Innovation opportunities for academic libraries to support teaching through open education

A case study at TU Delft, the Netherlands

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Innovation Opportunities for Academic Libraries to Support Teaching Through Open Education: A Case Study at TU Delft, The Netherlands

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ABSTRACT

Opportunities for academic libraries to enrich their products and services through facilitating open education (OE) in higher education are presented in an overview of good practices. A case study of open textbook publishing was performed at TU Delft to study how these products and services could stimulate educators to adopt OE. A simplified user acceptance model of innovation was developed and applied to the case study, to study the educator's mind-set before and after they published an open textbook with the support of the TU Delft Library. Using the insights that were gained from the case study and from good practices of other university libraries, recommendations are presented for professionalizing products and services by academic libraries to facilitate the adoption of OE into educational practice and to develop institutional policies and regulations that support educators with these practices.

KEYWORDS

Library innovation; OER; open education; open textbooks; user acceptance model

Introduction

With the turn of the century, a significant change has occurred in the way information is created, found, adapted, and used. We have now entered an age where information is abundantly available over a large variety of different types of carriers, including websites, audio and video formats, and paper and digital textbooks. Consequently, the way we handle this information is changing as well. This is of particular importance to universities, because this change affects how research output is shared between researchers and how education is provided to students. There are reports of universities that are developing methods to effectively facilitate these changes (Wade, 2013; Wynne, Dixon, Donohue, & Rowlands, 2016).

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Color versions of one or more of the figures in the article can be found online at www.tandfonline.com/racl.

Arguably, one of the most important methods of facilitating access to research and educational information sources is by making them available open access. Within the context of academic research, libraries, and universities in general are starting to adopt open access principles and develop policies, products, and services to support them. There are numerous examples of open access initiatives in Europe, for example in The Netherlands and Norway (Utrecht University, 2018; Van Wezenbeek, Touwen, Versteeg, & Van Wesenbeeck, 2017; UNIT, 2019; Science Europe, 2018). Interestingly, in these initiatives there is limited mention of open access publishing of educational literature and digital course materials, even though open access also has a wide range of possible applications in higher education.

In this work, the application of the principles of open access to education, called open education (OE), focuses on open educational resources (OER), and the practices performed to apply those resources to higher education using the 5R model, first introduced by David Wiley (Hilton, Wiley, Stein, & Johnson, 2010). This model argues that publication of educational resources should focus on sharing them openly in such a way that it is easy for others to adopt them and to adapt them to their own teaching. This way, students and educators are less dependent on commercial resources and can instead work with resources that can be reused, revised, retained, remixed, and redistributed. In order to support this process, educational resources should be published with Creative Commons licenses (Green, 2017). With these open licenses, authors can specify the kind of adoption and adaptation they allow for their publication.

Developments in the field of OE have been observed over the last 15 years. One of the best-known early examples of the application of OE is the launch of the Opencourseware program in 2002 by The Massachusetts Institute of Technology (MIT). In this program, MIT designed a repository for all of their digital course materials and shared them with open licenses. Their motivation for engaging in this large-scale OE initiative was to set a new international standard for the dissemination of educational resources (Goldberg, 2001). Since then, hundreds of other institutions have followed their example by starting their own OE initiatives. Many of them have joined together in the Open Education Consortium (https://www.oeconsortium.org), a members-based network of OE institutions and organizations.

The OE initiatives and studies on the benefits of using OER typically focus on how these resources save study costs and improve access to study materials for students, where the return of investment is described in number of dollars saved by students (Ikahihifo, Spring, Rosecrans, & Watson, 2017). There are limitations to using this focus as a motivation, however, because this return of investment does not flow back to the investors

themselves. Namely, the creators of OER and the investors in OE initiatives do not generate capital from their endeavors (Stacey & Pearson, 2017, p. 22), limiting their long term sustainability and scalability. Fortunately, there are a number of other benefits to engaging in OE initiatives, apart from financial gains. By offering OER as learning materials to students who do not have access to commercial textbooks, their study results improve (Jhangiani, Dastur, Le Grand, & Penner, 2018), a concept that is called the access hypothesis (Grimaldi, Basu Mallick, Waters, & Baraniuk, 2019). Survey results show that working with OER benefits educators as well, because it helps them to learn about new topics and to develop new ideas for teaching (Weller, de los Arcos, Farrow, Pitt, & McAndrew, 2015). However, in spite of these benefits, there are still obstacles that prevent the use of OER from becoming a mainstream practice in higher education.

