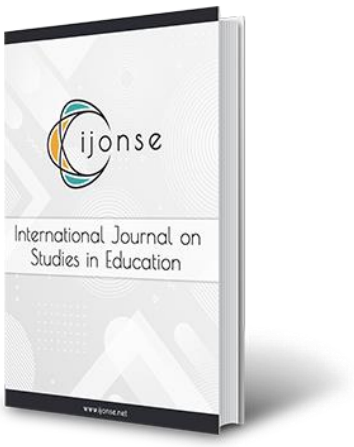

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A Typology of Educators Using Open Educational Resources for Teaching

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Abstract

With Open Educational Resources (OER) teachers have free access to high-quality educational resources and open licenses to prepare, enhance, or supplement their teaching practice. Yet adoption rates are understood to be low and teachers face many challenges when they want to use OER. In a survey study, 1819 educators from various educational sectors reported their use of OER, the types of OER they used, the purposes of the OER used, the challenges they face and the impact they see. Most teachers adapt OER to fit their own needs and considerably less teachers create, publish or add OER. The main challenges relate to finding resources that are relevant, up-to-date and of good quality, time issues and – to a lesser extent- acceptance at the workplace and institutional support. A typology of OER users has been developed with five types of OER users. Implications for practice for each type of educators are formulated.

Introduction

Open Educational Resources (OER) are "teaching, learning and research materials in any medium, digital or otherwise, that reside in the public domain or have been released under an open license that permits no-cost access, use, adaptation and redistribution by others with no or limited restrictions" (UNESCO, n.d.). With OER teachers have free access to high-quality educational resources and open licenses to manipulate these resources for personalized needs (Blomgren, 2018; Jimes, Weiss, & Keep, 2013). However, barriers still exist when teachers implement OER including teachers' lack of adequate technology skills, willingness, and pedagogical knowledge to consume, produce or integrate OER (Tang & Bao, 2020). In addition to these personal barriers, teachers need to overcome external barriers beyond their control (Kimmons, 2016). Yet it is not clear how many teachers adopt and integrate OER, whether adoption rates differ between educational sectors and how these teachers can be characterized as OER adopters. The current study contributes to insights into teacher profiles of adopting OER in educational practice.

OER Adoption in Teaching

Open Educational Resources (OER) provide teachers with free access to openly licensed educational resources so that teachers can retain, reuse, revise, remix, and redistribute to fit their needs (Read, Tang, Dhamija, & Bodily, 2020; Wiley, & Hilton, 2018). Specifically, teachers can reproduce and own a copy of OER (retain), use

OER in personalized manners (reuse), adapt and modify OER (revise), merge two or more existing OER tailored to individualized needs (remix), and disseminate OER for their own instructional purposes (redistribute) at no cost (Hilton, 2016; Lin & Tang, 2017).

Beyond cost-effectiveness, OER also provide teachers with openness and flexibility so that they can address students' individualized needs (Kimmons, 2016). For example, Park and Mcleod (2018) examined personalized high school mathematics instruction using OER to help students with learning disabilities learn effectively and become motivated to learn mathematics. Another advantage of OER over traditional textbooks is to allow teachers to use timely resources in OER repositories to tailor learning to students' emerging needs (Kimmons, 2015). Especially when course standards have recently changed, traditional textbooks usually cannot address the changes immediately as textbook adoption is usually not determined by teachers (Adebayo, 2018; Kimmons, 2015). Teachers might resort to OER and find supplementary content to adjust the instruction into alignment with the new standard. Other benefits refer to increased collaboration between fellow teachers across institutes (Chae & Jenkins, 2015) and growth in critical reflection of teachers on their practices (Weller, de los Arcos, Farrow, Pitt, & McAndrew, 2015).

OER could therefore have the potential to change teaching in all educational sectors by providing access to a a variety of resources, information and practices. Teachers can do this during four phases of their teaching (Armellini & Nie, 2013): (1) 'as-is' as a planned enhancement during curriculum design, (2) 'as-is' as a 'just-in-time' resource during course delivery, (3) adaption of OER during curriculum design, and (4) adaption of OER during course delivery. Nevertheless, despite the growing number of open resources accessible, the use of OER in education is low (Allen & Seaman, 2014; Schuwer & Janssen, 2018) or might be hidden (Beaven, 2018). The latter means that teachers either find resources online, receive resources from their colleagues or already have resources in their personal collections, without being aware of adopting OER. Other reason why teachers' adoption of OER is low is the quality, which is sometimes perceived as low and of limited additional value (Abrahomivich & McBride, 2018).

As previously stated, teachers encounter barriers when integrating OER in teaching (Kimmons, 2016). Tang (2020) categorized K-12 teachers' barriers referring to environmental conditions, such as a lack of supportive climate and sufficient time and/or support, as well as personal challenges such as lack of proficiency in searching OER and pedagogical knowledge about integrating OER. Kimmons (2016) discussed three levels of teachers' perceived barriers – macro, local, and personal barriers, with a focus on who can solve the barriers of integrating OER in classrooms. Particularly, macro barriers are teachers' barriers that exceed the reach of local school districts but require outside help from states, publishers, and other entities to overcome, such as a lack of legislative support and a lack of appropriate OER. Local barriers are those that require support from schools, institutions and districts to overcome, including a lack of time, technology infrastructures, opportunities for professional development, and community acknowledgement. Personal barriers include those that can be solved by teachers themselves, such as teachers' beliefs, values, and expertise about using OER. All of these barriers challenge teachers' integration of OER, but Kimmons (2016) indicated that macro and local barriers were more challenging for K-12 teachers.

Cox and Trotter (2017) distinguish even more clusters of factors that influence OER adoption and developed the OER Adoption Pyramid (Figure 1). This framework summarizes essential OER adoption factors into six categories, layered according to the level of control that individual lecturers have over them.

