



# The Impact of Open Educational Resource Professional Development for Teachers in Secondary Education

RESEARCH ARTICLE

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## ABSTRACT

Scholars suggest that when teachers retain, reuse, revise, remix, and redistribute Open Educational Resources (OER), the process of OER-enabled Pedagogy (OEP), they not only gain high-quality, digital teaching materials, but they also transform their teaching (Wiley, et al., 2017). Nonetheless, OEP is not an automatic outcome of using OER, rather it is dependent upon practicing key competencies through strategic professional development (PD). This paper reports a mixed-methods case study that contemplates the impacts of PD on OEP with five secondary education teachers, an under-investigated population. The findings reveal that small-scale PD can be successful in growing knowledge about OER, but that OEP is only catalyzed when teachers are required to reuse the OER in their classroom. Furthermore, small-scale PD cannot combat barriers like digital and information literacy that impede engagement in OEP efficiently and this may ultimately prohibit its sustainability in secondary contexts.

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There are many reasons to advocate that teachers adopt and adapt Open Educational Resources (OER). Scholars suggest that when teachers retain, reuse, revise, remix, and redistribute OER, the process of OER-enabled Pedagogy (OEP), they not only gain high-quality, digital teaching materials, but they also transform their teaching (Van Allen & Katz, 2019; Wiley, et al., 2017). OEP has also been shown to increase teacher collaboration and networking and stimulate reflection on one's teaching practices (Baas, et al., 2019). This is especially important for secondary teachers where resources may be outdated or lacking altogether and where curricula and course materials are dependent upon decisions imposed by school districts or states. The challenge is that OEP is not a passive process, nor does it automatically occur simply by using OER. Rather, OEP is dependent upon learning key OER competencies that must be targeted in strategic professional development (PD). While research has demonstrated the benefits OER and OEP offer, it is still unclear what approaches to PD are effective so that OEP can be sustainable to secondary teachers, an under-investigated population, specifically.

This paper presents the findings from a mixed-methods case study that corresponds to the second cycle within a Design-Based Research (DBR) Framework adapted from Palalas and Hoven (2013). Five secondary world language teachers engaged in a one-hour synchronous training and asynchronous activities (the PD treatment) to understand the short-term impacts on their knowledge and perception of OER, as well as their behavior in OEP as a result of retaining, reusing, and revising an ancillary activity from the Pathways Project (PP) repository to support prek-16 world language teaching. Ancillary OER (i.e., activities, and media) have been found to be favorable to secondary teachers (compared to OER textbooks) because they can be integrated *within* a curriculum rather than imposing on one (Blomgren, 2018). Yet, the impacts of ancillary OER are less understood than OER textbooks. In this study, there were two treatments (pre and post classroom implementation) and data collection included two video enactments, a survey, and semi-structured interviews. The findings and implications of this research are relevant to teacher educators and educational leaders of any discipline who want to facilitate successful PD in the future.

## LITERATURE

Previous secondary OER research has demonstrated that teachers' perceptions of OER improve because of engaging in OEP (Karunanayaka et.al, 2015). Tang (2020) found that teachers' attitudes became more positive, and they perceived themselves to be better at finding OER by the end of a 16-week study. However, finding and adopting OER is only part of the equation; the ability to *adapt* OER is the characteristic that distinguishes OER from open access or other copyrighted digital materials. Creative Commons licenses, for example, invite and allow users to make changes to material as well as delineate how a revised or remixed material can be redistributed. Blomgren (2018) remarks that secondary teachers can take advantage of OER to personalize their instruction to enhance diversity as well as to differentiate learning to be more inclusive of students' needs. This heightens teacher creativity and encourages collaboration (Baas et al., 2019). Nonetheless, adapting OER requires skills that must be learned and practiced. Wolfenden and Adinolfi (2019) found that the process of localization, or adapting OER for the local teaching context, was more challenging for teachers than was suggested in the OEP literature.

