Using Rogers' Theory of Perceived Attributes as a Framework for Understanding the Challenges of Adoption of Open Educational Resources

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Abstract

Over the last decade, the word "open" has also been used to describe educational resources (OERs) and courseware (OCW). The word "open," as used here, refers at one level to the fact that the end user does not pay to access the resources. However, various challenges exist in using and producing open content, and the fact that resources are free does not mean that they are automatically embraced by end users. Models of creating and sustaining OERs/OCW carry their own set of issues. This paper examines some of those challenges as seen through Rogers' Theory of Perceived Attributes. The theory covers important aspects of diffusion as one considers the potential adoption of the innovation, and may help give supporters of OER another means of securing its long-term sustainability.

Keywords: adoption, diffusion, open educational resources, relative advantage, compatibility, complexity, trialability, observability

1.0 Introduction

With his family unable to irrigate crops due to lack of a mechanical or electrical pump, and his small village in Malawi on the brink of starvation due to a severe famine, a teenager named William Kamkwamba went to a nearby town looking for a handout – but not the kind one might imagine. His physical hunger was matched by his intellectual hunger, and both took him to the library. There, he found a physics textbook and another text about windmills. Out of school because his family could not afford the fees, he had time to read about wind-generated pumps and electricity and scavenge for parts. The books, written in English, a language he had been learning only for a few years, provided him with what he needed to build a modest, working wind turbine. With it, he was able to generate a bit of power for his parents' home, but the result of his work electrified the world's imagination. The best-selling book, *The Boy Who Harnessed the Wind* (Kamkwamba&Mealer, 2009) details William's story. The account highlights not only one young man's ingenuity and success against crushing odds, but the power of having the right learning resources, at the right time, for the right price. Kamkwamba's compelling story illustrates the hope of all in the community working with Open Educational Resources, which "[promise] to bless the lives of people around the world" (Wiley &Gurrell, 2009).

One could well argue that the first repositories of open resources were in fact public libraries (Bertrand, 2009; Garcia López, 2007) or reading rooms, but even this means of sharing of knowledge with those outside organized societies (sectarian or otherwise) did not exist in Europe until the Enlightenment period of the mid 18th century. Up to the point of the formation of public reading areas, the majority of people were not permitted to access stores of printed knowledge not necessarily because of illiteracy, but due to the high costs of accessing the resources; membership fees were quite common. While the proliferation of web-based materials has increased exponentially since the early 1990s, the availability of comprehensive, organized, well-designed educational materials stayed behind the walls of the academy. Over the years, many generous teachers and professors who always posted their materials publicly to the web, but these materials did not flow together in a manner where a novice learner's experience would be somehow scaffolded as s/he grew in knowledge and experience, or where an academic could consistently find materials. Since the beginning of the new millennium, however, the outlook has changed.

2.0 Open Educational Resources

A report by the Organisation for Economic Co-operation and Development (OECD) defines the term 'Open Educational Resource' (OER) from its common usage, which is "digitised materials offered freely and openly for educators, students and self-learners to use and resuse for teaching, learning and research" (OECD, 2007, p. 10).

