TECHNOLOGY IN EDUCATION: ROLE, SCOPE, AND IMPLIMENTATION OF TECHNOLOGICAL INTIGRATION



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# Introduction

 Because technology progresses at such an exponential rate, we often find ourselves asking about its role and impact after the fact. It is incredibly difficult to “keep up” with all of the most recent and novel technological advances. As such, many institutions—including education—are “playing catch-up” and looking for new ways to implement technology into the classroom and student life. Given the ubiquity of technological tools available, it can overwhelming to determine what tools would and wouldn’t benefit an educational institution. Determining the scope and role of technology in education has been something that has received a great deal of attention over the last two decades, and now that technology is unabashedly *here*, it’s a question that is asked with greater and greater urgency, with school administrators afraid that their institutions will be lost in the twentieth century as the rest of the world’s industries move forward with cutting edge digital solutions.

 In this paper we’ll explore the role and scope of technology in education. We’ll begin by discussing how to best conceptualize technology’s role in a way that still puts learning first. In this discussion we’ll acknowledge some organic concerns regarding technological integration in education, and also consider how technological integration in education can pose pretty serious identity crises for long-established and enduring educational methods and infrastructures, which often become obsolete when considered in light of digitization. Finally, we’ll cover a variety of best practices for implementing new technological solutions in a learning environment. Technology is here to stay and educational institutions don’t have much of a choice as to *whether or not* they’ll use it, so school administrators will invariably be faced with situations where they are responsible for the smooth implementation of some new technology or another.

# Conceptualizing Technology’s Role in Education

 Technology is a tool, but it is so powerful a tool that it sometimes takes on the appearance of being “more” than a tool. In certain contexts, technology can be a total *replacement* for human skill. In manufacturing verticals (for instance), efficiency innovations (e.g. robotics and other assembly-line technologies) have the power to completely replace human involvement and intervention. So at least conceptually, technology is often looked to as a possible human substitute. A way to more efficiently and effectively “do the job” than a human person could.

 One difference between education and manufacturing is that manufacturing as we know it has always existed with some form of automation, while teaching has—for thousands of years—been a human expert led activity. It is one that has perennially been premised in student opportunities to engage, learn from, and be mentored by a human expert. To the degree that technology replaces the student-teacher interaction, it is tremendously disruptive to what has hitherto been a universal tradition in education.

 One way that many educational scholars help operationalize the use of technology in classrooms is by describing its “integration” in education. Technology integration has been an extant concept in the educational literature since the nineties, and it is about approaching technology in the classroom not as a matter of teaching students how to use technology in preparation for social and professional contexts, but about “helping teachers to use technology as a tool for learning.[[1]](#footnote-1)” Definitions of “technology integration” may differ slightly from one scholar to the next, but at a high level the term attempts to communicate technology playing a secondary rather than primary role in instruction, as a tool for the delivery and design of instruction rather than as an instructional method or source in its own right.

 It is important that at this conceptual level, educators have a clear theoretical understanding of technology’s role in the classroom. Online delivery platforms like D2L, new presentation software like Prezi, new communications software like Skype, etc. are all excellent examples of technology with high integrative potential. Such technologies easily accommodate conventional instruction and help bridge distances and keep material fresh while not being so disruptive as to jeopardize or threaten the longstanding instructional dyad of teacher-student.

 When selecting integrative technologies, school administrators and other decision makers should be sensitive to technology’s role in their classroom. Technology naturally takes a sort of “center stage” in our lives, but this is not the same thing as technology being the most important *thing* in our lives, nor in our classrooms. Technology in the classroom is in service to the learning process, and evaluating whether or not technology is being used effectively isn’t a question of “how much” technology a particular institute uses, how “advanced” it’s technology is, or how pervasive technology’s presence in an educational institution is. It’s a question of whether or not the technology that *is* being used is advancing and enhancing the pedagogical interests of the student body[[2]](#footnote-2). If technology is not advancing pedagogy, then it isn’t serving an important role in the educational institution, and if (due to a failed implementation, poor training, or just simple irrelevancy) it is *distracting* or in some way *detracting* from that end, then it has positively become a harmful presence in the learning environment and become antithetical to its role and purpose.