Arispe & Hoye (2023) posit there are OER competencies that scale in complexity as teachers engage in OEP. However, for every competence learned and practiced, there are barriers that prevent teachers from developing these competencies fully. Blomgren (2018) and Tang (2020) point out that digital and information literacy gaps become major roadblocks for OER and OEP sustainability. Further, it is well documented that secondary teachers are suspicious about the quality of the materials they find online (Blomgren & McPherson, 2018). This suspicion often stems from a lack of digital literacy and being able to vet digital materials related to their quality as well as their degree of "openness" which is connected to licensing and copyright awareness (Baas et al. 2019; Hood, 2018; Tang & Bao, 2020). "If teachers find a resource that would be of interest, then capacity will become an issue. Most teachers mentioned that the technical capacity to adapt OER is a concern, which is partly related to their limited awareness" (Baas et al., 2019, p. 8). Beaven (2018) corroborates the prevalence of these barriers, indicating that the empirical evidence for teacher OER reuse is lacking. Baas and Schuwer (2020) agree and report that teachers are

adapting “resources that need to be more context specific or are on specialized subjects” (p.538) but that they only share their materials with peers locally. This makes it especially difficult for OER researchers to fully capture reuse and redistribution, owing to what Beaven (2018) coins “dark reuse” (2018). Ultimately, Beaven suggests the missing ingredient to mitigating the lack of reuse is teacher OER support. Van Allen and Katz (2019) concur, concluding that “teacher educators are well-positioned to evolve future use of open practices within the secondary curriculum” (p.318).

Unfortunately, little research has evaluated the potential for PD to overcome these barriers and build OER competencies. Van Allen and Katz (2019) suggest a model that prioritizes pre-service teachers as key change agents because they can be trained while finishing their degree. But what about in-service teachers? As Hood and Littlejohn (2017) point out, “the continued professional learning of educators is a critical component for ensuring ongoing improvement and innovation in education and the adoption of new practices” (p.1586). Their study demonstrates that teachers not only become more knowledgeable about OER but that their teaching practice also evolves. Their research underscores the need for practical, situational professional development to occur. Participants in their study, for example, said that step by step guides and experimentation with OER were critical to the process. In a similar way, Karunanayaka et.al (2018) used a DBR approach to examine the professional development potential of Scenario-Based Learning (SBL) in a MOOC to impact OER and OEP amongst practitioners. They found that some of the barriers participants encountered were lack of time to complete tasks and challenges using the MOOC platform or SBL since these were new to most of the practitioners. Nonetheless, participants reported that peer feedback and collaborative group work were supportive strategies that helped them overcome these challenges. What is clear is that teacher professional development is integral to improving education (Kennedy, 2016; Misra, 2018) and secondary in-service teachers lack OER-oriented professional development, specifically. Understanding the potential impacts of PD as well as identifying challenges secondary teachers experience in the OEP process is integral to the sustainability of OER going forward.

## BACKGROUND

In 2016, Arispe conducted a needs assessment to determine what world language teachers needed to adapt to new state standards. This was done in the mountain-west region of the United States where Arispe is a university professor and is actively engaged with the secondary world language teaching community. The needs assessment revealed that teachers received minimal discipline-specific professional development from their districts as well as unevenness of professional development provided to teachers in rural communities. As a result, the Pathways Project was created in 2018 to share K-16 ancillary activities to support world language teaching and learning. Since its inception in 2018, the PP has evolved from a primarily local endeavor to a global community where teachers engage in OEP centered on best practices in teaching. More information about the design of the PP team can be found in (Arispe & Hoye, 2023).

This case study reflects the first instance when the PP strategically engaged with the in-service teacher community to investigate how secondary world language teachers perceived and utilized the PP OER materials as a result of PD. The following research questions were considered:

1. Following a one-hour synchronous training, what do secondary teachers learn about OER and how do they perceive OER materials for teaching and learning?
2. How do secondary teachers intend to reuse and revise OER?
3. How do teachers *actually* reuse and revise OER they used for their class?
4. Does OEP help teachers identify and apply best teaching practices?
5. What barriers do secondary teachers encounter when they retain, reuse, and/or revise?

## METHODS

This is a mixed methods case-study which allowed the researchers to understand both teachers' intentions to reuse and revise OER (quantitative analysis through a survey) and their actual retain, reuse and revision practices through qualitative analysis. As such, the data collection was sequential, allowing the results from the video recorded sessions and the survey responses to inform the questions asked in subsequent follow up semi-structured interviews.

