the repository will open the opportunity to share experiences and good practice among teachers. Also, in the interviews, most teachers asked for the need for teachers and students to communicate their experiences and share best practices together. This possibility needs to be considered while developing a DR, where such a repository should have the ability to make teachers communicate and collaborate to share their experiences of using specific LOs in different learning situations. Also, the possibility for them to modify or add their own LOs to the database will be an advantage for them to peer review each other and develop their pedagogical skills in using technology-based education. This is consistent with Arcos et al. (2017) who argue that repositories are designed not only to store and disseminate objects, but also to allow users to collaborate by reviewing, commenting on, and rating the content they access.

Apparently, this can assist teachers to change their teaching approaches and styles to be more technologically based and will encourage teachers to employ atypical teaching strategies. This idea is supported by Wenger (1998), by the Community of Practice where teachers from different schools in Oman will be allowed through the DR to form a group which shares the same concerns, interacts regularly, and learns from each other how to overcome their problems effectively.

The same argument can be extended to students themselves, where creating a community for them in the DR will increase the opportunity for students' collaboration. This is confirmed by Atenas and Havemann (2013) who assured that quality repositories serve as a place for users to interact and form communities of practice. Such practice will help them become active learners, allow them to be engaged more to learning, and raise their motivation to learn as reported by teachers.

As for the third type of needs related to the curriculum, the highest mean scores were given to enhancing the educational content and simplifying complex and abstract concepts. This is also consistent with the interview findings. Similarly, when dealing with the curriculum within this collaborative environment, teachers can improve the way a curriculum is introduced to students through sharing experiences, modifying LOs and updating the way they are used in teaching. Such results might shed light on the need to create a dynamic warehouse model to contain local LOs that emulate the taught subjects in Omani schools and allow teachers and students to communicate and interact for better utilization. (See figure 3).

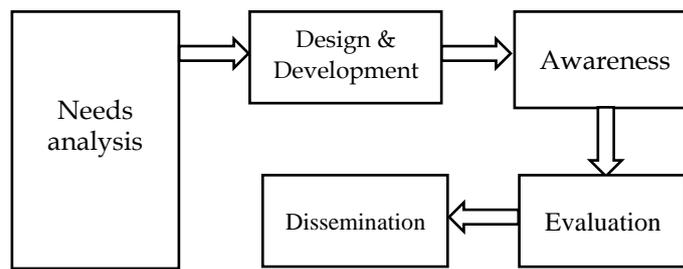


**Figure 3. Dynamic Digital Repository for Omani schools**

Based on the research methods findings, figure 3 shows how the DR can benefit Omani schools if it is designed according to their perceptions of DRs and how they can use it in teaching and learning. This is consistent with Yalcinalp and Emiroglu (2012) and Tang et al., (2020). The figure addresses how DRs can support teacher and student learning within the context of the local curriculum. Also, it shows DRs can allow teachers and students to interact and share best practices while using the DR in relation to school subjects in the Omani context. This is anticipated to aid in the promotion of teaching and learning experiences.

The DRs should be under the control of the Ministry of Education in order to ensure the sustainability and quality of the LOs, as well as their ability to achieve the required goals for educational institutions in light of modern technology. Based on the questionnaire results and interview analysis, the study proposes a comprehensive plan for implementing DRs in school education in Oman as follows:

The proposed plan consists of six stages as follows (see figure 4):



**Figure 4. The proposed plan for developing and employing DRs in Omani schools**

The first stage (needs analysis): seeks to identify the actual needs of schools in developing the DRs. This will primarily be determined by stakeholder needs. Information about the project must be gathered in terms of design, production, and implementation at this stage in line with teachers' needs. This also includes information about curriculum and learning materials. Analyzing human resources in schools and identifying needs and levels of expertise for both teachers and students are also required at this stage. Furthermore, it is critical to determine the availability of technical support as well as the quality of the internet connection. Finally, the financial aspect will be examined in terms of the cost of materials and software, with the goal of obtaining financial assistance from the local community.

Stage two (design & development): Based on the analysis of the interview results, the design stage reflects emergent themes related to "educational content", "developing a community" and "ease of use". The latter can be addressed by following the Human Computer Interaction (HCI) Principles in the design (Al Mahdi et al., 2019). Also, this phase can be addressed by applying the Dynamic DR (see figure 3).