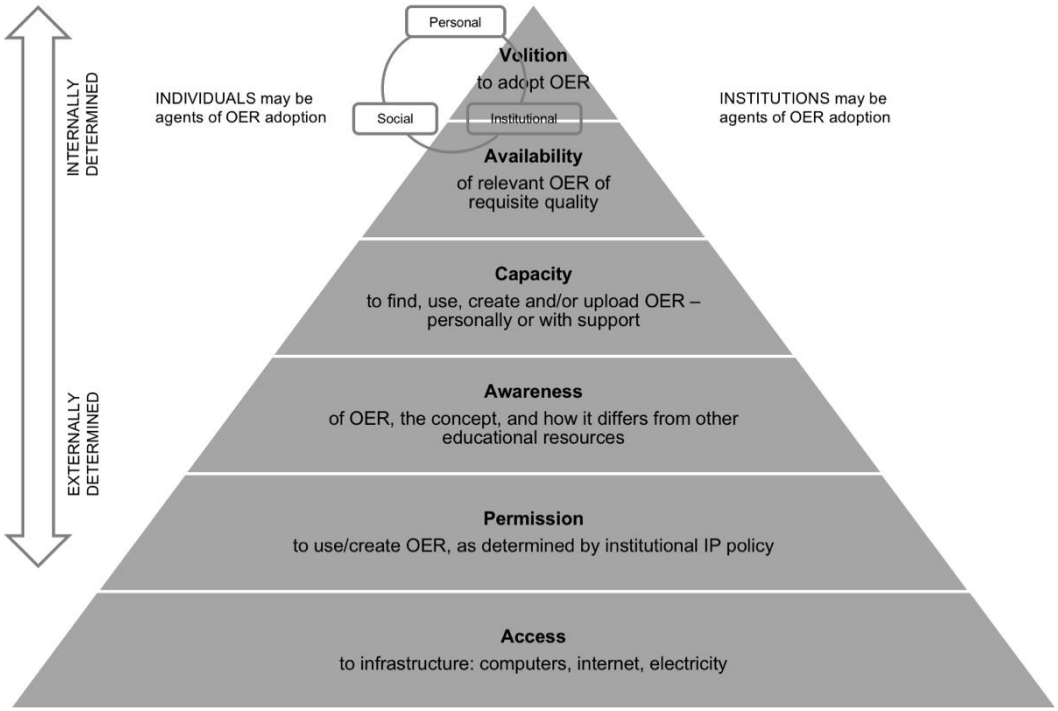

Figure 1. OER Adoption Pyramid (from Cox & Trotter, 2017)

The first factor determining lecturers' or institutions' engagement with OER is access. This refers to having access to the appropriate physical infrastructure and hardware necessary for engaging with digitally-mediated OER. A minimal level of information and communications technology (ICT) infrastructure is seen as an basic condition of OER adoption (de Oliviera Neto, Pete, Daryono, & Cartmill, 2017).

The second factor is whether lecturers or institutions have permission to adopt OER. Previous research by Cox (2013) showed that intellectual property (IP) policies of the institution determine whether teachers are allowed to share resources. For OER use, it is the OER itself – via its licensing provisions – that determines the parameters of how it may be used.

The third factor is lecturers' or institutions' awareness of OER. Essentially, the teacher must have been exposed to the concept of OER and grasped how it differs from other types of (usually copyright-restricted) educational materials. Yet several studies show that teachers' awareness of OER is low (Belikov & Bodily, 2016; Ozdemir & Bonk, 2017).

The fourth factor is lecturers' or institutions' capacity, or technical and semantic skills, for using and/ or creating OER. If teachers are aware of OER, technical skills are needed in order to find, use, create and upload OER. Finding appropriate OER might be an issue, as a lack in knowledge of IP rights and of open licenses negatively

influences teachers' uptake (Schuwer & Janssen, 2018). In addition, as OER are often not as structured or as complete as commercial materials (Chae & Jenkins, 2015), teachers need to determine whether the resources fit, or can be changed to fit, their specific context.

The fifth factor concerns the actual availability of OER for lecturers or institutions to use or share. Availability relates to not only the number of available OER, but also to the perceived relevance and quality of OER. In their study on OER adoption in the Netherlands, Baas, Admiraal, & van den Berg (2019) conclude that availability should be placed lower in the pyramid as a prerequisite for teachers to explore their capacity and volition.

The final factor in OER adoption relates to individual lecturers' or institutions' motivation or volition: their desire or will to adopt OER. Individual volition is potentially shaped by both social context (departmental and disciplinary norms) and institutional structures (policies, strategies and mechanisms), while institutional volition is often shaped by its lecturers' desires and the social context that abides across multiple sites at the university. Mtebe and Raisamo (2014) and Percy and Van Belle (2012) examined teachers' intention to adopt OER using individual as well as the social and institutional factors. These authors show that personal volition was the main factor that influenced teachers' intention to adopt OER. Tang, Lin and Qian (2020) found that perceived ease of use and perceived usefulness predicted K-12 teachers' intention to adopt OER with attitudes toward OER as a mediating variable. Yet Cox (2016) indicates that institutional structures were essential in facilitating teachers to spend time on OER, offering them support and creating a culture that permits academic freedom.

This Study

The studies mentioned above indicate a low-level of adoption of teachers in both secondary and higher education and the challenges and obstacles they report. An overview on how teachers in secondary and higher education use OER in their practice, the challenges and impact they perceive is still missing. The current study aims to identify teacher profiles of OER practice in order to understand how teachers adopt OER in their teaching practice and which challenges and possible impact they perceive. The following research questions directed this study:

1. How do educators use OER in their teaching, which types of OER do they use and with what purposes?
2. What kind of challenges do educators face to use OER in their teaching and which impact of OER do they discern?
3. How can educator groups be defined based on their use of OER?