The researchers used a listserv from the State Department of Education to contact all secondary world language teachers for recruitment to participate in a 2021 spring cohort. Prior to commencing the study, all participants signed and completed necessary Institutional Review Board consent. **Table 1** describes the participants across demographics and teaching experience, including language and level(s) taught as well as familiarity with the researchers’ institution, specifically the Department of World Languages.

<b>PARTICIPANT CODE</b>	<b>GENDER: MALE (M) OR FEMALE (F)</b>	<b>LANGUAGE TAUGHT</b>	<b>MIDDLE SCHOOL (MS) OR HIGH SCHOOL (HS)</b>	<b>LEVELS TAUGHT: NOVICE (N), INTERMEDIATE (I), OR BOTH (B)</b>	<b>URBAN (U) OR RURAL (R)</b>	<b>SCALE OF FAMILIARITY WITH UNIVERSITY DEPARTMENT 1 (LOW)- 5 (HIGH)</b>
A	F	Spanish	MS	I	U	5
B	F	French	MS	N	U	4
C	F	French	HS	N	U	4
D	F	Spanish	HS	N	R	3
E	F	German	HS	B	R	2

**Table 1** Participant Demographics (N = 5).

**RESEARCH PROCEDURE**

The overarching goal of this study was to evaluate the impact small-scale PD has on a teacher’s ability to engage in OEP and the scope was limited to the first three “Rs”, retain, reuse, revise. Participants were required to attend a one-hour synchronous training that covered two principal topics: 1) a 45-minute overview of the Pathways Project and OER and 2) a 15-minute explanation of how to complete the required activities in the study. Asynchronous assignments (treatments) were used in tandem with the synchronous meeting.

Specifically, participants were asked to complete two videos using Screencastify, a web-based screen-recording tool. Given the context of the pandemic, it was impossible for the researchers to meet with the teacher participants in person and screen recordings were used as a viable method to capture what they learned and how they retained the OER.

In the first video, participants were asked to enable the webcam only and prompted to answer the following questions based on what they remembered from the synchronous training:

- What is your definition of OER?
- What do you think are some benefits of OER?
- What do might be some concerns?

The webcam allowed the researchers to ensure they did not search for or read a definition online. Immediately following the first video, participants were asked to complete a second 10-minute video. This time, they were prompted to record both their screen and webcam and to:

1. Determine the unit and main vocabulary or thematic topic.
2. Open the browser and type: The Pathways Project, <https://www.boisestate.edu/pathwaysproject/>
3. Set a timer for 10 minutes.
4. Find two activities aligned to one’s unit.
5. Verbalize one’s experiences, thoughts, actions, and feelings while locating two activities that align to the unit selected.

Participants were given ten minutes so that the researchers could consider the feasibility to navigate the OER tool efficiently and effectively in a realistic setting. Secondary teachers have challenging time constraints preparing classes and the researchers were interested in determining if the PD provided was sufficient to successfully guide their navigation of the repository under normal circumstances.

The researchers used deductive coding for the first video based on the OER literature related to general definitions and perceptions of OER, including predictions about potential benefits and barriers. A coding comparison in NVivo revealed 0.80 reliability for deductive analysis. The second video was coded differently. First, the researchers analyzed and recorded how long it took participants to locate and select each activity to understand their ability to retain OER. Second, the researchers independently tagged key instances where participants encountered barriers or indicated how they would reuse or revise the OER. Immediately after completing videos one and two, participants were asked to complete a survey where they rated their level of satisfaction with the activities. The survey also required participants to indicate the degree to which they intended to revise each activity (either to keep it as is, make slight adjustments, or make major changes). These questions were based on a Likert scale, but participants could also provide their rationale with open-ended (optional) responses, as well. Finally, participants were asked to implement *one* of the activities they selected with one of their classes. Once classroom implementation was complete, each participant attended a semi-structured interview with the researchers. The interview allowed participants to explain how they adapted the activity to meet their needs as well as to offer suggestions on how to improve the PP OER tool. The researchers then met to discuss coded observations from video two as well as the findings from the semi-structured interviews to analyze participant behaviors in reusing and revising OER that will be presented in Table 4.