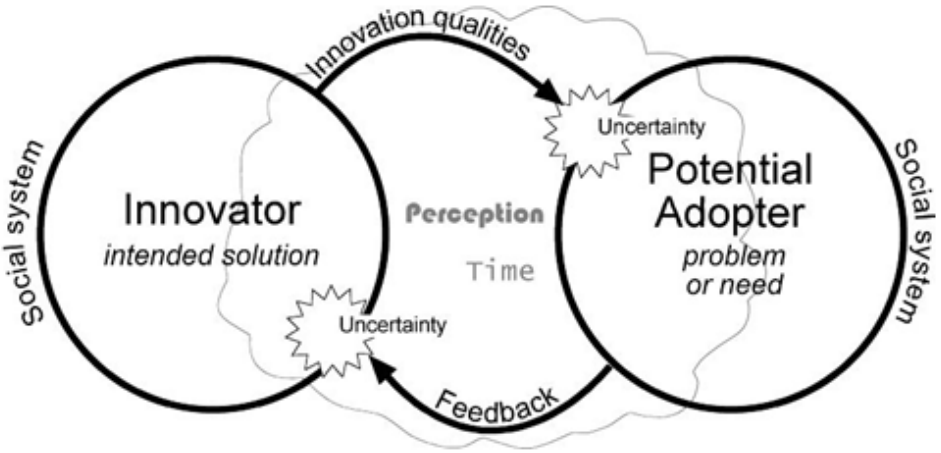
The digitized materials could include software or learning content. The contrast of time between the creation of written knowledge and its public accessibility with the creation of the World Wide Web and openness of materials could not be starker. On one hand, hundreds of years separated people from knowledge. Interestingly, the advent of openness of printed material was followed by the Industrial Revolution in Europe. Although industrialization's causes are far more complex, the opening of knowledge to the population certainly had an impact on innovation. The movement toward openness of digital materials, on the other hand, began in the late-1990s (Wiley &Gurrell, 2009), less than five years after "the web" entered common parlance. The spread of OER has been heralded not just by founding academics, but by international organizations to include the United Nations, who see OER as helping fulfill the UNESCO millennial educational goals (McIsaac& Moreira, 2009). What remains to be seen, of course, is how OERs will be more broadly adopted, especially in areas that have the most need for such resources. The 2010 Horizon Report (Johnson, Smith, & Stone, 2010), which annually predicts the technologies predicted to "enter mainstream use on campuses" (p.3), indicates the OERs will be widely adopted by 2011 – though it gives no indication about who is doing the adopting, or where. The exact measure of this adoption is not indicated either.

The challenges to widespread adoption are substantial, and they have been extensively documented (e.g., Atkins, Brown, & Hammond, 2007; Downes, 2007; Hylén, 2006; Lee, 2008; Yuan, MacNeill, &Kraan, 2008). Challenges include questions about the ability to reuse and adapt materials, methods of indexing and distributing materials, materials design, pedagogical assumptions, infrastructure costs, long term sustainability, quality control of content, establishing credibility, intellectual property issues, access to resources in areas without stable information and communications technology (ICT) infrastructure, and ways of mitigating against cultural hegemony. To guide the discussion, this paper will use a framework that has guided such discussions for the past four decades, E. M. Rogers' (2003) work on diffusion of innovations.

3.0 Diffusion of Innovations: Specialized Communication

Rogers' (2003) work related to the diffusion of innovations has been the foundation of research in the field for many years, and a number of authors recognize the importance of applying ideas about diffusion to educational technology (Burkman, 1987; Ellsworth, 2000; Surry & Farquhar, 1997; Yates, 2001). The definition of diffusion includes elements of a general communication model, and Rogers states that diffusion is just that – a specialized instance of communication. The specialized nature is found in the fact that the communication is about a new idea, object, or process (p.5). A number of communication theories exist (Wisely, 1994) and Rogers' concept of diffusion accounts for the elements found in many of them. The elements of a general communication model include the sender (the innovator), the receiver (the potential adopter), the channel (planned or unplanned information about the innovation and resulting feedback), and interference (uncertainty), which results from perception. An illustration of an innovation communication model is shown in Figure 1.

Figure 1: An innovations communication model.



The goal of educational innovation is to "improve or change certain aspects of the educational process" (Malan &Rassekh, 1983, p.5). Diffusion is "a kind of social change, defined as the process by which alteration occurs in the structure and function of a social system" (Rogers, 2003, p. 6). Important to remember, also, is that innovation and change are not the same:

> Innovation is not synonymous with change. Change is merely a shift from one practice to another. By contrast, innovation is purposeful change, directed change, which self-consciously attempts to improve, reform, make new. Innovation is an attempt to improve quality and service: the quality of a product must be better than before…. (Hall, 1991, p. 7)

That educational technology (a type of innovation) is not being applied as it should frustrates any number of ICT professionals. Therefore, diffusion theories and studies should be important to instructional technologists for at least three reasons, as Surry and Farquhar (1997) point out:

1. A better understanding of the numerous factors that affect the diffusion of innovations may help experts in educational technology account for variables that either block or aid the adoption of their work.
2. Instructional technology itself is an innovative discipline, and those working in instructional technology who better understand diffusion theory will be ready to work more efficiently with potential adopters.
3. Since instructional technology already uses a systematic process to guide design, it is possible that a systematic model of diffusion of innovations could guide them in much the same way. (para. 4-6)

Schneberger and Jost (1994) speculate that educational technology is not be applied to the degree that has been expected for at least three reasons: teacher resistance, bureaucratic inertia, and lack of funding. While there are many other barriers to adoption such as social pressures, inadequate information about an innovation, inherent complexity, ignorance of political inertia, poor timing, and so on (Hall, 1991), problems of adoption are not unique to educational or educational technology – they extend to any aspect of new technology (Schneberger&Jost, 1994).