Methods

Participants

The dataset used in this research was retrieved from a secondary dataset published by the OER Research Hub (OERRH, 2014) at the Open University, UK in 2015. This dataset was released with creative common licenses (CC-BY) on Figshare (http://figshare.com/articles/OERRH_Survey_Data_2013_2014/1317313) allowing

researchers to adapt and distribute it for personalized purposes (Farrow, Pitt, de los Arcos, Perryman, Weller, & McAndrew, 2015). This dataset provided survey responses collected by the OER Research hub to assess respondents' perception of how OER influence teaching and learning (Farrow et al., 2015). The survey respondents for this dataset included educators from different sectors (e.g., university, college, and K-12), librarians, and also learners using OER for their formal education and/or informal learning opportunities. These respondents were invited to answer different survey questions based on their identity. In the end, survey responses from around 6,390 respondents in 180 different countries were recorded in this dataset (Farrow et al., 2015).

In this study, only data from educators have been included. In total, data from 1,819 educators have been included in the analyses: 675 K12 teachers, 423 college teachers, 566 university teachers, 309 work-based trainers and 359 one-to-one tutors. Few of these educators taught in two or three sectors. More information about the background of these teachers is included in Table A1 in the Appendix.

Measures

In addition to the background information of the participants the questionnaire asked for information about participants' internet access and ICT use, their use of OER, the types of OER they used and for which purposes, the challenges they face when using OER and the impact they see of using OER.

Internet Access and ICT Use

In Table 1, the information about participants' reported internet access and ICT use is summarized. For the final analyses, two variables have been computed, which consist of the mean score of the relevant items (all scored 0=no; 1= yes): Internet access (Mean= 0.48 and SD= 0.22, range from 0 to 1) and ICT use (Mean= 0.61 and SD= 0.21, range from 0 to 1). Internet access refers to the extent participants have accessed the internet with different tools during the past three months and ICT use refers to the extent participants have used different software applications in the last year.

OER Use, Types of OER and OER Purposes

OER use has been measured with 6 items about how participants use of OER, 14 items about the type of OER that has been used and 17 items about the purpose of the use of OER. All items were answered with either no (0) or yes (1). The six items about use of OER refer to whether participants have adapted OER to fit their needs (Adapt OER), created OER for study or teaching (Create OER), created resources and publish them with open license (Publish OER), added a resources to a repository (Add OER), added a comment to a repository about the quality of a resource (Comment OER), and add a comment to a repository suggesting ways of using a resource (Suggest use OER).

Table 1. Internet Access and ICT Use

	Frequency (percentage)
Internet access*	
Smartphone	1065 (69)
Tablet	1048 (68)
Home broadband	1293 (83)
Game console	122 (8)
Work	1097 (71)
Education institute	732 (53)
Library	276 (18)
Cyber cafe	272 (18)
ICT use*	
Email	1987 (98)
Word processing software	1074 (97)
Presentation software	989 (89)
Spreadsheet software	902 (81)
Wiki	246 (22)
Blog post	363 (33)
Share image online	649 (59)
Micro blogging platform	375 (34)
Video chat	754 (68)
Internet forum	548 (50)
Social network	822 (74)
Cloud-based storage	814 (74)
Online shopping	906 (82)
Download pod cast	630 (57)
Virtual Learning Environment	761 (69)
Upload video	477 (43)
Upload pod cast	177 (16)

* more than one answering option possible

Types of OER used was measured with 14 items referring to particular applications such as videos, podcast, quizzes, and more extensive materials such as lectures, textbooks and courses. Purposes of OER use was measured with 17 items: to prepare teaching (Prepare teaching), to get new ideas and inspiration (New ideas), to supplement existing lessons or course work (Supplement), as assets (e.g., images/text abstract) in the classroom (Assets), to give to learners as compulsory self-study materials (Compulsory self-study), to give to learners as optional self-study materials (Optional self-study), to provide e-learning materials to online learners (E-learning materials), to compare them with own teaching/training materials (Compare materials), to broaden the range of

teaching methods (Broaden methods), to broaden the range of resources available to learners (Broaden resources), to make teaching more culturally diverse (Cultural diversity), to enhance professional development (Professional Development), to stay up-to-date in a subject or topic area (Stay up-to-date), to learn about a new topic (Learn new topic), to engage students more fully in a topic area (Engage students), to connect with teachers/learners with similar interests (Connect teachers), and to interest hard-to-engage learners (Hard-to-engage). The descriptive statistics are summarized in Table 2 (OER use), Table 3 (Types of OER used) and Table 4 (Purposes OER have been used for).

OER Challenges and Perceived Impact of OER

OER challenges were measured with 15 yes-no items about challenges participants most often face when they use OER. These 15 items refer to overcoming technology problems when downloading resources (Download resources), knowing where to find resources (Find resources), finding suitable resources in the subject area (Suitable resources), finding resources of sufficiently high quality (Quality resources), finding resources that are up-to-date (Up-to-date resources), finding resources that are relevant to the local context (Relevant resources), getting work colleagues/managers to accept the use of OER (Acceptance at work), not being skilled enough to edit resources (Editing skills), not knowing whether they have permission to use or change a resource (Permission to change), not having enough time to look for suitable resources (Time to search), not having connections with OER-using peers (Connections peers), not knowing how to use the resources in the classroom (How to use in class), not having enough time/opportunities to experiment (Time to experiment), lacking institutional support for use of OER (Institutional support), resources not being aligned with professional standards (Professional standards), and missing/needing the support of a tutor or teacher to help (Support tutor).

Perceived impact of OER have been measured with 9 items that refer to impact on teachers' teaching skills and knowledge and 12 items that refer to impact on students' learning processes and outcomes. All items were scored on a 5-point Likert type scale with *1*= strongly disagree and *5*= strongly agree. Factor analyses with varimax rotation confirmed both scales with 59.37% and 71.23% explained variance for impact on Teacher and Students, respectively. Example items for Teacher are "I use a broader range of teaching and learning methods", and "I reflect more on the way that I teach" (Cronbach's α= 0.91); for Students: "Increases learners' interest in the subjects taught" and "Increases learner satisfaction with the learning experience"(Cronbach's α= 0.97). The two scales of OER impact (Teacher and Students) are based on the mean scores of the relevant items. Descriptive statistics about OER challenges and impact are summarized in Table 5 and 6, respectively