In summary, the procedure had two rounds of data collection following two treatments (the PD synchronous online training and classroom implementation). Table 2 below presents the treatment and data collection procedures for cycle two of the DBR informed exploration phase.

STAGE	PLANNING	TREATMENT (1)	DATA COLLECTION	TREATMENT (2)	DATA COLLECTION	TRANSCRIPTION & DATA ANALYSIS	INTEGRATION
Cycle two of the DBR: Informed exploration	PD materials created	1-hour synchronous training	2 Video enactments	Participants implement a PP activity in class	Semi-structured interview	Deductive/ inductive coding	DBR reflection and future planning
	Recruitment & participant selection		Survey			Key findings: survey and interviews	PP OER (tool) improvements

**Table 2** Treatment and Data Collection Procedures.

## FINDINGS

### TEACHERS' KNOWLEDGE AND PERCEPTIONS REGARDING OER

#### How do Teachers Define OER?

The training explicitly defined OER and introduced the distinction between free online materials and OER. After attending this workshop, two of the five participants defined OER with an informed definition whereas three of the five participant's responses indicated a basic understanding. The statement, "resources that I can find online that are free, that I can change and modify in any way that I want" was coded as informed. An example of a definition coded as basic is "resources that are typically online, that are free and that are for teaching purposes". None of the participants' responses were uninformed.

#### Benefits for Using OER

Participants valued qualities like digital availability, zero-cost, ease of access, and time-saving measures. Some examples include, "I think the fact that it's free is a huge benefit" (free); "something that my students could also access" (easily accessible); and "... you have just great resources that you can get at the drop of a hat, and you can save your time" (time-saver).

#### Barriers to Using OER

Two participants raised questions about whether the quality of OER might be good enough for a teacher to use: "...there may also be some questionable materials just because what one person thinks is a great communicative activity, another person might think that it's too simple

or too complex or not understand what to do with it.” Accessibility was coded as a barrier when participants referred to challenges finding, downloading, or integrating materials. Participants also questioned the appropriateness for their learners, for example, “...one of the concerns that I have had in the past is that a lot of them tend to be at the college level.” Finally, one comment was made about the cost to print materials.

Video one characterized what participants knew about OER as well as their attitudes about OER after the one-hour synchronous training. Table 3 depicts salient themes that emerged for all five participants, collectively.

THEME	CODE	N	%
Benefits of OER	Digital	1	7.7
	Easily Accessible	3	23.1
	Free	5	38.5
	Time Saver	4	30.8
Barriers	Quality	2	28.6
	Accessibility	1	14.3
	Appropriate for Learners	3	42.9
	Cost to Print Materials	1	14.3

**Table 3** Teacher Perceptions and Attitudes about OER.

### HOW TEACHERS INTEND TO REUSE AND REVISE OER

The survey asked participants to indicate what they would need to do to use the OER in their classroom: (1) make slight changes, 2) make significant changes or 3) make no changes), answering the second part of research question two “Upon initial review, how do they intend to reuse and revise them?” Although each participant selected two activities to rate, Participant A was only successful in selecting one activity, therefore, there were a total of nine ratings. There was one instance where a teacher would use an activity without making any changes (1/9, 11%). There were 6 instances where teachers would make slight changes (6/9, 67%) and three instances where teachers would make significant changes (3/9, 33%). These results are displayed in Table 4 according to individual cases.

### HOW TEACHERS ACTUALLY REUSE AND REVISE ACTIVITIES

Participants were asked to implement one of the two activities they rated. Once complete, participants individually attended a semi-structured interview, allowing the researchers to probe about their reuse and revise practices. There were three main findings that emerged. First, most teachers had to make slight changes to the OER to include a larger class size. Only a few teachers made significant changes by creating and integrating additional worksheets, pre-tasks, and/or rubrics. Second, several teachers requested the interface of the OER tool be improved by removing large amounts of instructions. They suggested glossing techniques like bolding keywords or adding instructional videos to access teaching materials faster and to vet if they would use the activity before having to read instructions about how to implement it. Third, several participants suggested adding searchable keywords to locate key information that aligned to their curricula.

