

Open Knowledge Diffusion Tools: FOSS, OER, OT, MOOC and the Role of the Library in Mitigating the Social Inertia of Constrained Learning Environments

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Abstract:

The cost of higher education and the rise of student debt, juxtaposed with the attrition of formal learning and the rise and evolution of informal learning presents a unique challenge to academic institutions. Students can no longer afford the cost of textbooks, and the use and embracement of proprietary software limits the freedom of knowledge exchange. A successful pedagogical metamorphosis will depend on the resistance to social inertia, influenced by internal and external entities of academic institutions, and the pressure to remain in a constrained learning environment. In this research, we present our concept of open knowledge diffusion and the effects of social inertia in preserving constrained learning environments. We identify and explain Open Knowledge Diffusion Tools (OKDT) such as Open Educational Resources (OER), Open Textbooks (OT), Massive Open Online Course (MOOC), and Free and Open Source Software (FOSS). We discuss their impact on pedagogy and informal learning. Finally, we present a framework in which libraries play a major role in mitigating the social inertia of constrained learning environments.

Keywords: FOSS, OER, MOOC, Open Textbooks, Open Knowledge Diffusion Tools (OKDT).

Introduction

The cost of higher education and the rise of student debt, juxtaposed with the attrition of formal learning and the rise and evolution of informal learning presents a unique challenge to academic institutions. According to the Federal Reserve Bank of New York, student loan debt is the only form of consumer debt that has grown since the peak of consumer debt in

2008 [1]. The Institute for College Access and Success (TICAS), in its tenth annual report on debt at graduation, reported that student debt rose over 56% from \$18,550 to \$28,950 between 2004-2014 [2]. It is estimated that student loan debt in the U.S. is currently between \$1.3 and \$1.5 trillion and continues to rise each year.

There are three major factors that contribute to the high cost of higher education, which as a consequence impact student retention, and student debt. First, consider the balance between tuition affordability and financial aid availability. According to a report in U.S. News, between 1995 and 2015, tuition and fees at both public and private universities throughout the U.S. rose an average of 226% for out-of-state tuition, and 296% for in-state tuition [3]. In addition, the Center on Budget and Policy Priorities reported that state funding to (public) universities is down 20% per student [4]. Universities respond to a decrease in state funding by increasing tuition, and decreasing funding to colleges and departments across campus. As a consequence, services are reduced, full time faculty are replaced with adjunct faculty, and course offerings dwindle. This can ultimately affect the quality of education to the student. The second factor that contributes to the high cost of education is the high cost of traditional commercial textbooks. Depending on the discipline and major pursued by students, the cost per semester of commercial textbooks for classes (assuming a full load) for a full year can rival the cost of tuition at smaller colleges for a semester. At Kent State University, the estimated cost per year for books is \$1290.00. Like Kent State University, most universities across the U.S. have taken steps to mitigate these costs. For example, it is now common for universities to work with departments across campus to ensure that book orders are placed in advance so students can decide how and where to purchase their books. Students now have the option to either do one of the following:

- **Purchase new from the university bookstore.** Students pay the full price for textbooks including any additional bundled items such as software. If applicable, students can choose the electronic version of the book at a reduced cost. They may also resell textbooks back to the bookstore or to other students at the end of the semester, but at a fraction of the cost of what they originally paid.
- **Purchase used from the university bookstore.** Students pay a reduced cost for the textbook that may or may not include bundled items. If applicable, students can choose the electronic version of the book at a reduced cost.
- **Rent from the university bookstore.** The cheapest alternative through the university bookstore. Students rent either a new or used (even less expensive) textbook at a lower price, but must return the book at the end of the semester. This works the same for physical and electronic version of the book.
- **Purchase new, used, or rent from Amazon, Barnes and Nobles, E-bay, or other applicable online bookstores.** Students again either pay the full price for new textbooks (may not include bundled items), a reduced price for used books, or rent-to-return at the cheapest amount. If applicable, students can choose the electronic version of the book at a reduced cost.

University libraries play a major role in mitigating the costs of textbooks by subscribing to digital libraries such as Safari Books online. This allows student's access to a plethora of electronic books (E-books) at no cost to the student. In addition, subject librarians work with faculty in their respective units to ensure core class textbooks are available in the library's catalogue. What's more is most university libraries across the U.S. in each respective state are a part of a consortium, which allows sharing of resources among those institutions. Kent State University belongs to two consortiums. The first is OhioLINK, which consists of over

140 college and university libraries in the state of Ohio. The second consortium is SearchOhio, which consists of 25 public libraries in the state of Ohio [6].