Data Analysis

In order to answer research questions 1 and 2, descriptive statistics have been used. In addition, chi-square tests (for the 0-1 items) and independent samples t-tests (for the impact scales) have been performed to test differences between the categories of educators (K12 teachers, College teachers, University teachers, Work-based trainers and One-to-one tutors). As these educator categories were scored either 0 (no) or 1 (yes), chi-square tests and t-tests have been carried out separately for each educator category. Cluster analyses were

performed on the six items of OER use. K-means with squared Euclidean distance was used, which aims to choose cluster centers so as to minimize φ, the total squared distance between each point and its closest center. For 2-10 clusters, the Variance Ratio Criterion (VRC, Calenski & Harabasz, 1973) has been calculated, which refers to the ratio of within- and between-subjects variances, corrected for the number of groups and participants. In addition, ω has been calculated which indicates the relative increase of decrease in explained variance from cluster solution to cluster solution. A division into five resulted in the highest ω and a relatively high VRC value, and was therefore used in the current study to define teachers groups with respect to OER use. The difference between the five types was significant for the six input items (with $p<0.001$), explaining between 24% (Publish: publish OER myself with open license) and 99% (Comment: adding comments about the quality of a resource) variance in scores. In order to further characterize the teacher types information about OER types, OER purposes, OER challenges, OER Impact, Internet access and ICT use and background variables was related to the five types (with performing analyses of variance).

Findings

Educators' Use of OER, Type of OER Used and Purposes of Use of OER

Use of OER

From Table 2 it is clear that teachers teaching in different sectors generally do not differ much in the way they use OER in their practice. Many teachers reported that they adapt OER to fit their own needs, whereas the other ways of OER use have been reported substantially less frequent. The chi-square tests show only five significant differences: three with K-12 teachers, one with college teaches and one with university teachers. K-12 teachers reported relatively more frequent that they have adapted OER to fit their needs ($\chi^2(1)= 7.76$; $p=0.005$) and have added comment to suggest how to use a resource ($\chi^2(1)= 5.17$; $p=0.023$). Both college teachers and university teachers reported relatively more frequent that they have publish their own OER ($\chi^2(1)= 5.61$; $p=0.018$ and $\chi^2(1)= 4.87$; $p=0.026$, respectively), which has been significantly less reported by K-12 teachers ($\chi^2(1)= 5.17$; $p=0.023$). All differences can be understood as small (with explained variance 1% or less).

Table 2. Use of OER (Percentages within each Educator Category)

	K-12 N= 334	College N= 255	University N= 299	Work-based N= 104	One-to-one N= 116	Total N= 845
Adapt OER	84.7**	81.8	76.6	82.7	82.8	79.8
Create OER	38.0	41.3	40.5	41.3	34.5	38.0
Publish OER	11.1*	19.6*	18.4*	17.3	16.4	14.8
Add OER	27.8	30.7	28.1	33.7	31.0	27.0
Comment OER	24.9	24.4	24.1	26.0	30.2	23.8
Suggest use OER	17.7*	15.6	13.7	17.3	25.9	14.3

*** $p \leq 0.001$; ** $p \leq 0.01$; * $p \leq 0.05$

Type of OER used

In Table 3 the descriptive statistics for the items on types of OER used are summarized, per educator group. Compared to the use of OER, the chi-square tests show that teacher groups differ in various ways with respect to the type of OER used. Video and images –which are the type of OER most frequently mentioned- have been used more by K-12 teachers ($\chi^2(1)= 24.72$; $p<0.001$ and $\chi^2(1)= 13.77$; $p<0.001$, respectively) and college teacher ($\chi^2(1)= 6.67$; $p=0.010$, and $\chi^2(1)= 9.96$; $p=0.002$, respectively), and less by work-based trainers ($\chi^2(1)= 16.46$; $p<0.001$, and $\chi^2(1)= 4.37$; $p=0.037$, respectively), and one-to-one mentors ($\chi^2(1)= 513.08$; $p<0.001$, and $\chi^2(1)= 12.67$; $p<0.001$, respectively). Open textbooks –mentioned by 53% of the participants are especially used by university teachers ($\chi^2(1)= 12.98$; $p<0.001$). Other differences between teacher groups relate to types that are generally less used (see Table 3). All differences can be understood as small (with explained variance 3% or less).

Table 3. Types of OER Used (Percentages within each Educator Category)

	K-12 N= 559	College N= 371	University N= 457	Work-based N= 233	One-to-one N= 280	Total N= 1473
Videos	72.7***	70.4**	62.8	53.2***	55.6***	64.6
Audio podcasts	30.3	31.0	30.4	27.5	32.1	27.9
Images	65.4***	66.3**	56.2	53.2*	50.0***	59.1
Infographics	25.4	30.0	32.9***	30.4	28.7	26.2
Games	39.7***	22.4	17.5***	20.6	25.7	24.8
Lectures	35.4	41.8***	33.7	38.2	36.8	33.4
Lesson plans	46.0***	35.8	31.0*	49.3*	52.3***	36.2
Tutorials	40.1**	40.7**	34.4	36.5	37.9	35.0
Quizzes	41.3**	46.4***	33.7	37.8	41.8*	36.2
Full Courses	18.1	19.9	22.5**	31.3***	26.4***	18.3
Parts of a course	37.2	46.6***	45.1**	50.6***	43.6	39.3
Open Textbooks	51.7	57.1	60.2***	54.9	57.1	53.0
Data Sets	13.0	19.2	26.6***	26.0*	16.8	16.1
Learning tools	40.7*	36.9	37.9	37.0	37.4	36.0

*** $p \leq 0.001$; ** $p \leq 0.01$; * $p \leq 0.05$

Purposes of Use of OER

In Table 4, the descriptive statistics for the items on Purposes of the use of OER are summarized. Most educators use OER to get new ideas and to prepare or augment their teaching; OER have been less used to support self-study or to attract specific target groups. From Table4 it is clear that college teachers reported higher scores on almost all purposes except for professional development on which they reported significant lower scores. In addition, K-12 teachers reported relatively high scores on the purpose related to teaching and teaching materials, on which work-based trainers show significant lower scores. Finally K-12 teachers also

reported relative high scores on the use of OER for the purpose of professional development. All differences can be understood as small (with explained variance 4% or less).