### CASE BY CASE: TEACHER PARTICIPANTS’ INDIVIDUAL OEP JOURNEY

The researchers were interested in looking at participants’ individual experiences and their OEP development related to the PD synchronous and asynchronous components. Table 4 summarizes salient themes that characterize each participant’s knowledge, perceptions, and behaviors because of treatments one and two. This analysis addresses the fourth and fifth research questions, “Does OEP help teachers apply best teaching practices?” and “What barriers do secondary teachers encounter when they retain, reuse, and/or revise?”

**Table 4** Teacher Participants' Engagement with and Evaluation of the PP OER Activities.

Note: Words in bold indicate ways their revisions emulate best teaching practices.

PARTICIPANT	TREATMENT 1: SURVEY & VIDEO 2					TREATMENT 2: SEMI-STRUCTURED INTERVIEW	
	Knownledge about OER	Video 2: Duration to select activity.	Survey: It was easy to align PP activities to curriculum	Survey: It was easy to access for the classroom	Survey: To use this activity in class, I will make	Video 2 Observations	(1) Reuse & Revision Summary  (2) Summary, feedback on PP OER tool
A	Informed	Activity 1: 2:08; but unsuccessful and moves on  Activity 2: 8:24	Somewhat agrees	Strongly agrees	Activity 1: incomplete  Activity 2- slight changes	Only has time to select one activity. Searched for activities by grammatical topic instead of task topic. Is adaptive and capable of searching when search in Intermediate does not yield results and instead utilizes the "All Group Resources" tool. Uses the description on the activity landing page to initially evaluate the activity. Can quickly identify changes she'd make to instructional materials and the activity to adapt them for her classroom.	Selected an entirely different activity due to curricular changes. Adapted the warmup to fit the level, adapted activity materials to match what they're doing in class, added a free writing activity to start, created new wrap up, warmup and cool down.  Remarks that the warmup and cool down she created are good <b>formative assessments</b> that can be customized. Reflects on the PP tool in general saying she values using <b>performance tasks</b> (like the PP) over traditional exams.
B	Basic	Activity 1: 8:00  Activity 2: 2:45	Somewhat agrees	Somewhat agrees	Activity 1- significant changes  Activity 2- significant changes	Spends time exploring additional content on the PP and OER Commons site, including other website content outside of the main section. Can quickly identify items that she'd like to change. Identifies content in materials that is <b>inclusive</b> and <b>diverse</b> . Is skeptical and unsure about using the activity with her classes due to the age and level of her students. Evaluates materials before reviewing activity instructions.	Adapted the activity for the level and classroom size, added <b>sentence starters</b> , added <b>images to aid comprehension</b> , polled students for the activity instead of relying on what was provided to <b>increase student interest</b> , utilized an <b>interactive tool</b> to increase student participation.
C	Informed	Activity 1: 8:43 Activity 2: 2:22	Somewhat agrees	Somewhat agrees	Activity 1- slight changes  Activity 2- slight changes	Is adaptive and capable of searching for an activity using different keywords. Encounters barriers accessing the instructions and materials in an activity. Can quickly identify changes she'd make to the activities to adapt them to her classroom.	Adapted the activity to the level of her students. Added a new warmup to provide <b>input</b> and <b>alignment to their essential question</b> . Provided additional explanation in directions to help learners, changed the vocabulary sheet, added a <b>speaking rubric</b> , and added additional <b>authentic materials</b> (YouTube video). Explained how she has students use the <b>can-do statements</b> .  Valued the activities were <b>communicative</b> . However, she is insecure about sharing the activity back because she is not confident if her changes are good enough.

(Contd.)