## Integrating Technology: Abuses

 A great deal of technological integration has *already* occurred in educational institutions, with students who bring (and use) their smartphones in class. “BYOD”—“bring your own device”—is a much studied concept in business literature because BYOD strategies (whether planned or unplanned) can represent significant savings or losses to organizations. On the one hand, placing the responsibility on users to bring their own device saves organizational resources, while also not being “too much to ask”—since virtually everyone already ones a smartphone, tablet, laptop, etc. But in both business and educational contexts, there is a serious concern about whether or not such devices do more harm than good.

 Educational authors are divided on the impact of BYOD in schools. Some fear that the potential for distraction and cheating, not to mention the possibility of incompatibility between user and school software, are all very high[[3]](#footnote-3). Other concerns include the fear that BYOD as an accepted “culture” in education would render the existing educational infrastructure obsolete, because physical space becomes increasingly less important (or at least, less emphasized) in the educational environment.[[4]](#footnote-4)

 But in all of these cases, it is unclear if technology is really *aiding* the learning process. Smartphone use is still relatively novel and not perfectly understood by research, so over time we may be able to better capture the degree to which it interferes (or helps) with learning. In the meantime, it suffices to say that technological integration in schools far transcends the fact that students bring their own devices, since such technology use, though possibly (or possibly not) useful to education, has happened without the oversight or intention of the school’s administration. But what BYOD *does* tell us is that technology integration *will* happen, so it is up to the educational institutions to take the lead and ensure it happens in a way that is conducive—rather than harmful—to learning.

## Integrating Technology: Organizational Purpose and Identity Crises

 The main challenge with successfully integrating technology from a conceptual perspective is subordinating technology to pedagogy, and ensuring that technology maintains a supplemental role to the primary role of educating. One sector of education where this has been especially difficult is in school libraries. Libraries have existed for thousands of years, and for thousands of years have always and unexceptionally been purveyors and curators of physical print *books*. But digitization has supplanted the physical book, and has been a driving force behind the closure of book stores worldwide[[5]](#footnote-5). As a result, something of an identity crisis is posed for school libraries who, to remain relevant for a digitally native student body, must abandon their most treasured artifact.

 But schools and their libraries *do* need to change, and while they don’t need to adopt technology for its own sake, they should be looking for *relevant* ways to leverage technology in the delivery of their educational services. Unlike private organizations, schools and their libraries have *public* deliverables, and therefore face not just a burden of adapting to social needs and expectations in their own interest to “stay afloat,” but in the interest of delivering the public good their stakeholders are expecting from them.[[6]](#footnote-6) Unlike a private firm, these institutions cannot “reinvent” themselves completely, but must continue to provide the promised deliverables—just in a more innovative and novel way, consistent with the technological savvy of their patrons. This calls for a great deal of creativity.

 In the case of libraries—as well as the classroom—technology isn’t actually eliminating the demand for what these institutions deliver, it’s just changing the way demands are delivered, and also creating some new demands. And while libraries have been intimidated by the aspect of “going digital,” there are a variety of technologies which can be adopted at little to no cost: virtual tours, social media presences, SMS alerts and notifications are all existing technologies which school libraries can and have been adopting to better bring themselves up to date and to make them relevant again in the minds of the student body.[[7]](#footnote-7) There are of course much more dramatic and long-term technological plans that libraries will eventually need to consider: making digital books available for renting, implementing well-indexed and easily navigable database platforms, etc. But as a way of overcoming the basic conceptual disruption of no longer being a “book repository” for students, libraries can get their proverbial feet wet by adopting basic and familiar technologies to increase their digital footprint.

 The reason libraries are worth highlighting by proxy is that they represent a narrow and somewhat dramatic technological disruption: the replacement of time-honored and comfortable content mediums. But by seeing how libraries can “overcome” the digital revolution to not just stay relevant but continue to provide needed educational services, we can see that it is by no means impossible for educational institutes to adopt and integrate technology while still valuing their core purpose.