In this research article, we discuss a number of obstacles to overcome before OE practices can be applied by educators and how academic libraries could facilitate this process. This is done by approaching OE as an educational innovation and applying a generalized theory for innovation adoption. In the literature review, insight in OE initiatives is provided, through review of OE products and services that are offered by academic libraries. The methodology describes a simplified user acceptance model of innovation that we use to determine how the mind-set of prospective adopters of OE practices is influenced by the availability of support for the adoption process. We present a TU Delft case study of Open Textbook publishing, which we consider a good practice of OE. The case study is evaluated with the model to study the effect of the library's activities on the attitude of educators towards using OER in their educational practice. Finally, we present recommendations for professionalizing products and services by academic libraries to facilitate adoption of OE practices and to develop institutional policies and regulations that support educators with these practices. This serves as a basis for the development of an OE community, initiated by academic libraries.

Literature review

There is a wide variety of reports on products and services designed by academic libraries that stimulate the adoption of OE, of which we provide a nonexhaustive review. The emerging OE community of educators and support staff generates a number of opportunities to develop innovative products and services for higher education. Libraries are keen to embrace and develop new services to support this community with novel pedagogical approaches and to promote the adoption of OER. Some of these initiatives are close to the more traditional library competencies and

expertise, while others are less naturally associated with academic libraries as will be discussed in this section.

We have classified the initiatives into the following activities: evaluating and collecting resource platforms, providing tools for the selection and evaluation of resources, maintaining institutional resources repositories, curating resources, supporting the publication of OER, and advocating OE through courses and training.

Academic libraries typically provide researchers and educators with overviews of relevant information resources that are applicable to their practice. An example of applying this to OE is compiling existing repositories of OER and presenting them in a comprehensible way to educators. The BCOER librarians group from British Columbia has reported the development of a rubric to assess repositories for this activity (Smith & Lee, 2017). Libraries also often maintain institutional repositories of research and educational materials, which as Mitchell and Chu's (2014) survey suggests could contribute to the adoption of OER in courses. There are also libraries that have developed an educational collection strategy for OER (Petrides, Goger, & Jimes, 2016).

Training educators increases the effectiveness of their efforts to find suitable OER, as stated by Massis (2016). Many academic libraries already offer information literacy courses and provide tools and methods to evaluate the reliability and relevance of different information type. Although these are not solely focused on OER, they could easily be adapted to serve that purpose.

Several libraries have invested into curation of open resources to facilitate the search and selection process which is a time-consuming activity. Projects have been carried out where librarians managed the search process for OER for educators (Evelyn & Kromer, 2018; Davis, Cochran, Fagerheim, & Thoms, 2016). Unfortunately, this approach has proven to also be time-consuming, with sometimes limited effect on the adoption of OE (Davis et al., 2016). Alternatively, research on and the development of improved and advanced search engines with result visualization could make the user's experience more enjoyable (Gunarathne, Ochirbat, Chen, Reisman, & Shih, 2018).

Academic libraries are also engaged in advocating OE through workshops and discussions (Crozier, 2018), which generate awareness and encourage adoption. Walz (2015) has made an inventory of opportunities, depicting the support that libraries can provide. These are, among others, related to the finding, the design, the adoption, the implementation, and the sharing processes. Furthermore, providing copyright and licensing information for OER plays a key role in adoption of OE practices (Walz, 2015).

The creation of OER also involves publishing, which requires expertise that is not by default present in academic libraries. Publishing is based on collaborative work of several parties and libraries are appreciated as intermediaries between faculties, educators or other services like a university press (Waller, Cross, & Rigling, 2017). Examples of prerequisites and additional services that are in place or have been developed to facilitate publishing have been listed by Goodsett, Loomis, and Miles (2016). This includes providing a publishing platform, including branding and a printing service, but also text editing, advice on copyright, and licensing of open textbooks. TU Delft Library has chosen a similar approach to the Michael Schwartz Library (Goodsett et al., 2016), which will be outlined in the next section.