PARTICIPANT	TREATMENT 1: SURVEY & VIDEO 2				TREATMENT 2: SEMI-STRUCTURED INTERVIEW		
D	Basic	Activity 1: 6:45  Activity 2: 4:07	Somewhat agrees	Strongly agrees	Activity 1- no changes  Activity 2- slight changes	Values that the materials are ready to be used (i.e., complete). Struggles to find an activity that fits her topic for the level.	Made minimal changes to the activity. Added additional vocabulary to increase the level of difficulty. Edited a few slides and added additional ones.  Provided feedback on the PP OER tool: too text heavy and wished she could skip to the materials faster. Made suggestions for searching by key vocabulary instead of topics.
E	Basic	Activity 1: 9:45  Activity 2: 10:28  Note: this participant greatly exceeded time constraint	Somewhat agrees	Somewhat agrees	Activity 1- slight changes  Activity 2- significant changes	Looks at the meta-data for the activity including the author, rating, date, etc., Faces barriers with the amount of information presented in the activity ("feels overwhelmed"). Identifies changes that need to be made to fit the secondary context. Searches by scrolling through the list instead of using the search function. Quickly identifies additional learning materials that could make the activity more appropriate for her learners.	Created a handout for students to <b>scaffold</b> the main activity and a <b>handout</b> to have students supply responses.  Provided feedback on the PP OER tool: label activities better and add subtopics to the main topics in the search function. Wanted to get past instructions to get to the content faster. Suggested an upload button to make sharing back easier.  Mentioned concerns with internet connection due to being in a rural school district and negative impacts on creating content online and barriers to resharing.

In one example, Participant D has a basic understanding of OER post training. She favorably perceives the PP OER while also emphasizing valuing activities that are “complete”. Survey results indicate she intends to make no changes to one activity and slight changes to the other. The interview reveals that she did make slight changes but that these were limited entirely to scope; she edits the activity to use for a larger class size and changes some vocabulary items to fit her curriculum. In comparison, Participant B also has a basic knowledge of OER but intends to make significant changes to the OER. The semi-structured interview reveals that her behavior is consistent with her intention, and she applies best practices in her revisions. For example, she scaffolds the materials by modifying them to be more comprehensible by adding images. Similarly, she adds sentence starters to support learners who need this scaffolding when producing output in French. In a third example, Participant E, like B and D, has a basic understanding of OER and intends to make slight changes to one activity and significant changes to the other. She does apply best teaching practices through major revisions by creating an accompanying handout to help students supply responses in German, similar to the sentence starters Participant B creates for her French students. However, video two revealed that Participant E also encounters barriers related to information literacy when retaining the activities in the first place. At one point, she states she is “overwhelmed”. And unlike the other four participants who went about one minute over the intended time, Participant E finishes retaining two activities in twice as much time (20+ minutes).

## DISCUSSION

When considering the impacts of small-scale PD on knowledge and perceptions about OER, teachers can generally define OER. When recalling the benefits OER has to offer, teachers exclusively focus on ways OER reduces their workload (i.e., timesaving). Furthermore, teachers



do not recall or associate the ability to adapt or customize OER as a benefit. Findings from video two suggest that secondary teachers approach ancillary OER with false expectations that they function like a substitute to traditional textbook activities as a “ready-made” product. Furthermore, there were no comments that reflect the ways OER can be an important change driver for diversity, equity, and inclusion and to help students see themselves better reflected in the teaching materials.

Both videos reveal that teachers are skeptical about OER that stem from higher education. Their skepticism is not related to the quality of the content, rather how the activity will fit what they need. For example, teachers make negative remarks when the terminology or the instructions do not match their local context or curricula. Although superficial, terminology can have a trigger effect that acts as a barrier for reuse. As a result of these findings, the researchers made all PP materials inclusive and agnostic (i.e., appropriate for K-12 or tertiary contexts). Not surprisingly, teachers value OER as a time-saver; they are looking for something that they can access and understand quickly to fit their context. However, these expectations may be reductive since they might limit how teachers adopt and/or adapt OER. Future PD can make clearer that most OER require some level of customization, and this is not a deficiency, rather a benefit. For example, customization can lead to greater agency and teacher autonomy so that, as Participant E stated, they can “make it their own”.