 As we noted previously, schools have already adopted a variety of technological tools which at least at face value seem to help rather than hinder the identity and purpose of the educational industry. Online learning platforms are the most obvious example, being able to deliver education over distance. YouTube, Prezi, and other multimedia presentation tools can make learning more engaging and dynamic. Online communication tools allow for even interpersonal instruction to be delivered over great distance, and even on demand. Even basic technological staples like Word, PowerPoint, etc. (though hardly considered “cutting edge” any longer) have a powerful and transformative power in a learning context, streamlining homework and learning. These are all great examples of how technology *can* be integrated in a way that still puts “learning first” without necessarily threatening the role or identity of the institution.

## Integrating Technology: Summary and Conclusion

 Integrating technology in the classroom means that technological tools are adopted and implemented as a way to make the learning process itself more efficient or effective. As such, they have a pedagogical focus and purpose, and the degree to which such technologies are useful is the degree to which they advance and improve student achievement and ability. Simply “having” technology in the educational environment is not the same as integrating it into the environment.

 There are a variety of fears surrounding technological integration in schools. These fears are multi-faceted; with more “organic” integration (i.e., student led and initiated integration via BYOD) there is the fear that the learning environment is becoming distracting or worse, obsolete. There are also conceptual and identity-based fears, most notable when considering school libraries, where a struggle exists to maintain an educational identity when something so fundamental to the educational process (like books) truly is being *replaced* by new technology.

 Looking at existing, successful instances of technological integration—basic ones like D2L, Prezi, YouTube, Microsoft Office, etc.—is important to remind educators that technology can and *has* been successfully integrated into the classroom. Most educators would not feel as though their student’s ability to type a paper or develop a more creative presentation, or log into a portal to get notes, represents a *threat* to learning. The common theme across all of these legitimately integrated tools is that they succeed in prioritizing learning, and are in the service of education—rather than education being in the service of them.

 With some of the basic principles of what makes (and doesn’t make) technological integration useful, some effort on *how* technology should be integrated is warranted. This section is necessarily more operational, focusing on important best practices for ensuring that a selected technological improvement does, in fact, *improve* the lives of students and faculty.

# Integrating Technology: Implementation

 As with all institutionalized tools, processes, and strategies, technology must be effectively implemented in order for it to have a successful impact in education. Failures in implementation cause a variety of problems. Complete failures (i.e., where no implementation happens at all) represent a waste of time and resources which could have been allocated to more effective and successful projects. Partial failures (i.e., incomplete or imperfect implementations or onboarding strategies) can be even more frustrating, as students and staff are faced with learning an un-optimized new technology, forcing them to not only abandon their previous and familiar ways of doing things, but to learn cumbersome work-arounds in the process, which in effect can lead to a practical abandonment of the tools by students and staff, ultimately becoming a complete failure of implementation, but one which wasted the time, energy, and resources of students and faculty rather than just administration and IT.

 In order to avoid failures of implementation, a variety of best practices can be kept in mind. These practices can help administrators and other stakeholders in educational technology projects better understand how to avoid a failed implementation. They include clearly defining the project’s requirement, involving stakeholders, keeping an appropriate schedule, having good change controls against scope creep, and providing sufficient training for the affected students and staff.

## Project Requirements

 First in the order of chronology and of logic is ensuring that the school has a clearly and finitely established set of requirements for the new technology project. In order for the implementation team to have the desired outcomes communicated to them, the design, scope, and requirements of the new technology must be thoroughly understood by the educational institution’s project manager.[[8]](#footnote-8) It is then the responsibility of the project lead to effectively communicate the defined requirements up and down the project team, so that all project members have the same expectations and are working toward the same goal.

 Without a clearly defined set of requirements for the project, it has little hope of being successfully implemented, or even implemented at all. If the institutional, functional, and programmatic outcomes expected of the new technology are ambiguous, misunderstood, or vague, the project will only ever be successful by accident. Ensuring that the project’s requirements are firmly established, defined, and communicated is the first and most important step to ensuring that the school’s technology implementation is successful.