Methodology

The adoption of OE could be viewed as part of an educator's existing educational practice. In this study, however, we propose to consider OE as an innovation of the existing educational practice and approach it accordingly. A set of prerequisites that determine whether educators are likely to adopt OE practices has been described by Schuwer and Janssen (2018). These are considered as external influences that would affect their mind-set and their choice whether or not to adopt the innovation. They include the quality of OER, the benefits of cooperation between educators in OER publishing, an easy way of creating and sharing published OER, and the need for institutional and governmental policies and regulations. Schuwer and Jansen (2018) consider the absence of any of these prerequisites as an obstacle for adoption of OE practices. We have labelled these external influences as content, communities, support, and policies and regulations, respectively. We propose that by working on adjusting these influences, libraries can actively influence the mind-set toward this adoption.

There are various models that explain the mind-set toward adoption of an innovation from a sociological and psychological point of view. These are typically used in relation to innovations in fields such as consumer products, organizational development and information technology. In this study, the mind-set is evaluated using the Theory of Reasoned Action, first formulated by Fishbein and Ajzen (2010), which is considered to be "one of the most fundamental and influential theories of human behavior" (Venkatesh, Morris, Davis, & Davis, 2003). Despite limitations of this theory (Trafimow, 2009), we believe it yields sufficient insight into how to evaluate the mind-set of educators in relation to the adoption of OE practices.

In the most recent publication of the Theory of Reasoned Action, the state of the mind-set is determined primarily by beliefs with regards to the

proposed innovation (Fishbein & Ajzen, 2010). Beliefs are determined through a set of perceived characteristics that are affected by the presence or absence of the external influences (content, community, support, and policy and regulations). A variety of characteristics, based on Rogers (2003), was determined by Moore and Benbasat (1991). They determined that evaluating the characteristics voluntariness, relative advantage, compatibility, image, ease of use, result demonstrability, visibility, and trialability yields the most accurate description of one's beliefs.

In the case of OE, educators express their beliefs by showing their attitude toward OE practices and their intention to use OER. The presence or absence of external influences also affects their attitude and intention (Venkatesh et al., 2003). If their presence results in positive beliefs, attitude, and intention, the educators will perform the desired behavior of adopting and using of OER in their educational practice.

We combine the Theory of Reasoned Action with the set of external influences into an extended model, which is shown in Figure 1. This model is a simplified representation of innovation adoption in education and was used to evaluate the case study presented in this article. The model is formed by defining the perceived characteristics of educators through their beliefs, attitude, and intention toward adoption of OE practices.

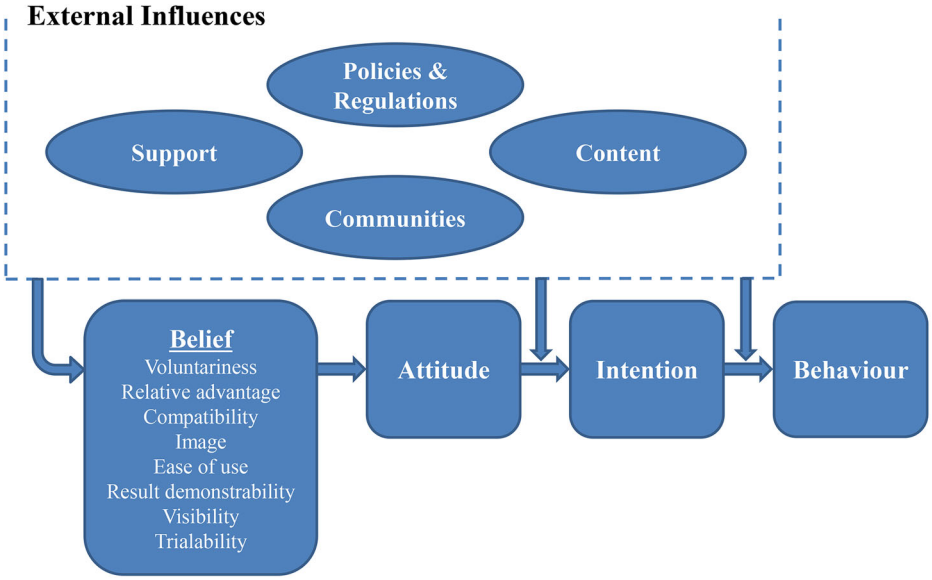

Figure 1. A simplified representation of innovation adoption in education, combined with external influences on the educator's behavior toward adopting open education (OE) practices.