Table 4. Purposes of Use of OER (Percentages within each Educator Category)

	K-12	College	University	Work-based	One-to-one	Total
	N= 598	N= 396	N= 513	N= 279	N= 307	N= 1611
Prepare teaching	71.2***	71.0**	64.5	57.3***	64.2	65.5
New ideas	80.8	83.3**	75.4*	80.3	77.2	78.2
Supplement work	67.8**	75.0***	63.2	51.6***	52.1***	62.9
Assets in class	46.6***	48.4***	42.6	32.6***	33.6**	40.7
Compulsory ss	25.1	33.3***	24.2	22.2	22.1	23.5
Optional ss	40.4	56.7***	46.1**	38.4	40.4	41.1
e-Learning materials	23.5***	42.4***	33.1**	22.2**	24.2	28.5
Compare materials	32.1	40.8***	34.6	34.1	34.2	31.4
Broaden methods	59.0***	61.5***	51.8	45.2**	51.5	52.2
Broaden resources	52.4	61.1***	52.2	42.3**	45.3	49.1
Cultural diversity	28.0	37.1***	28.5	27.6	33.2*	28.2
Prof. Development	59.6***	49.8**	52.4	60.9**	55.4	53.8
Stay up-to-date	59.0**	59.6**	52.4	54.8	56.0	54.0
Learn new topic	57.8	59.8*	57.3	58.8	65.8***	55.1
Engage students	48.9**	55.3***	42.7	33.7***	39.1*	43.7
Connect teachers	28.5*	31.8***	28.3*	22.9	24.5	24.9
Hard-to-engage	33.7***	32.3	28.1	22.2**	30.3	28.2

Note. Prof.= Professional; ss= self-study; *** $p \leq 0.001$; ** $p \leq 0.01$; * $p \leq 0.05$

Educators' Perceived Challenges and Impact of OER

Challenges of Using OER

In Table 5, the descriptive statistics with respect to the challenges educators perceived with the use of OER. In general, the challenges related to the quality of OER (to find relevant, suitable and high-quality resources) are reported most frequently. As with other educational innovations, educators also reported time available (to search or to experiment) as a main challenge. Aspects related to individual qualities of the educator (editing skills, how to use OER in class and support needed) have been reported less. In general, differences in perceived challenges to use OER between the teacher groups are small. Relatively more K-12 teachers reported time issues (time to search: $\chi^2(1)= 11.16$; $p= 0.001$ and time to experiment: $\chi^2(1)= 12.256$; $p< 0.001$), which were less reported by both work-based trainers (time to search: $\chi^2(1)= 17.32$; $p< 0.001$ and time to experiment: $\chi^2(1)= 7.05$; $p= 0.008$) and one-to-one mentors (time to search: $\chi^2(1)= 9.10$; $p= 0.003$). Furthermore, relatively more work-based trainers reported Acceptance at work as a challenge ($\chi^2(1)= 6.95$; $p= 0.008$) as did one-to-one mentors with Institutional support ($\chi^2(1)= 7.58$; $p= 0.006$). All differences can be understood as small (with explained variance 2% or less).

Table 5. Perceived Challenges of Use of OER (Percentages within each Educator Category)

	K-12 N= 367	College N= 267	University N= 339	Work-based N= 140	One-to-one N= 169	Total N= 997
Download resources	39.5	39.3	32.4	41.4	32.0	34.9
Find resources	51.2	55.8	58.7*	52.9	50.3	53.3
Suitable resources	56.4	64.0*	61.7	51.4	52.7	58.2
Quality resources	57.2	59.6	56.6	49.3	51.5	56.1
Up-to-date resources	36.0	42.3	43.4	43.6	44.4	39.3
Relevant resources	39.5	40.8	38.9	36.4	37.9	37.2
Acceptance at work	16.9*	24.7	23.6	29.3**	24.9	20.9
Editing skills	19.1	22.1	18.3	14.3	18.3	18.2
Permission to change	28.1	33.7*	29.5	25.7	30.2	28.2
Time to search	55.3***	52.1	47.5	32.1***	37.9**	47.8
Connection peers	22.3	24.3	27.7**	22.1	22.5	22.7
How to use in class	8.8	8.5	13.2**	10.4	11.8	9.5
Time to experiment	39.9***	32.4	32.0	23.0**	28.0	32.5
Institutional support	13.4	19.3	16.9	19.3	23.0**	15.6
Professional standard	13.1	15.8*	9.2*	14.1	16.1	12.1
Support tutor	8.0	3.6	13.2	12.5	10.7	8.2

*** $p \leq 0.001$; ** $p \leq 0.01$; * $p \leq 0.05$

Perceived Impact of OER

From Table 6 it is clear that participants generally see more impact of OER on students' learning processes and outcomes compared to impact on teachers and teaching.

Table 6. Perceived Impact of Using OER (Mean Score (M), Standard Deviation (s.d.) and Number of Valid Responses (N), per Educator Category

	K-12 M (s.d.) N	College M (s.d.) N	University M (s.d.) N	Work-based M (s.d.) N	One-to-one M (s.d.) N	Total M (s.d.) N
Teacher	3.58 (0.85) 403***	3.46 (0.79) 263	3.23 (0.90) 273***	3.16 (1.01) 177***	3.27 (0.97) 207**	3.44 (0.86) 1002
Students	3.77 (0.69) 339***	3.60 (0.66) 247	3.51 (0.80) 281***	3.66 (0.93) 122	3.71 (0.85) 139	3.63 (0.74) 881

*** $p \leq 0.001$; ** $p \leq 0.01$; * $p \leq 0.05$

With respect to differences between teacher groups, it shows that K-12 teacher reported higher scores on impact on both teacher ($t(990)= 4.04$; $p< 0.001$) and students ($t(872)= 4.70$; $p< 0.001$), compared to the other educators. The results for university teachers mirror those of the K-12 teachers, with significant lower scores on impact on

teacher (t(90)= 4.90; p< 0.001) and students (t(872)= 3.29; p= 0.001). College teachers did not significant differ from their colleagues on their impact scores. Both work-based trainers and one-to-one mentors reported significantly lower scores on impact on teacher, compared with other educators :(t(226.60)= 4.35; p< 0.001) and (t(288.03)= 3.06; p= 0.002), respectively. All differences can be understood as small (with explained variance 3% or less).