Accordingly, the repository can be designed and developed with the following features:

- Unrestricted access to digital content for all teachers and students.
- The digital content in Omani schools should be localized and cover all school subjects and scientific disciplines at all grade levels.
- DR should allow and encourage teachers to upload their own lesson plans for use by other teachers and students.
- DR should encourage interaction between teachers and students so that they can share best practices and ideas for reusing digital learning objects in a variety of educational settings. This will assist teachers in improving their pedagogical skills and developing novel teaching methods and strategies for use in teaching and learning.
- DR should protect the intellectual property of knowledge resource owners and encourage them to participate more.
- Refreshing digital content on a regular basis.
- A user-friendly interface, as well as adhering to the appropriate technical and educational standards when developing the repository

Stage three (raising awareness): Based on the analysis of the interview results, the awareness stage reflects the emergent theme related to “training”. This stage aims to establish mechanisms for increasing beneficiary awareness of the importance of incorporating the DR into the educational process and improving teaching and learning. Also, this is to provide appropriate pedagogical training for teachers and students in order for them to efficiently utilize the repository.

Stage four (evaluation): aims to pilot the repository and assess its usability from the perspective of the beneficiaries, where we can gather feedback and users' opinions about the content, ease of use of the repository, and the extent to which it is beneficial in the teaching and learning process.

Stage five (dissemination): This is the final stage, in which the repository is made available on the internet so that it can be used in more than one school and is easily accessible to both teachers and students.

## **6. Conclusion and future work**

DRs are one of many advanced systems for e-learning and distance learning that can hold a wealth of information and useful elements for achieving educational objectives. They may contain many digital LOs, which can provide an enhanced educational environment in which these elements can be easily reused in various educational situations based on the needs of each educational situation. The power of this study is that it reflects teachers' perceptions about using such technology in teaching and learning. Suggestions of the study are based on their teachers' perceptions as they can be a key to better implementation. According to the findings, DRs are required in Omani schools on three levels of needs: teachers' support, students' learning support, and curriculum enhancement. The suggested Dynamic DR model assimilates all these needs to ensure better operation. Also, based on the findings and the suggested Dynamic DR model, a proposed plan for developing and employing digital repositories in Omani schools is introduced. This will ensure the systematic implementation of DRs in Omani schools under the control of the Ministry of Education to ensure quality, effectiveness of usability, and sustainability. Additionally, the current study will help to establish the concepts of "free and open access" to educational content within the context of Omani schools, where teachers and students will be able to browse, download, edit, and upload content at any time using a dynamic DR that provides open interactive e-learning content to improve teaching and learning processes in Omani schools. Future studies are to work on the evaluation of the feasibility of using DRs after implementing them in a systematic way. The evaluation should go beyond knowing teachers' perceptions to trying to understand how this practice was beneficial to students themselves and their views about improvement.

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## 8. References

- Al Mahdi, Z., Rao Naidu, V., & Kurian, P. (2019). Analyzing the Role of Human Computer Interaction Principles for E-Learning Solution Design. In Al-Masri, A., Curran, K. (eds) *Smart Technologies and Innovation for a Sustainable Future. Advances in Science, Technology & Innovation.* (pp. 41-44). Springer, Cham. [https://doi.org/10.1007/978-3-030-01659-3\\_6](https://doi.org/10.1007/978-3-030-01659-3_6)
- Arabshian K., Dickmann C., & Schulzrinne H. (2009) Ontology-Based Service Discovery Front-End Interface for GloServ. In: Aroyo L. et al. (eds) *The Semantic Web: Research and Applications. ESWC.* Lecture Notes in Computer Science, vol 5554, pp. 684-696, Springer, Berlin, Heidelberg. [https://doi.org/10.1007/978-3-642-02121-3\\_50](https://doi.org/10.1007/978-3-642-02121-3_50)
- Atenas, J., & Havemann, L. (2013). Quality assurance in the open: an evaluation of OER repositories. *International Journal for Innovation and Quality in Learning*, 1(2), 22-34. <https://eprints.bbk.ac.uk/id/eprint/8609>
- Bakker, R., & Rowan, K. (2018). Benefits and Challenges of Building and Managing Your Own Digital Repository. *Collections: A Journal for Museum and Archives Professionals*, 13(3/4), 265.
- Bogucki, J. (2021). The Rationale for a Digital Repository in the Cloud. *Library Technology Reports*, 57(5), 5-7. <https://www.proquest.com/scholarly-journals/chapter-1-rationale-digital-repository-cloud/docview/2556925769/se-2?accountid=145454>
- Boonmoh, A., Jumpakate, T., & Karpklon, S. (2021). Teachers' perceptions and experience in using technology for the classroom. *Computer-Assisted Language Learning Electronic Journal*, 22(1), 1-24. <http://callej.org/journal/22-1/Boonmoh-Jumpakate-Karpklon2021.pdf>
- Boté, J., & Minguillón, J. (2012). Preservation of learning objects in digital repositories. *Revista de Universidad y Sociedad del Conocimiento* 9, 217-230. <https://doi.org/10.7238/rusc.v9i1.1036>
- Çakiroglu, Ü., Baki, A., & Akkan, Y. (2012). The effects of using learning objects in two different settings. *The Turkish Online Journal of Educational Technology*, 11(1), 181-191. <http://www.tojet.net/articles/v11i1/11117.pdf>
- Castro, M. D. B., & Tumibay, G. M. (2021). A literature review: efficacy of online learning courses for higher education institution using meta-analysis. *Education and Information Technologies*, 26(2), 1367-1385. <https://doi.org/10.1007/s10639-019-10027-z>
- Arcos, B., Faems, B., Comas-Quinn, A., & Pulker, H. (2017). Teachers' Use and Acceptance of Gamification and Social Networking Features of an Open Repository. *European Journal of Open, Distance and E-learning*, 20(1), 127-138. <https://doi.org/10.1515/eurodl-2017-0008>
- Dixon-Woods, M., Fitzpatrick, R., & Roberts, K. (2001). Including qualitative research in systematic reviews: opportunities and problems. *Journal of evaluation in clinical practice*, 7(2), 125-133. <https://doi.org/10.1046/j.1365-2753.2001.00257.x>
- Drozdowicz, M., Ganzha, M., Paprzycki, M., Szymeja, P., & Wasielewska, K. (2012). Onto play-a flexible user-interface for ontology-based systems. In *AT*, 86-100. [https://www.ibspan.waw.pl/~paprzyck/mp/cvr/research/AiG\\_papers/AT\\_Dubrovnik\\_2012.pdf](https://www.ibspan.waw.pl/~paprzyck/mp/cvr/research/AiG_papers/AT_Dubrovnik_2012.pdf)
- Esquivel, A., Fluhr, T., & Strohm, A. (2021). Leveraging the flexibility of Islandora to create a dual-use digital repository. *Journal of digital media management*, 9(2), 153-163. <https://www.henrystewartpublications.com/jdmm/v9>
- Francom, G. M. (2020). Barriers to technology integration: A time-series survey study. *Journal of Research on Technology in Education*, 52(1), 1-16. <https://doi.org/10.1080/15391523.2019.1679055>
- Guan, B., Hu, L., Liu, P., Xu, H., Fu, Z., & Wang, Q. (2019, July). DpSmart: a flexible group-