## Involving Stakeholders

 It is also important that when designing and implementing a new technology in an educational setting that all stakeholders be involved in the process. There are a variety of different reasons that stakeholder involvement is important. First and foremost, if those whom the technology is effecting the most (students and faculty) are not involved in selecting them, then for what reason should they be expected to be excited about *using* them? Even if the implementation goes off without a hitch, if the students and staff have no *interest* in using the new tools, there’s no reason to expect that the desired impact and outcomes will be effected.

 With that in mind, not just administrators and technicians, but students and faculty should be involved in the selection process of the new technology. This will give them a stake and an interest in the project going well. Research suggests that lack of stakeholder involvement is a major reason why educators find themselves overwhelmed by new technology.[[9]](#footnote-9) Because they “never asked for it” nor were they sufficiently informed throughout the selection, design, and implementation process what it would *do* for them, or how it would *work*, educators are blindsided by new technology. Just as with any other industry, the core personnel should be involved in a tight feedback loop regarding the resources made available to them by their employers. Without this feedback loop, it is unrealistic to expect new technology to be adopted affably.

## Schedule

 From one technology project to the next, there is a significant degree of variance in scope. As a result, the schedule of the project should be developed with regard for the size and impact of the project.[[10]](#footnote-10) Implementation can suffer from a poorly designed schedule. If the schedule is not deadline-oriented enough, then it can be a struggle to keep project members engaged and motivated. On the other hand, if the schedule is hyper aggressive and simply unrealistic for the scope of the project, then hastiness and inattentiveness are likely to effect the final implementation, notably increasing the risk of an incomplete or ineffective implementation. As with any other type of project, good results are difficult to expect if the project is rushed.

## Scope Creep and Change Control

 While earlier it was mentioned that involving stakeholders is essential to making sure that the implemented technology is actually *used*, it is also important that stakeholder input not be allowed to enlarge the scope of the project in harmful ways. As such, it is important that whatever stakeholder involvement there is, roles are clearly defined. The particular or unique needs of a few personnel should likely not factor in to a technology implementation of a tool designed for general use, as it would needlessly complicate the project and its design. Similarly, if a tool is being developed and implemented *for* a particular department with unique needs and expectations, generalized input should not play a significant role in the development of the solution.

 If roles are poorly defined and if project managers are unable to decipher what input should and shouldn’t be incorporated into the technology’s function, then scope creep is the result. The new technology slowly becomes something it was never intended to be as additional features are added, prolonging the schedule and confusing the initial project requirements for what is ultimately only a minor additional feature[[11]](#footnote-11). Part and parcel to defining roles and avoiding scope creep is having established change control processes. It is perfectly conceivable that a particular technology *would* truly benefit from some user suggested function, and in instances where good ideas come from non-members of the project team, it’s important for project managers and others more directly involved in the implementation to have a process for selecting what features are (or are not) added to the project’s requirements.

## Training

 Finally, no implementation is truly complete with sufficient training. Involving stakeholders is a good way to ensure that the new technology is *desired* and going to be *used* by students and faculty, but simply implementing it without ceremony or further ado is unlikely to result in it having any transformative effect[[12]](#footnote-12). Users who will be effected by the new system need to be on-boarded to use it. Training comes in many different shapes and sizes; virtual training, individual training, vendor-led training, etc. The best form of training for each implementation will depend largely on the type of project, its scope, and its envisioned role at the school. But planning for and executing a training strategy are an important final stage for a successful implementation, since it will help students and faculty hit the ground running with the new technology.

# Conclusion

 In this paper we explored what technology’s scope and role in education was. Technological integration means understanding that technology is simply an instructional *tool* rather than a replacement for instruction. As such, it must always be viewed conceptually and operationally as being in the service of pedagogical theory. And while there are many legitimate concerns about technology being abused or misused in an educational setting, there are as many instances of technology being a truly beneficial augment to the student learning process. With that in mind, we also discussed some very important best practices for ensuring that technological projects are implemented efficiently and effectively. However promising a given integration, it will not come to fruition if the implementation fails.

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