Typology of Educators' OER Use

Based on cluster analyses on the information on Use of OER a typology has been developed. Five types of educators were distinguished. In Table 7, the mean scores are presented of the input variables for the five types of OER users. Below we will go into more detail into the five types of OER use, based on the information from Table 7 as well as the relationship between these five types with Types of OER used (Table A2), Purposes of OER use (Table A3), Challenges OER users face (Table A4), Impact of OER use reported (Table A5), and Internet access, ICT use and background information (Table A6). All tables labeled with A are included in the Appendix.

Table 7. Typology of OER Users (Mean Scores which are Percentages within each Type)

	Type 1 N= 410	Type 2 N= 106	Type 3 N= 99	Type 4 N= 97	Type 5 N= 133	Total N= 845
Adapt OER	**100**	73	**95**	**96**	*0*	80
Create OER	28	*17*	**60**	**99**	24	38
Publish OER	*6*	*8*	21	**61**	11	15
Add OER	*0*	31	**100**	**84**	*11*	27
Comment OER	*0*	**100**	*0*	**98**	*5*	24
Suggest use OER	*3*	27	*9*	**68**	*5*	14

Note. Relatively high score printed bold; relatively low scores italic (based on Scheffé post-hoc analyses).

Type 1: Adapt and Re-use (N= 410)

This type of OER educators shows a high score on adapting OER to fit their needs and low scores on the other items on OER use, although about one quarter of the educators of this type also reported to create OER. The educators of this type are relatively inexperienced teachers who adapt all different kinds of OER and use OER for various purposes. They do not differ from the other educator types in scores on challenges they face, which means that a majority of the educators of this type see finding suitable and quality resources as their main challenge (see Appendix). This type of OER educators includes almost 50% of the participants of this study.

Type 2: Adapt and Comment (N= 106)

This type of OER educators shows a high score on commenting about resource quality in a repository and relatively low scores on the other items on OER use. About three quarters of the educators of this type also

reported to adapt OER to fit their own needs. They work relatively often with video materials and images, and less with full courses. These educators use OER for various purposes. They do not differ much in scores on challenges they face from the other educator types, except for time issues: a majority of the educators in this type reported that they lack time to find suitable resources and many reported that they not have enough time to experiment with OER (see Appendix). This of OER educators includes about 12% of the participants of this study.

Type 3: Adapt, Create and Add (N= 99)

This type of OER educators shows high scores on Add and Adapt: almost all educators reported to adapt OER to fit their needs and all educators reported that they have added resources to a repository. A small majority reported they have created OER and one fifth that they have published them with an open license. With respect to the type of OER used, relatively more educators in this type mentioned that they use videos and images (both more than 80%) and lectures and course parts (a bit more than 50%). Most educators in this type (three quarter or more) use OER to get new ideas, to supplement their work, to organize self-study for their students, to learn themselves, and to broaden their resources. The challenges they mentioned especially relate to finding suitable resources and resources of good quality. Relatively more educators in this type struggle with work-related issues, such acceptance at work, connection with colleagues and institutional support (around 50%). This type of OER educators includes about 12% of the participants of this study.

Type 4: Adapt, Create, Publish, Add and Comment (N= 97)

This type of OER educators shows high scores on all user items with almost all educators indicating that they adapt OER to fit their own needs, create OER for their teaching and study, and comment on resource quality in a repository. They reported high scores on all types of OER with lower scores –though higher than the other types of OER users- on full courses and data sets (only one third of the educators of this type). They also reported high scores on all purposes of OER, with a lower score –though higher than the other OER user types- on the purpose of making teaching more culturally diverse (about half of the educators in this type). Educators in this type have relatively more teaching experience, are ICT-minded (with high scores on Internet access and ICT use) and relatively more educators are engaged with online en blended teaching (about one quarter to one third). A majority of the educators see as their main challenge to find up-to-date resources and resources of good quality and one third reported challenges about aspects related to their work context (Acceptance at work and Institutional support; see Appendix). This type of OER educators includes about 11% of the participants of this study.

Type 5: Retain and Consume (N= 133)

This type of OER educators show low scores on all user items with only one quarter of the educators of this type who reported to create OER. These educators also reported low scores of all types of OER and all purposes. A small majority –albeit less compared to the other types- reported they created videos and images, with the

purpose to enhance their teaching or to get new ideas. The educators of this type do not differ much in challenges they are faced with compared to the other types of OER users, except for finding quality and up-to-date resources: only one third of the educators of this type (which is considerably less than in the other user types) see this as a challenge (see Appendix). This type of OER educators includes about 16% of the educators who participated in this study.

Discussion and Conclusion

In this survey study, educators reported on the way they use OER, which types of OER they use, for which purposes, the challenges they face and the impact they see on their teaching practice and student learning. Many teachers reported that they adapt OER to fit their own needs, whereas the other ways of OER use, such as creating, publishing and adding OER, have been reported substantially less frequent. Educators from different educational sectors generally showed similar scores on OER use. The main types of OER used were videos, images and open textbooks, while more extensive materials such as courses and data sets were less used. Most educators used OER to improve their teaching practices and to get new ideas or learn about topics themselves. This was especially the case for K-12 and college teachers, and less for university teachers and other educators. In general, this OER practice as described above seems to be quite straightforward and mostly include only the initial steps of using and sharing OER as distinguished by Tang et al. (2020). These findings about OER use are more similar to the final phases as distinguished by Armellini and Nie (2013).