4.0 Educational Technology and Diffusion

Formal attempts to integrate educational technologies into teaching and learning in the developing world have been made since the 1960s (e.g., Dordick, 1968; Lefranc, 1967; Schramm, Coombs, Kahnert, & Lyle, 1967). It was during the same time that a number of predictions were made that directly linked economic development to the education of citizens (Carnoy&Samoff, 1990; DeYoung& McKenzie, 1989; Fägerlind&Saha, 1989; Michele, 1987). If education was needed to develop national economies, educational technology could help do it faster, or so it was thought. The prevailing sentiment was that educational technology could solve a host of problems faced by education systems in countries that did not have the resources to educate large numbers of people (Chadwick, 1970; Coombs, 1968). Interestingly, both Cox (1971) and Marchessou (2000) wrote nearly the same thing about the effects of educational technology's effects three decades apart:

> The "extensions" and newer electronic media have become critically pertinent to basic educational problems faced by all developing nations, but newer media considered as panaceas to educational problems have often created as many problems as they have solved. (Cox, 1971, p.66)

> We have in the past 35 years seen many enthusiastic expectations about the forthcoming miracles come to grief whenever the successive waves of technological media failed to deliver any dramatic improvements to the never-ending educational crises that affect the First, Second, and Third worlds. (Marchessou, 2000, p. 114)

Why is it that two authors, one writing 30 years before the other, would note the same failures? Is 30 years too short a time for technologies to diffuse in such a way as to be at least nominally effective in each context to which they are applied? Determining all the reasons for adoption or failure to adopt with any degree of specificity would be quite difficult as many factors go into such decisions.

The following discussion examines adoption studies of educational technologies in developing nations through Rogers' (2003) work, specifically his theory of perceived attributes. Rogers writes that "the perceived attributes of an innovation are one important explanation of the rate of adoption of an innovation" (p. 221). The elements of the theory relate to how an innovation is perceived based on its relative advantage, compatibility, complexity, trialability, and observability. As the elements of the theory are discussed, the challenges to OER adoption will be considered. Additionally, occasional references to historical cases related to adoption will be used to further elucidate the aspects of the theory. This also will give the reader the opportunity to see that such considerations are hardly novel despite the relative newness of OERs.

4.1 Relative Advantage

A central tenant of innovation theory is not concerned with the inherent qualities of an object or idea, but how those qualities are perceived. Rogers' (2003) theory of perceived attributes takes into account the notion of relative advantage, which he defines as "the degree to which an innovation is perceived as being better than the idea that it supercedes" (p. 212). Furthermore, the advantages are not those dictated by the producers, but those as perceived by the individual (p. 223). Relative advantage can be measured in economic terms, social prestige, convenience, satisfaction. The most obvious advantage of OERs, at least as promoted by those who create and host them, is that the resources are free to the end user. However, this is only a necessary but not sufficient condition to ensure adoption, as even "free" products have costs (Downes, 2007). For example, the well known open source learning management platform, Moodle, is free, but the equipment on which it must be hosted, and the human infrastructure needed to maintain it, are hardly without cost. For organizations trying to implement it, another cost – that of training – must also be reckoned.

With regard to social prestige, the idea of something that is free may not be as immediately appealing as one might suspect. Even among people who cannot afford costly school fees, there may be the idea that anything that is free or cheap does not have worth. Though people may be able to satisfy their intellectual curiosity with free resources, in some places there is little prestige associated with having something that anyone else can get. Much the same argument can be made concerning satisfaction, where end users might always somehow feel less than satisfied because, in the end, they are "taking what they can get," rather than necessarily getting what they want. And, while the convenience factor of OERs – particularly open courses – might appear to be another strong advantage, it may not be so to the prospective audience. A good example of this might be in accessing materials. Though an institution might conceivably have a computer lab set aside for users to access the free content, the lab may be booked up for other classes. Without time to thoroughly read the course content, students might wish to print – but can only do so if that particular resource is available and is low cost. Again, something that is free does not make it, bi facto, convenient. In developing regions, though mobile technologies have been gaining traction, a wide digital divide remains, making access to learning materials very difficult (Atkins, et al., 2007).