- based recommendation framework for digital repository systems. In *IEEE International Congress on Big Data*, 111-120. <https://doi.org/10.1109/BigDataCongress.2019.00028>
- Granić, A., & Marangunić, N. (2019). Technology acceptance model in educational context: A systematic literature review. *British Journal of Educational Technology*, 50(5), 2572–2593. <https://doi.org/10.1111/bjet.12864>
- Harrell, S., & Bynum, Y. (2018). Factors affecting technology integration in the classroom. *Alabama Journal of Educational Leadership*, 5, 12-18. [https://www.icpel.org/uploads/1/5/6/2/15622000/ajel\\_volume\\_5\\_2018.pdf#page=20](https://www.icpel.org/uploads/1/5/6/2/15622000/ajel_volume_5_2018.pdf#page=20)
- Heitink, M., Voogt, J., Fisser, P., Verplanken, L., & van Braak, J. (2017). Eliciting teachers' technological pedagogical knowledge. *Australasian Journal of Educational Technology*, 33(3), 96-109. <https://doi.org/10.14742/ajet.3505>
- Istambul, M. R. (2021). Strategy for Implementing Elearning to Achieve Outcome-Based Education. *Turkish Journal of Computer and Mathematics Education (TURCOMAT)*, 12(4), 847-851. <https://doi.org/10.17762/turcomat.v12i4.572>
- Kati, R. (2021). *The Carolina Digital Repository During COVID-19: Responding to a Pandemic*. <https://doi.org/10.17615/2btt-rt57>
- Kati, R., Smith, J., & Rudder, J. (2019). *Implementing a new Carolina Digital Repository: communities, customizations, and change*. <https://doi.org/10.17615/cmp3-kb13>
- Kati, R., & Stukes, D. (2021). *Facilitating Access: Remediating Accessibility in the Carolina Digital Repository*. <https://doi.org/10.17615/6v74-x862>
- Knight, F. T. (2018). *Osgoode Digital Commons: Digital Repository Success Stories*. <https://digitalcommons.osgoode.yorku.ca/librarians/26/>
- Kovyazina, E. V. (2019). The Digital Repository Integration with External Information Services. <http://ceur-ws.org/Vol-2569/short11.pdf>
- Luís, C., Marcelino, M.J. (2022). Accessibility and Usability in Learning Objects. In: Mesquita, A., Abreu, A., Carvalho, J.V. (eds) *Perspectives and Trends in Education and Technology. Smart Innovation, Systems and Technologies* (Vol. 256), 83–92. Springer, Singapore. [https://doi.org/10.1007/978-981-16-5063-5\\_7](https://doi.org/10.1007/978-981-16-5063-5_7)
- Maldonado, J. J., Bermeo, J. L., & Pacheco, G. (2016). Assessing a Methodological Proposal for the Design, Creation and Evaluation of Learning Objects Oriented to Educators with Diverse Educational and Technological Competencies. *CLEI Electronic Journal*, 19(1), 1-19. <https://doi.org/10.19153/cleiej.19.1.3>
- Masader. (2022). *Overview*. <https://www.masader.om/overview>
- Mering, M. (2019). Transforming the quality of metadata in institutional repositories. *The Serials Librarian*, 76(1-4), 79-82. <https://doi.org/10.1080/0361526X.2019.1540270>
- Ministry of Education. (2022). *Zawity*. <https://zawity.moe.gov.om/index.php>
- Mishra P., & Koehler M. J. (2006) Technological pedagogical content knowledge: A framework for teacher knowledge. *Teachers College Record*, 108(6), 1017–1054. <https://doi.org/10.1111/j.1467-9620.2006.00684.x>
- Nayana, R., & Pai, R. D. (2018). Publishing in Digital Repository: Author Perspective Study. *Library Philosophy and practice*. <http://eprints.manipal.edu/id/eprint/153054>
- Papadakis, S., & Kalogiannakis, M. (2022). Exploring preservice teachers' attitudes about the usage of educational robotics in preschool education. In *Research Anthology on Computational Thinking, Programming, and Robotics in the Classroom* (pp. 807-823). IGI Global. <https://doi.org/10.4018/978-1-7998-4576-8.ch013>
- Poulakakis, Y., Vassilakis, K., Kalogiannakis, M., & Panagiotakis, S. (2016). Ontological modeling of educational resources: a proposed implementation for Greek schools,