Case study: TU Delft Open Textbook program

The TU Delft Library has designed a case study to demonstrate good practice in supporting adoption of OE practices by developing products and services for education innovators. We started a pilot program to motivate educators to publish an open textbook and to positively influence their mind-set toward the process. We approached people who were recognized within TU Delft as education innovators, in accordance with the adopter category as defined in Diffusion of Innovations by Rogers (2003, p. 282). The library provided a number of products and services to motivate them to participate in the pilot program and to support them during the publication process.

In the pilot programme, the library supervised all the stages of the publication process. In order to determine the role of the library, we discussed the educators' ambitions with them and what they considered the biggest obstacles that they needed to overcome to be able to publish their open textbook. Using the feedback from these discussions, the library designed support products and services to help them to overcome these obstacles.

The library facilitated the writing process by first introducing the educators to Pressbooks.com to use as an online writing platform. One agreed to use this platform, the others preferred to use a writing platform with which they were familiar. In each case, the library provided them with templates for the design and the layout of the textbook. They all used their own educational materials in their textbook. The library advised on copyright matters with these materials and on how to publish a textbook with an open licence. Text-correction and formatting was performed on the initial textbook manuscripts by a professional editor. The library designed a template for the covers, which is used as branding of the open textbooks. The results are published with persistent identifiers on a digital platform (TU Delft, 2018), which offers free access to and download of the textbooks, including printing on demand. To date, support is still offered with updating existing textbooks or publishing new versions.

The pilot program has yielded over 30 initial projects where one or two authors had the desire to publish a textbook. Seven of these projects have resulted in the publication of an open textbook within the first year.

The motivation for publishing an open textbook varied with each case. Initially, not all of the educators involved in the case study were considering making their textbook available outside of TU Delft. One of them wanted to publish his resources in a way that his students had easy access to it, while another wanted to adopt an existing open textbook to his campus education course. The majority of the resources that were used in the cases were created by the educators themselves, which they originally designed for their campus education courses. One of the authors had

decided to adopt an existing open textbook and revise it with some of his own educational resources. One of the textbooks was designed to be used as open course literature in a Massive Open Online Course (MOOC). All of the MOOC resources that were created by this author are shared on the TU Delft Opencourseware platform (TU Delft, 2007). In addition to these course materials, the educator wanted to publish the course literature in the form of a textbook. In order for this textbook to fit the requirements of the MOOC, it needed to be published as an open educational resource.

Results

The simplified user acceptance model was applied to study the outcomes of the case study, by identifying the educators' ambitions and obstacles. We categorized these as perceived characteristics that influenced their beliefs with regards to adoption of OE practices. We determined these through personal conversation with them and designed our approach to open textbook publishing to suit the ambitions and to take care of the obstacles. The educators had different perceived characteristics as obstacles to their beliefs and the case study was focused on facilitating all of them. We determined success measurements for the different perceived characteristics that we used to evaluate the approach to influencing the mind-set. The obstacles, performed activities, and success measurements for each of the perceived characteristics are listed in Table 1.

The educators showed a strong voluntariness towards adoption of OE practices. This was established by the fact that they had personally approached the library after learning about the possibility of receiving publishing support for an open textbook. In two cases, it was a prerequisite to publish the book open access, due to the aim of the project. It was a requirement for all of them that their publication would be linked to their professional profile. To facilitate this, the library published all of the open textbooks with persistent identifiers and coupled this to the educators' professional profile in the university's Current Research Information System (CRIS).

The relative advantage for the educators to engage in the case study was based on the active support they received in the publication process and the funds and time that were saved by working with the library. The library made an assessment of all the steps that were required to publish an open textbook and proposed to the educators that the library take over all the steps that did not involve content creation. This way, they could focus on producing content and they did not have to be involved in publishing, printing, and disseminating their work. The library invested in familiarizing itself with these activities and professionalizing this support, for example

Table 1. Overview of the obstacles toward adoption of open education (OE) practices indicated by the educators involved in the pilot.[a]