While the steps taken to mitigate the costs of textbooks to students are helpful, in some cases, it still isn't enough. Paulsen and St. John make the case that students from lower income families face many difficulties financially in supporting their education [5]. For example, low-income students can apply for a Pell Grant, a grant that the U.S. Department of Education provides for students with financial need [7]. This grant helps to offset some of the costs of tuition, but does not cover textbooks. The only other viable option is to apply for loans to make up the rest of the cost of tuition in addition to the estimated cost of textbooks for the academic year. Access to E-book collections through subscription does not come without limitations. The problem is the level of access. For example, Kent State University has a 150 concurrent user license for Safari Books Online, which mean that up to 150 students can access the E-book collection simultaneously. If 150 students access the collection simultaneously, student 151 won't be able to access the collection. While access to shared resources in a consortium can be helpful, the problem lies in availability and loan constraints of those resources. For example, if a student reserves and checks out a book from another institution within the consortium, they are only able to renew that item a specified number of times. However, should another student place a hold on the same book during the loan of the book, the student who has the book in their possession must return it at the end of the loan period. Moreover, the number of textbooks available, whether paper or E-books can never be congruent to the number of students who need the textbook. E-book sharing through institutions can also bring another set of problems. As Walter points out, the most fundamental problems with E-book sharing include restrictive license provisions, restrictions on viewing, downloading, printing, and transferring files, proprietary software and file formats, digital rights management (DRM), and the single-user business model adopted by many e-book vendors [11]. These restrictions, when applicable, present another obstacle for students. Therefore, it is not a viable option for students to borrow textbooks from the library for a full semester of coursework.

The final factor we believe that contributes to the high cost of education is commercial software. The cost is twofold, and both directly affect students. First, consider licensing costs of commercial software. During a semester, students often use commercial software promoted and used by faculty. In most cases, the software is available on computers in the department's computer labs, and in some cases in collaboration with units across campus; the library will also purchase licenses to make the software available on their computers to give students greater access in case the other labs are at full capacity. The problem is that lab time is finite, and there are typically more students than computers in the lab. To account for this, there is a negotiation with commercial software vendors to allow students access to the software at a reduced cost or for free, depending on the language in the license agreement [8], [9], [10]. For example, a perpetual license may allow students to install and use the software on their personal computer system indefinitely, however it is common that after a certain time period, updates and new features to the software are not permitted without a cost [10]. In addition, when applicable, students may only use the software as long as they are students of the university. Second, universities purchase computers for faculty and labs with proprietary operating systems. To offset the cost, students enrolled in courses that may require lab usage must pay a technology fee in addition to their tuition per course.

Constrained Learning Environment

The social inertia of formal learning is a consequence of obsolete learning spaces, traditional pedagogy, and resistance to knowledge transfer. Educational spaces convey an image of educational philosophy about teaching and learning [12]. Many universities have adopted a hybrid curriculum delivery system that consists of courses taken in the physical space (on campus) as well as the virtual (online), also known as distance learning. Adopting the virtual space allows universities the ability to expand the size of the student body and increase their bottom line. In fact, most universities today have programs in which the degree is earned 100% online. Groenwold and Knol suggest that one of the reasons for the popularity of distance learning is to increase the number of participants that can be enrolled in a course simultaneously [13]. However, it is the case that the class sizes in the physical space are equivalent or larger than online class sizes. For example, at Kent State University when the instructional method is traditional (physical space) in both Computer Science and Library Information Science courses, the class size is larger than classes with the 100% online instructional method. In addition, classes that offer a hybrid instructional method (Physical and Virtual), the class size is typically the same. Absent face-face instruction, virtual pedagogy is still structured like traditional pedagogy in the physical space. The physical space hasn't changed much. In most cases, it is still structured like so:

- The professor or faculty member sits or stands at the front of the classroom and teaches with the aid of a PowerPoint presentation, chalkboard, or whiteboard.
- Students face the professor or faculty member and take notes, and are expected to read the course material in preparation for class for Q&A, and assignments.

In comparison, in a virtual space the structure is similar:

- The professor or faculty member leads with a PowerPoint presentation with audio.
- Students are expected to read the course material for Q&A session designated by faculty for a certain day of the week.