Challenges

The main challenges educators of this study face relate to finding resources that are relevant for their context, of good quality and up-to-date. A second cluster of challenges includes time issues: time to find resources and time to experiment with OER. These time issues appear to be mostly reported by K-12 teachers. Finally, about one fifth of the educators experienced challenges with respect to their work context, such as acceptance at work, connecting with colleagues and institutional support. These work-related issues were mostly reported by work-based trainers and one-to-one mentors, who teach outside the main educational sectors of secondary and higher education. The importance of finding good quality resources confirms the conclusions from Tang et al. (2020) that perceived ease of use and perceived usefulness are the main predictors of teachers' intentions to use OER. The findings of the current study with respect to challenges educators face seem to contradict previous findings from, for example, Mtebe and Raisamo (2014) and Percy and Van Belle (2012), that aspects of personal volition are more significant predictors of teachers' intention to use OER than social and institutional aspects of volition. In the current study, only about 10% of the participants indicated challenges at a personal level, such editing skills, skills how to use OER in class and need for support.

Limitation and Future Research

A limitation of the current study is its unidimensional data collection with a self-report questionnaire. As it is not clear to all educators what OER contains, questionnaires about OER always lead to a bias of educators who

at least heard of OER before. Therefore, we did not interpret the absolute frequencies and did not conclude about adoption rates of OER. But even within the focus of this research, additional data collection such as interviews or focus-group meetings with teachers might provide a richer set of data, especially with respect how OER has been used, created, published and shared and what kind of difficulties teachers experience with all these forms of OER use. This kind of mixed-method study has been carried out before (e.g. Baas et al., 2019), but with a limited sample.

Typology and Implications for Practice

In the current study, five types of OER use by educators have been distinguished: two based on a quite straightforward use of OER with teachers adapting OER to fit their own needs and comment on resource quality in a repository (*Adapt and re-use* and *Adapt and comment*); two based on a more extensive use of OER with teachers adapting, creating, publishing, adding and commenting OER (*Adapt, create and add* and *Adapt, create, publish, add and comment*); and one based on using OER without adaption, publishing or commenting (*Retain and consume*). Educators from these five types face different challenges and different obstacles might apply for different teacher types.

Teachers from the fifth type (*Retain and consume*) generally do not face more or other challenges compared to the other educators; they even see less challenges related to finding good quality and relevant resources compared to the educators. This might be indication that these teachers are less "OER-minded" and therefore are not aware of challenges that relate to findings proper resources. A practical implication for this type of teachers would be that they first become more aware of the benefits of using OER for their practice and own learning. Probably one-to-one mentoring of these teachers in order to support successful pilots with OER might help them to get a more positive attitude towards using and creating OER.

Teachers from both the third (*Adapt, create and add*) and fourth type (*Adapt, create and add* and *Adapt, create, publish, add and comment*) reported challenges with respect to finding good quality resources and work-related aspects. In order to further enhance their use of OER structures could be set in place that support these teachers to search for relevant and good quality resources, and to make uploading and meta-tagging of the OER they created more easy. In addition, institutional policies to promote to use, create and share OER might help these teachers to become even more positive about using OER for their practice. Teachers from these types can also help institutions to promote OER use amongst colleagues, for example by giving them a task in guiding teachers from fifth type *Retain and consume*.

Teachers from the second type (*Adapt and comment*) reported as one of their main challenges time to find proper resources and time to experiment with OER. These time-related issues might also be the reason that teachers from this type stick to adapting OER to fit their needs and submit comments about quality of resources online. Probably more time can stimulate these teachers to also create OER and share them with others. Yet time issues were also quite often mentioned by teachers from the other types.

Most teachers were included in the first teacher type (*Adapt and re-use*) with teachers adapting OER to fit their own needs. Although these teachers mentioned finding good quality resources as their main challenge, it might be more important to make these teachers aware of the importance of sharing OER and commenting on others, instead of just download and adapt OER. One way could be to support these teachers to publish their adapted OER online or to upload these in the repository they were extracted from as an additional context these OER were used in. Of course, this kind of sharing should be recognized by their institution as it should be clear that adapted OER, especially in combination with the original OER, might give other educators significant insights how to use, adapt and share OER for their own teaching practice.

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Appendix

Table A1. Background Participants (Frequency with Percentage within brackets)

Gender	
Female	745 (48)
Male	808 (52)
Age	
Under 15 years	6 (1)
15-18 years	12 (1)
19-24 years	99 (8)
25-34 years	281 (23)
35-44 years	293 (24)
45-54 years	284 (23)
55-64 years	195 (16)
65-74 years	54 (4)
Over 75 years	4 (0)
Highest Educational Qualification	
No formal qualification	21 (1)
Vocational qualification	42 (3)
School leaving qualification	68 (4)
College diploma or certificate	162 (10)
Undergraduate/Bachelor degree University	369 (22)
Postgraduate/Graduate degree University	1029 (61)
Teaching section*	
K-12	675 (38)
College	423 (24)
University	566 (32)
Work-based	309 (18)
One-to-one	359 (20)
Employment	
Part-time	253 (21)
Full-time	762 (63)
Unwaged seeking employment	45 (4)
Unwaged domestic responsibilities	18 (2)
Not able to work	9 (1)

Retired	48 (4)
Part-time voluntary work	47 (4)
Full-time voluntary work	27 (2)
Teaching experience	
Less than 1 year	107 (9)
1-3 years	137 (12)
4-6 years	130 (11)
7-10 years	160 (14)
Over 10 years	607 (53)
Teaching mode*	
Part-time face-to-face	315 (31)
Full-time face-to-face	515 (50)
Part-time online/distance	183 (18)
Full-time online/distance	67 (7)
Part-time blended	113 (11)
Full-time blended	124 (12)
Work-based training	209 (20)
Teaching subject*	
Informatics/computer science	175 (18)
Psychology/Philosophy	194 (21)
Religious studies	74 (8)
Social sciences	201 (20)
Language/linguistics	200 (20)
Science	434 (44)
Math	233 (24)
Arts	153 (16)
Literature	155 (17)
History/geography	172 (18)
Economics/business management	134 (14)
Applied sciences/engineering	148 (16)
Medicine	88 (10)
Health/social care	102 (11)
Education studies	201 (22)
Physical education	57 (6)
Special education	46 (5)