Perceived characteristics	Educator-formulated obstacle	Library-proposed solution	Success measurement
Voluntariness	No freedom to adopt the innovation, no mandatory participation in OER adoption.	Approach educators on campus to engage them in OE activities and design a professional reward structure for publishing open educational resources and adopting OE.	• A significant number of educators engage in OE activities. • Published OER is coupled to educator's professional profile. • Published OER has a positive effect on the educator's performance evaluation.
Relative advantage	It is a time-consuming process that primarily offers long-term benefits against a large time-investment.	Design a method for easy adoption of open educational resources by educators.	• Educators receive support with adopting OER by using OER search tools and receiving an overview of OER platforms. • Educators receive structural personal support with publishing OER. • Time- and cost-investment by the Library significantly decreases the educator's time investment.
Compatibility	It is not consistent with the current needs and practices and with past experiences.	Evaluate the teaching practice and define how OE enriches it.	• University's education services are involved in OE adoption as part of teaching practices innovation. • OE activities are included within educator's course development. • An institutional copyright licence policy is determined that supports the adoption and publication of OER. • Usage of publications in campus education is tracked through download metrics.
Image	Education is considered a secondary task by university staff. It is not considered a means of improving one's image.	Facilitate academic publishing of open educational resources by educators. Support the dissemination of publications.	• Educator can publish OER with persistent identifiers. • Publications are available in OER repositories. • Usage of publications is measured by tracking downloads, citations, and reuses.
Ease of use	There is limited support and experience with finding, using, and publishing OER, making it a difficult practice.	Develop support services for creating, reusing, revising, remixing, storing, and publishing open resources.	• Educator is able to publish OER within a short timeframe. • Personal support services are available for copyright issues with open resources. • The publications are available on an open textbook platform. • OER templates for typesetting, layout, and cover design are available. • There is a fixed development track for publishing OER that is managed by the Library.

(*continued*)

Table 1. Continued.

Perceived characteristics	Educator-formulated obstacle	Library-proposed solution	Success measurement
Result demonstrability	There are limited examples of good practice of OE adoption available.	Have educators demonstrate to their peers how to adopt OE.	• Educators present their publications and their practice to their peers.
Visibility	There are limited examples of successful (re)use of open resources within the teaching community.	Formulate a communication strategy to share publications and communicate about published OER.	• Library arranges communications about all publications on institutional website, social media, and faculty meetings. • Open textbook releases are shared through events and news items.
Trialability	Experimenting with OE adoption is time-consuming with uncertain return-of-investment.	Create support for educators to experiment with adoption of OER.	• Training in adapting and creating OER is developed for educators.

Note. OER = open educational resources. [a]Each of the obstacles is identified as a perceived characteristic. The proposed solution is provided for each of the perceived characteristics, with the success measurements that were used to determine if the mind-set was successfully influenced.

through the development of templates for typesetting, layout, cover design, and providing a publication platform. This is considered to be a direct decrease in cost- and time-investment required by the educators themselves. During the publication process, the library kept in regular personal contact with them to provide structural support with publishing their open textbook. During these contact moments, which were held on a biweekly or monthly basis depending on their preferences, progress, and requirements, were assessed.

The specific services that were performed by the library during the publication process were focused on optimizing the ease of use and trialability for the educators. Copyright support for the materials was required, as well as templates for typesetting, layout and cover design, text correction, and formatting of the initial textbook manuscript. The library developed a process in which all materials were analyzed by a copyright professional and similarity software, to confirm that all material contained in the textbooks was original or publishable under an open licence. All templates were designed by a professional designer to be adopted easily by the educators, matching their preferences. The final textbooks are all published with ISBN and DOI on an open platform that is maintained by the library and all the content is open and available for reuse.

The successful dissemination of the publications with persistent identifiers enabled the educators to enhance their professional image, to demonstrate their results to their peers and to enhance their visibility. The library supported them with this by submitting the publications to established OER repositories. They also presented their products on campus through

book launches and faculty meetings, where they explained their efforts and what the role of the library was in this process. After the initial launch, the number of views and downloads of the publications on the open textbook platform was tracked periodically to measure the usage of the publications. Here an increase in the number of downloads of the publications by a factor of 10 to 20 was observed during the period where they were used in campus education. This indicates that students were able to find and download the publication, which would make it compatible with the educator's teaching practice.

Apart from all of the aforementioned success measurements that were determined and evaluated, the educators also gave personal feedback on how they experienced the publication process. They were positive toward the publishing process and the support that they received. They all expressed the desire to publish more OER in the future.

Discussion

The results of the case study indicate that adopting OE practices on a small scale can be effective when the academic library uses a personal approach to support educators. It focuses on decreasing cost- and time-investment for them and delivering a publication that can be easily shared and presented within their community.

There were also a number of possible positive outcomes that are defined in Table 1 that were not measured in the case study. The voluntariness would be positively influenced if their efforts were recognized in their performance evaluation, which is not yet the case within the educators' faculties. The compatibility with the educator's current practices was also not explicitly observed.