The findings also reveal that ten minutes is not long enough for teachers to successfully retain two PP activities after a one-hour training. Analysis of their searching behavior suggests that teachers would benefit from practicing how to retain activities to align them to their curriculum. For several participants, deficits in information literacy impeded their ability to access activities efficiently and effectively. One way the researchers enhanced the PP tool as a result was to create a thematic index with icons as visual scaffolds. A large section of instructions was removed from the start of each activity so that teachers could get to the materials faster. Now, each level has a FAQ and Resources section that is pinned to the top but concealed unless the user clicks it. Future PD should model digital search techniques and provide teachers with practice exercises to identify key information online as well as to role-play additional processes to find and select OER material within a repository.

## CONCLUSION, IMPLICATIONS AND SUGGESTIONS

The work of future PD is to help teachers understand their role and agency in the OEP process and to practice key OEP competencies in context. If teachers come to ancillary OER conceptualizing them as finalized products, they may be less willing to make changes or to reuse them in the first place. School districts transitioning from textbook adoptions to OER must be strategic in providing teachers time to practice OEP; supplying links to OER isn’t enough. Recently, because of the pandemic, online professional development has become pervasive, but Bragg et al. (2021) emphasize the need for sustained, longer-term professional development for it to be effective, corroborating Gulamhussein (2013): “Professional development can no longer just be about exposing teachers to a one-time workshop or giving teachers basic knowledge about a teaching methodology. Instead, professional development in an era of accountability requires a fundamental change in a teacher’s practice that leads to an increase in student learning in the classroom” (Cited in Misra, 2018, p.68). The minimal PD provided to teachers in this study helped us pinpoint barriers teachers encounter in retaining, revising, and reusing OER effectively and efficiently. While minimal PD may raise awareness about OER, it was the treatment to reuse the OER in their classroom that catalyzes customization and best practices in revising. In other words, knowledge about how to retain and revise is not enough. For OEP to be sustainable going forward, K-12 teachers need time to practice these competencies for a specific purpose and with incremental feedback through mentoring, a supported approach to professional development (Kennedy, 2016). Furthermore, we believe PD has the potential to develop digital and information literacy which were initial barriers the teacher participants encountered in this study.

Even though there were barriers in retaining and revising the OER in this study, all five participants do successfully customize one OER ancillary activity for their classroom. Furthermore, the evidence from the semi-structured interviews indicates that most teachers ultimately make significant changes to the OER to support the needs of their learners,

reflecting best teaching practices and suggesting that OEP was at work. When asked what they value early on, teachers name what solves their most critical problems: time, cost, and resources. However, when given the time and impetus to experience the full potential of OER through adopting *and* adapting, the teachers in this case study move beyond gaining knowledge about OER and can apply best practices in teaching by making critical changes to materials to support their learners.

## LIMITATIONS

This study was conducted one year into the COVID-19 pandemic and therefore teacher perceptions about OER may be marred by the unprecedented realities of adapting to remote teaching. Unfortunately, the researchers did not track how long it took teachers to make changes to the activity which would have been helpful in anticipating future PD that targets how to adapt OER. Furthermore, the researchers did not record or analyze teacher practices while implementing the OER in the classroom. While classroom implementation of OER ancillary activities may be of interest for future research, it was beyond the scope of the research questions relevant to this study. Finally, this is a case study that explores five teacher participants' knowledge, perceptions, and behavior and the findings should not be extrapolated beyond the participants within the current study.

## DATA ACCESSIBILITY STATEMENT

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

## ETHICS AND CONSENT

The Boise State University Office of Research Compliance reviewed the protocol application and determined the research exempt from further IRB review and supervision under 45 CFR 46.101(b).

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## COMPETING INTERESTS


The authors have no competing interests to declare.


## AUTHOR CONTRIBUTIONS

Conceptualization, K.A. and A.H.; methodology, K.A.; software, A.H.; formal analysis, K.A., A.H. and K.P.; investigation, K.A. and A.H.; data curation, K.A. and A.H.; writing—original draft preparation, K.A., A.H. and K.P.; writing—review and editing, K.A., A.H. and K.P.; visualization, K.A., A.H. and K.P.; supervision, K.A.; Project administration, K.A.; funding acquisition, K.A. and A.H. All authors have read and agreed to the published version of the manuscript.

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