4.2 Compatibility

Rogers defines compatibility as "the degree to which an innovation is perceived as consistent with existing values, past experiences, and needs of potential adopters" (2003, p. 240). Up to this point, the perspective considered has been that of the end-user. One must remember, however, that the producers of OER materials are also adopters, as they must commit to a system of content production, storage, and dissemination that is likely quite a bit different than models with which they are already familiar. Additionally, the funding model that might best sustain their OER initiative (see Dholakia, King, &Baraniuk, 2006; Downes, 2007) may be different than whatever is already in place. The dimensions of compatibility include the manner in which an innovation "fits" extent values and beliefs, previous ideas, and expressed needs. One example of a challenge to OER has to do with copyright issues (Lee, 2008; Yuan, et al., 2008). The open licensing standard has existed now for more than a decade (Caswell, Henson, Jensen, & Wiley, 2008), but institutions of higher education, and faculty within them, have long stood by the notion that materials created using university resources are proprietary. Though more institutions are following the lead of the Massachusetts Institute of Technology (MIT), which is recognized as the first university to make all of its course content public and has now published 2,000 course (MIT, 2010), the greater majority of institutions in North America and globally have yet to follow suit.

4.3 Complexity

Any innovation quickly gains a reputation as to its ease or difficulty of use, being "classified on the complexity-simplicity continuum" (Rogers, 2003, p. 257). With regard to OER materials, complexity very much depends on the commitment of the producer to creating either software or instructional content that adheres to best practices of design. Going back again to free learning management systems (LMS) such as Moodle or Sakai, though the user-producer community is constantly updating those tools with upgrades and new additions – the ability to do so makes them very attractive to some – there are others who would like to use the LMSs but cannot because they are unable to modify it for their own purposes due to a lack of technical knowledge. In such cases potential adopters may opt for a cost-based solution for two reasons: 1) a company in competition with others will pour a great deal of resources into ensuring that its interface has a competitive advantage, and 2) users without technical expertise can simply pay others to take care of the "back-end" for them (such as integration with a university's student database system).

Instructional design of OER course content is an aspect that should be done with close consideration of the values of OER itself (Kahle, 2008), which include design for access, agency, ownership, participation, and experience. Without such considerations, the resources intended for open distribution may well have no use whatsoever, meaning that much effort has been wasted. The Open Participatory Learning Infrastructure Initiative (OPLI) "seeks to enable a decentralized learning environment that: (1) permits distributed participatory learning; (2) provides incentives for participation (provisioning of open resources, creating specific learning environments, evaluation) at all levels; and (3) encourages cross-boundary and cross cultural learning" (Atkins, et al., 2007, p. 57). Even following established models of instructional design (e.g., Gustafson & Branch, 1997) does not ensure a decrease in complexity if the product is not extensible, modifiable, reusable, etc. Though instruction might not be "complex," in technical terms, course materials that take a good deal of time to reconfigure will likely go unused due to the complexity of having to localize them.

4.4 Trialability

An important characteristic of an innovation is the ability of end users to experiment with it, or use it on a trial basis (Rogers, 2003). A trial period for an innovation helps potential adopters answer their own questions about how an innovation might work in their particular situation. New ideas that can be tested for a limited time are "generally adopted more rapidly than innovations that are not divisible" (p. 258). With respect to OERs, it is important that content is created in such a way that it can be divisible, which is in keeping with the aforementioned OPLI goals (Atkins, et al., 2007). Content units, in particular, must be catalogued and indexed in such a way that allows users to choose what, and how much, they want of a given resource (Duncan, 2003). It is also imperative to keep in mind that "free" resources are not free, as previously noted, and cannot be evaluated if there is an expectation that would use materials like costly textbooks, multimedia, or other pieces that users might not be able to afford or cannot otherwise access.