* more than one answering option possible

Table A2. Typology of OER Users with Types of OER Used (Mean Scores)

	Type 1 N= 361	Type 2 N= 97	Type 3 N= 94	Type 4 N= 96	Type 5 N= 122	Total N= 770
Videos**	70	**85**	**85**	**93**	*63*	75
Audio podcasts**	26	38	39	**55**	*20*	32
Images**	68	78	**84**	**90**	*53*	72
Infographics***	*23*	39	36	**66**	*18*	31
Games*	27	35	33	**47**	*20*	30
Lectures*	36	44	**51**	**56**	*24*	40
Lesson plans**	38	36	38	**58**	*14*	36
Tutorials**	35	47	48	**68**	*26*	41
Quizzes**	45	52	44	**70**	*25*	46
Full Courses*	22	16	24	**34**	*10*	21
Parts of a course**	47	47	**59**	**75**	*24*	48
Open Textbooks**	65	60	54	**82**	*39*	61
Data Sets*	19	21	19	**36**	*8*	20
Learning tools***	42	47	52	**71**	*17*	43

Note. Relatively high score printed bold; relatively low scores italic (based on Scheffé post-hoc analyses). Scores between 0 and 100. *** items > 10% explained variance; ** items 5-10% explained variance; * items < 5% explained variance; others non-significant.

Table A3. Typology of OER Users with Purposes of Use of OER (Mean Scores)

	Type 1 N= 385	Type 2 N= 104	Type 3 N= 98	Type 4 N= 96	Type 5 N= 126	Total N= 809
Prepare teaching*	73	74	76	**93**	*58*	73
New ideas**	86	82	90	**98**	*68*	85
Supplement work*	80	81	89	**97**	*65*	81
Assets in class**	51	64	68	**88**	*36*	57
Compulsory Ss**	32	29	**51**	**60**	*17*	35
Optional Ss***	50	54	**80**	**86**	37	56
e-Learning materials***	34	33	**55**	**80**	*28*	41
Compare materials**	37	40	46	**68**	*19*	39
Broaden methods**	61	62	71	**89**	*43*	63
Broaden resources**	61	74	74	**91**	*46*	65
Cultural diversity**	31	42	39	**56**	*18*	34
Prof. Development**	56	66	**71**	**80**	*33*	59
Stay up-to-date**	60	67	71	**85**	*39*	62
Learn new topic**	61	62	**77**	**83**	*36*	62
Engage students**	55	59	64	**89**	*39*	58
Connect teachers**	28	41	**47**	**64**	*14*	34
Hard-to-engage**	34	43	47	**66**	*15*	37

Note. Relatively high score printed bold; relatively low scores italic (based on Scheffé post-hoc analyses). Scores between 0 and 100. *** items > 10% explained variance; ** items 5-10% explained variance; * items < 5% explained variance; others non-significant.

Table A4. Typology of OER Users with Challenges They Face (Mean Scores)

	Type 1 N= 372	Type 2 N= 101	Type 3 N= 91	Type 4 N= 93	Type 5 N= 121	Total N= 779
Download resources*	37	36	**43**	39	*25*	36
Find resources	58	53	57	52	47	55
Suitable resources*	60	*50*	**72**	68	53	60
Quality resources*	58	62	**70**	**69**	*50*	60
Up-to-date resources*	40	46	45	**51**	*33*	41
Relevant resources	38	41	50	46	33	40
Acceptance at work*	19	24	**50**	**37**	20	23
Editing skills	18	19	34	27	21	20
Permission to change	31	31	17	29	23	29
Time to search*	49	**61**	*27*	**60**	46	53
Connection peers*	23	24	**58**	35	24	26
How to use in class	11	11	33	7	8	10
Time to experiment	34	44	9	40	33	37
Institutional support*	16	23	**43**	**31**	17	18
Professional standard*	10	20	**41**	20	10	13
Support tutor	9	0	11	10	16	8

Note. Relatively high score printed bold; relatively low scores italic (based on Scheffé post-hoc analyses). Scores between 0 and 100. *** items > 10% explained variance; ** items 5-10% explained variance; * items < 5% explained variance; others non-significant.

Table A5. Typology of OER Users with Impact They Perceive (Mean Scores)

	Type 1 N= 299 N= 343	Type 2 N= 80 N= 91	Type 3 N= 75 N= 90	Type 4 N= 58 N= 88	Type 5 N= 86 N= 99	Total N= 598 N= 711
Teacher*	3.47	3.54	3.62	**3.84**	*3.44*	3.53
Student	3.68	3.67	3.80	3.75	3.54	3.68

Note. Relatively high score printed bold; relatively low scores italic (based on Scheffé post-hoc analyses). Scores between 1 and 5. *** items > 10% explained variance; ** items 5-10% explained variance; * items < 5% explained variance; others non-significant. N is provide for both variables separately.

Table A6. Typology of OER Users with Participant Information (Mean Scores)

	Type 1	Type 2	Type 3	Type 4	Type 5	Total
Internet access*	50	55	57	**63**	47	52
ICT use**	60	67	69	**76**	58	63
Teaching experience*	*3.92*	4.29	4.22	**4.54**	3.99	4.09
Part-time face-to-face	54	60	46	48	59	54
Full-time face-to-face	31	24	29	27	20	27
Part-time online/distance*	7	9	9	6	*4*	7
Full-time online/distance*	17	15	28	**38**	25	22
Part-time blended*	11	16	17	**26**	11	14
Full-time blended*	9	14	**22**	**25**	7	13
Work-based training*	17	25	**34**	25	11	20

Note. Relatively high score printed bold; relatively low scores italic (based on Scheffé post-hoc analyses). Scores between 0 and 100 (except for teaching experience, which has scores between 1 and 5. *** items > 10% explained variance; ** items 5-10% explained variance; * items < 5% explained variance; others non-significant. Age, gender, teaching sector, highest educational qualification, and employment did not significant differences between the five types of OER users and are therefore not included in this table.