We propose that all of the success measurements that were absent in the results require innovation efforts on an institutional level. To achieve this, external influences on the mind-set should be developed further as well. Each of these influences requires a distinctive development approach, for which we provide recommendations.

Educators need to be able to adopt OER in their educational practice, if OE practices are to be adopted on a larger scale in the educational community (Jhangiani et al., 2018). This requires that the content meets certain quality standards, as mentioned by Schuwer and Janssen (2018). Performing quality control on the resources is a large investment of resources for libraries, with limited proven value (Davis et al., 2016). Libraries could instead invest in designing automated search tools for OER, which effectively evaluate the quality of these resources. This can be performed by metadata analysis on OER, to assess quality attributes such as relevancy,

reliability, comprehensibility, good organization (structuring) of the content, ease in editing, openness through licence type, and up-to-dateness (Demir, Ozsaker, & Ilce, 2007; Vercoustre & McLean, 2005). Further research is needed to determine exactly which quality attributes should be applied on different OER and how the metadata of OER can provide insight into these attributes.

The academic library also has an important role to play in building OE communities. A 2010 Cetis survey demonstrated that librarians have skill-sets that should be applied to OER projects (Kazakoff-Lane, 2014), to address important problems within the OE community, many of which were determined by the 2012 Paris OER Declaration (UNESCO, 2012). The most effective initial approach to OE community building would be to bring together the early adopters of OE practices and the educators with a positive attitude or intention toward OE adoption. The early adopters are defined as individuals who substantiate one or more of the four categories that motivate an individual to become engaged in OE (OECD, 2007): the altruistic motivation of sharing, the personal nonmonetary gain, the economic or commercial benefit, and the philanthropic reasoning. The educators that were involved in the case study are all examples of early adopters. As was demonstrated in this study, the library can effectively facilitate contact between the early adopters and their peers to create a community where educators review, reuse, revise, and remix OER.

The role of the library should be especially prominent in the development of products and services that stimulate the overall adoption of OE practices by supporting the creation, adaptation, retention, and (re)distribution aspects of OER (Waller et al., 2017; Goodsett et al. (2016). Assisting in publishing an open textbook is an example of such products and services. Waller et al. (2017) and Goodsett et al. (2016) also indicate that other effective examples might include facilitating the evaluation of open resources that educators might use, conforming to licensing requirements when using these resources and curating the platforms where they can publish open resources. Academic libraries could also develop training for educators on how to use open resources in their educational practice and how to publish open resources themselves. Development of policies and regulations that support them with their open educational practices could also stimulate institutional adoption of OE (Schuwer & Janssen, 2018).

It should be emphasized that academic libraries cannot implement large scale adoption of OE practices without the cooperation of other stakeholders. Universities and government should strive to develop national and international policies and regulations in order to propel OE forward and embed it as part of an institutional strategic program, as was concluded in a study by Bossu, Brown, and Bull (2012) on the adoption of OER in

Australian higher education. Their study also addresses the need to develop a new rewarding system in education that includes recognition for staff to encourage them to create or adapt OER. In addition, institutional policies regarding the application of open (copyright) licences should be defined and communicated via guidelines for educators to inform them how they can disseminate different types of OER, while being aware of the gains and risks (Geser, 2012). Institutional policies and regulations are culture dependent and can be different for universities. Examples of institutions that have defined policies and regulations are Massachusetts Institute of Technology (2015), University of Leeds (2017), and Wageningen University & Research (2019), which could serve as examples for other institutions when designing their own.

Conclusions

We have presented the concept of OE as an educational innovation that has the potential for adoption into higher education. Open education ties into the developing institutional, national, and European policies for publishing research work open access. We have provided a range of recommendations for realizing large-scale adoption by academic institutions and by communities of educators. By reviewing OE practices at other academic libraries, as well as performing and evaluating a case study of small-scale adoption at the TU Delft, we have determined a set of external influences (content, communities, support, and policies and regulations) that affect the likelihood of educators adopting OE practice. We have outlined the opportunities for universities and in particular academic libraries to affect these external influences through products and services that can be embedded into their core activities. As our case study also has demonstrated, by starting the adoption of OE on a small scale, best practices are created that could serve as the basis for upscaling this process to create an international community of OE practitioners that generate high quality OER.

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