One must remember, too, that outsiders who create content to be considered by an indigenous population – whether individuals, university faculties, etc. – are in fact playing the role of importer (Hawkridge, 1991; Modest, 1997; Schramm, 1977; Thomas, 1987; Wells, 1976). As Kahle reminds his readers, "Design is a highly influential, value-laden and reflective practice which, within our context, must mirror, accommodate, and reconcile the values and assumptions intrinsic to open education" (Kahle, 2008, p. 27). Therefore, whenever a person or an institution is opening materials for broader dissemination, particularly if the wish is for the resources to actually be useful, it is imperative to create a means that allows for them to be used on a trial basis. Some may think that this is easily done, as all that a potential user has to do is download material(s) and try them for him or herself, the classroom, or some other group of people. While it may be true that questions related to trialability are easily solved at the individual level, it is important to keep in mind that individuals operating within an organizational context are part of a larger political system that may have other goals. Conducting formative field trials is not necessarily only a time or money consideration; it can also be cultural in nature. Commenting on the use of instructional television in American Samoa during the 1960s, Schramm (1977) describes a culture that would not tolerate pilot tests that would benefit one group of students to the exclusion of others; "…the chief reason may have been the reluctance of the Samoans themselves to introduce the new system one grade at a time. A Samoan cultural norm, or so it was reported at the time, provided that 'all should go forward together'" (p. 153).

The aspect of perception must be re-emphasized. Sometimes a trial period cannot take place due to time or funding constraints. At other times, however, the perception exists that a technology will work simply because it is technology. As Ely (1990) notes,

> Another reason for acceptance and implementation has been the perception of modernization on the part of educational and government leaders. Using the Western-model of problem-solving through technology, many countries purchased communication hardware that symbolized progress. It could be seen and touched. It was the same equipment that was being used in the more developed nations and therefore conferred status on the owner. Little thought was given initially to the software or the materials required to use it or to the methods of utilization. (p. 77)

Nearly the same sentiment is echoed by (Altbach, 1987, p. 161). When decision-makers are misled about an innovation, if they are uninformed, or if they get "stars in their eyes," the result can have serious consequences.

4.5 Observability

The fifth aspect of Rogers' theory of perceived attributes is related to "the degree to which the results of an innovation are visible to others" (2003, p. 258). Institutions and individuals might give any number of reasons for contributing to the larger body of OER materials, and among them are the desires to establish credibility and gain recognition (International Institute for Educational Planning (IIEP), 2006). When an institution or organization decides to become producers and consumers of OERs, they should do so with clear goals in mind. Only with clear goals can an innovation be properly evaluated (Weiss, 1998). Furthermore, there is an ongoing need for empirical data related to the use of OERs (Center for Educational Research and Innovation [CERI], 2006), and though these have slowly been introduced (e.g., Johansen & Wiley, 2010), the need remains to do closer evaluation in OER's various contextual representations (CERI, 2009). In the concluding chapter of *Opening Up Education*, editors Iiyoshi and Vijay Kumar write as their first recommendation concerning OER's forward-looking agenda,

> Open education is a means to an end. However, as we noted in our introduction, one of open education's most critical questions—how can open educational tools, resources, and knowledge demonstrably improve education quality?—is rarely mentioned or explored. Unfortunately, this omission from the conversation and action mirrors the education community's serious lack of engagement in investigating the transformative potential of open education. (2008, p. 430)

Rogers (2003) writes "the observability of an innovation, as perceived by members of a social system, is positively related to its rate of adoption" (p. 258). Given the importance of being able to see results from other adopters, and knowing how to measure local attempts, makes the call for better research and evaluation imperative.

5.0 Conclusion

Although the potential for positive change exists with many innovations, they are not always adopted. The relative advantages of a technology must first be understood by the potential adopters, which happens through a variety of means. This same knowledge and subsequent observations then inform the decision to keep or abandon an innovation. Trial periods allow an adopter to experiment with an innovation in a local context, but such periods are not always feasible or possible depending on the type of technology, how it is funded, and the availability of support systems needed to do pilot testing. Once an innovation has been implemented, the adopters watch factors that they perceive as important – to some it might be availability, to others it might be effectiveness, and to many, it might be cost. If the innovation does not meet perceived needs, it is typically abandoned. Educational technology, as an innovation, has often been looked to as a way to solve educational problems or ameliorate existing instruction. Open Educational Resources are one of the latest of these innovations, and the challenges to its wider adoption and sustainability need to be understood within the diffusion framework established by Rogers (2003). Here, only the Theory of Perceived Attributes was considered. Going forward, it will be important to examine other aspects of diffusion theory when examining the broader adoption of OERs.

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