Jobrack points out, that the textbook is the core of curriculum delivery [14], [15]. Externally, commercial publishers of textbooks, have a vested monetary interest in keeping things business as usual. In fact, publishers assign representatives to each university. In some cases based on discipline, multiple representatives can be assigned to a department. If a book is adopted for a class, the professor usually receives a copy for free. Students must then choose an option upon which to acquire the textbook.

Open Knowledge Diffusion Tools

We define Open Knowledge Diffusion (OKD) as a global dissemination of knowledge and information, where creations of the mind of an individual or group is shared to the masses without legal consequence. We identify the following as OKDT:

- **Free and Open Source Software (FOSS).** The use and embracement of proprietary software limits the freedom of knowledge exchange. FOSS essentially allows for single or collaborative efforts to develop software that can be freely distributed, studied and modified without legal ramifications [16]. Software is ubiquitous and has become an ecosystem of knowledge exchange. Dexter and Kozbelt point out that FOSS has become more than just a software development principle. It is a useful domain to study creativity [17].
- **Open Educational Resources (OER).** According to UNESCO (United Nations Educational, Scientific and Cultural Organization) open educational resources 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, adoption, and redistribution by others with no or limited restrictions. Whenever possible, they should also be available in formats that are accessible to people with disabilities and no access to the Internet [18], [19].

- **Open Textbooks (OT).** A type of OER that allows the textbook in a digital format to be reused, modified, and shared at no cost [5], [20].
- **Massive Open Online Course (MOOC).** MOOCs are online classes offered at little to no cost to large numbers of students by individual schools, non-profits, or school consortiums [21].

Informal Learning Environment

As Smith explains, the point of education shouldn't be to regurgitate and pass down knowledge, rather, to develop and harness a skillset, and embrace the culture of creativity and collaboration [22]. He also makes the case that too much schooling kills off the desire to learn and that universities should become more like hubs of learning [22]. We believe that universities should become more like a learning commons, where the entire learning environment is one that fosters research, collaboration, and resources are used to create and maintain creative spaces. We view an informal learning environment as an environment where organic knowledge exchange takes place free from the minutiae and constraints of traditional institutionalized curricula. It can be structured or unstructured, but the general outcome is not evaluated by tests. It is applied learning, and thus is measured by the knowledge gained and exchanged between collaborators in space and substantiated by the project or projects produced by the end of collaboration.

The Knowledge Exchange

There are two types of knowledge that is generally shared among students and faculty; the first is explicit knowledge. Explicit knowledge is knowledge ascertained over time through the medium of publicly accessible knowledge. This knowledge is acquired from research papers, journal articles, textbooks, previous work experience, and by knowledge diffusion and knowledge transfer through colleagues. Not all students that attend universities lack the domain knowledge of their discipline. In fact, many non-traditional students, usually identified by age or part time status [23], are practitioners in the field or discipline for which they seek the degree. These students have valuable knowledge that often includes best practice knowledge. We define best practice knowledge as explicit knowledge that is proven to be reliable through empirical justification. In many cases these students may be more knowledgeable on a particular area because they have applied that knowledge in the real world. The second type of knowledge is tacit knowledge. According to Polanyi, tacit knowledge is hidden knowledge that can't be articulated and is not in a form that can be stated in propositional or formal terms [24]. Kingston introduced symbolic experimental knowledge as a category of tacit knowledge. According to Kingston, symbolic experimental knowledge is knowledge gained from experience that the knowledge owner knows that they possess, and is in the form of words or concepts but has never been verbalized or recorded [25]. An informal learning environment, gives both faculty and students the platform in which to extract, articulate, and share this knowledge for the benefit of collaboration.

The Library's Role and the OKDT framework

Since the nineteenth century, American Libraries have served the educational, recreational, and information needs of their users [26]. It only makes sense that libraries become the leading agent of change on campus in the fight to mitigate the social inertia of constrained learning environments. Change requires a framework (See Figure 1). It starts with FOSS. Libraries have begun the process of providing on their machines, free and open source alternative applications that are installed alongside their proprietary counterparts. However, we believe libraries should go further. Every system in the library should be open, meaning free or open source operating systems and accompanying applications, installed on every library machine, including library faculty and administration. In addition, if applicable, the library should circulate mobile devices where the operating system and applications are free or open source. The library should hold seminars and workshops where faculty and students bring in their PCs, laptops, and any mobile device for the purpose of either installing FOSS on their machines outright (removing the host operating system), or alongside their proprietary counterparts to ease into the transition.