- Educ Inf Technol*, 22:1737–1755. <https://doi.org/10.1007/s10639-016-9511-z>
- Shuaa Oman Research Repository. (2022). About Shuaa: *Vision and Mission*. <https://shuaa.om/about/vision?locale-attribute=en>
- Sek, Y. W., Law, C. Y., & Lau, S. H. (2012). The effectiveness of learning objects as alternative pedagogical tool in laboratory engineering education. *International Journal of e-Education, e-Business, e-Management and e-Learning*, 2(2), 145-151. <http://www.ijeeee.org/Papers/098-Z00081F00021.pdf>
- Taguchi, N. (2018). Description and explanation of pragmatic development: Quantitative, qualitative, and mixed methods research. *System*, 75, 23-32. <https://doi.org/10.1016/j.system.2018.03.010>
- Tang, H. (2020). A Qualitative Inquiry of K-12 Teachers' Experience with Open Educational Practices: Perceived Benefits and Barriers of Implementing Open Educational Resources. *International Review of Research in Open and Distributed Learning*, 21(3), 211-229. <https://doi.org/10.19173/irrodl.v21i3.4750>
- Tang, H., Lin, Y. J., & Qian, Y. (2020). Understanding K-12 teachers' intention to adopt open educational resources: A mixed methods inquiry. *British Journal of Educational Technology*, 51(6), 2558-2572. <https://doi.org/10.1111/bjet.12937>
- Turel, Y. K., & Gürol, M. (2011). Comprehensive evaluation of learning objects-enriched instructional environments in science classes. *Contemporary Educational Technology*, 2(4), 264-281. Retrieved from <https://dergipark.org.tr/en/pub/cet/issue/25726/271443>
- Vrana, R. (2021). Open educational resources (OER) as means of promotion of open education. In *44th International Convention on Information, Communication and Electronic Technology (MIPRO)*. IEEE, 576-581. <https://doi.org/10.23919/MIPRO52101.2021.9596873>
- Wathiq Portal. (2022). *What does Wathiq Gateway offer you?* <https://www.ewathiq.com/wathiq/mod/page/about.php>
- Wenger, E. (1998). *Communities of Practice: Learning, Meaning, and Identity*. Cambridge: Cambridge University Press. ISBN 978-0-521-66363-2.
- Yalcinalp, S., & Emiroglu, B. (2012). Through efficient use of LORs: Prospective teachers' views on operational aspects of learning object repositories. *British Journal of Educational Technology*, 43(3), 474-488. <https://doi.org/10.1111/j.1467-8535.2011.01212.x>
- Zervas, P., Tsourlidaki, E., Cao, Y., Sotiriou, S., Sampson, D. G., & Faltin, N. (2016). A study on the use of a metadata schema for characterizing school education STEM lessons plans by STEM teachers. *Journal of Computing in Higher Education*, 28(3), 389-405. <https://doi.org/10.1007/s12528-016-9113-1>
- Zimudzi, E. (2012). Web-based learning objects for senior school computer studies, *Asian Journal of management sciences and education*, 1(1), 52-62. <https://docplayer.net/14313988-Web-based-learning-objects-for-senior-school-computer-studies-abstract.html>