Libraries should begin promoting OER, and start a conversation with university faculty on its potential integration and effectiveness on pedagogy. Moreover, more libraries need to get involved with organizations such as the Open Textbook Network, to be a part of group that determines the quality of open textbooks, and OER in general; an important step in eventually supplanting commercial textbooks. Libraries should also promote MOOCs and locate classes that don't overlap university course offerings.

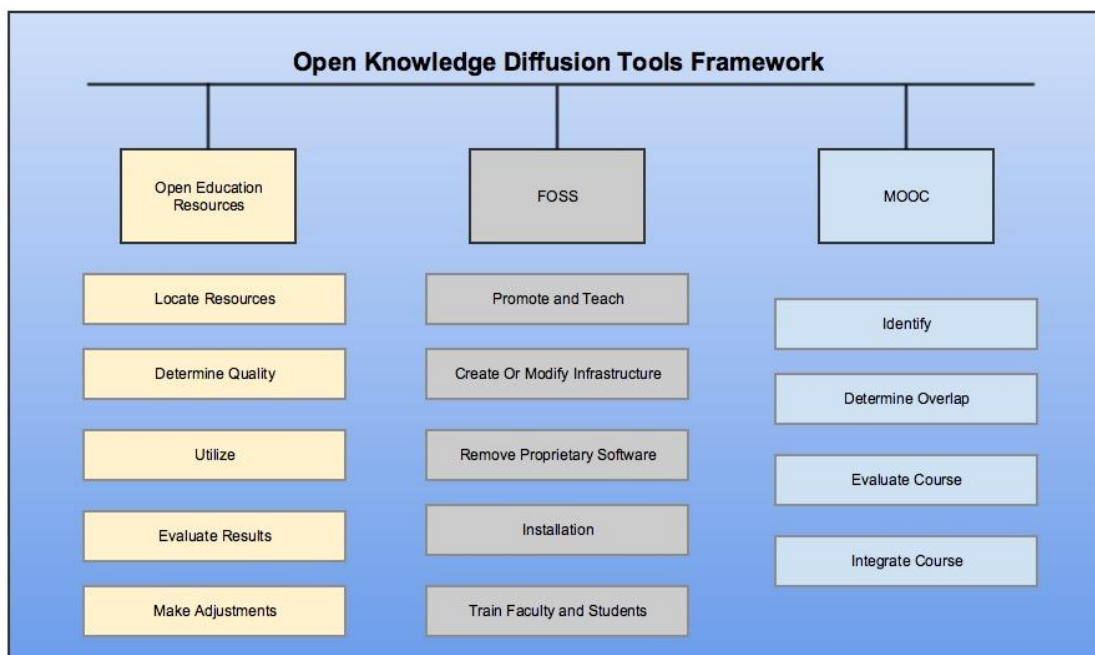


Figure 1: Open Knowledge Diffusion Tools Framework.

The potential impact of OKDT is threefold. First, it will benefit everyone financially. It will cauterize the wound that is student debt, which has been a major burden on the U.S. economy. The amount of money universities spend on proprietary licenses, and monographs can be utilized in other ways that can help save students money. In addition, it can be used to support student and faculty research. College will be much more affordable for future

generations. Secondly, it will impact the way we solve real world problems. Instead of innovating for the purpose of making a profit, we will innovate for the greater good of society. Finally, we believe that it will improve relationships. An environment that fosters collaboration is one that accepts and appreciates ideas from people not necessarily from the same socioeconomic, or cultural background.

Conclusion

Adopting OKDT will be met with some challenges. Any form of change is typically met with some form of resistance. We identify a few challenges:

- **Convincing faculty and students to switch to FOSS.** Most faculty and students are used to proprietary operating systems such as Microsoft Windows and Mac, and are not familiar with free and open source operating systems, such as GNU/Linux.
- **Time spent teaching and training for FOSS.** For some, it will be a learning curve. It is important to put together a comprehensive and reasonable plan and timeframe to prepare for training.
- **Faculty willing to embrace OT.** This may take some time. Publishers such as Cengage and Pearson are relentless when it comes to promoting their products (commercial textbooks). Faculty must be reassured that OT can be as high a quality or even better than their commercial counterparts.
- **Considering MOOCs as a supplement to courses not available but relevant to the degree.** This can be useful in filling in the gaps; however, faculty may not feel comfortable promoting this. Subject librarians make perfect candidates to push this idea to students, especially if it will support student research.

While this change may not help students that have graduated and moved on with substantial student debt, it will lay the foundation for generations to come.

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