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More Technology, Less Learning?

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Abstract

Modern information technologies (presentation software, wireless laptop computers, cell phones, etc.) are purported to enhance student learning. Research to date provides an ambivalent and often conflicting set of outcomes about the effectiveness of such technologies in the context of the college classroom. Anecdotal evidence further complicates this matter by presenting viewpoints which often conflict with existing studies and prevailing best practices. Do modern technologies belong in the classroom and to what extent? The answers to these questions are neither direct nor simple. This paper integrates the results of published studies, anecdotal evidence, and theory, and considers the potential drawbacks of an over reliance on modern technologies to the learning process in higher education.

Keywords: Learning, Education, Technology

1. INTRODUCTION

Institutions of higher education are often at the forefront of technological progress and the adoption of new technologies. Cutting edge technologies are standard equipment in many classrooms. The term 'ubiquitous computing' describes the phenomenon of a campus environment connecting students and faculty by means of Wi-Fi technologies (Fried, 2008). The use of fixed-position technologies created an 'e-learning' environment. Now, the proliferation of portable devices has resulted in a shift to mobile learning, or 'm-learning' (Wurst et al., 2008). Some have raised concerns over the effectiveness of the learning process in these new environments (e.g. Fried, 2008).

Contemporary e-learning and m-learning technologies do not guarantee a superior learning experience. Reliance on these technologies may actually result in decreased student interest and participation, increased distraction, decreased classroom participation, and increased complexity of knowledge dissemination. Although such technologies are undoubtedly appropriate in specific and specialized cases, the benefits are neither

universal, nor as significant as their advocates might suggest. This paper considers the potential pitfalls of contemporary e-learning and m-learning technologies in higher education, and examines a view of best practices which can increase the chances that these technologies will help, rather than hinder the learning process.

2. TECHNOLOGIES CONSIDERED

We specifically consider the following three technology categories: presentation hardware and software, laptop and notebook computers, and cell phones and smart phones. These also encompass related software-based components (e.g. presentation software), and hardware-based components (e.g. projectors). This serves as an informal aid to explaining and understanding current uses of technology in the classroom rather than suggesting a formal taxonomy.

These technologies are all intended to be used for the academic purposes of presentation, information retrieval, communication, or authoring within the classroom environment (Bugeja, 2007). Presentation hardware and software present data in a multi-media format, presumably to facilitate viewing of information and note-taking. Commonly used presentation platforms include Microsoft PowerPoint and course management software systems such as Blackboard and WebCT (Young, 2004). Laptop computers are used for note taking, to access the Internet for information retrieval and messaging, and author document management. The overwhelming majority of laptop computers are equipped for wireless Internet access (Young, 2006). Cell phones and smart phones may serve a similar purpose, but are differentiated by their much smaller form factors, and the use of cellular rather than local wireless networking. Like laptop computers, they are used for information retrieval and to send messages (Bugeja, 2007). The described functionalities are by no means the sole capabilities of these technologies, but reflect their typical roles in academic environments.

3. TECHNOLOGY AND LEARNING

We now consider different aspects of technology use in university classrooms, and the extent to which it can interfere with the learning process, negating the benefits it would otherwise have. The previously noted effects of decreased student interest and participation, increased levels of distraction, decreased classroom participation, and increased complexity of knowledge dissemination are part of this analysis.

Decreased Student Interest and Participation

Educational institutions use the appeal of technology to attract students (Schwartz, 2003). Academicians advocate technology as a means of engaging students in learning material rather than simply presenting it (Young, 2005). Research suggests that students are more engaged with classroom material when it is accompanied by technology (Wurst et al., 2008). Technology is widely perceived as a means of increasing interest in learning. The counter argument is that students are more interested in the technology, and not focused on the learning.

Instant access to a wealth of largely unfiltered information creates a disincentive to learning. Students do not need to formulate potential answers, think about causes and effects, or think critically - they can simply find "an" answer. This removes interest and excitement from the prospect of learning and exploration. Students find the information interesting, but they have not engaged in the quest for knowledge. Technology has made learning an empty quest which removes thinking or understanding from the learning process.

While technology seems to increase enthusiasm for learning, it may really distract from the students' learning processes. Students pay more attention because of the entertainment value of using technology rather than any added learning value. Unfortunately, this creates the illusion of increasing interest in learning. Technology may also act as a crutch, further compounding the problem of decreased passion for learning. The use of technology may reduce curiosity and enthusiasm for learning. Meierdiercks (2005) states that technology creates an unhealthy dependence, neutralizing students' abilities to think, analyze, and understand. Because technology does it for them, students cease being able to forge knowledge themselves. In sociological terms, technology creates its own social forces that we, its creators, have lost the ability to regulate.

As students increasingly depend upon technology as a surrogate for thinking, analyzing, and understanding, they may fall into the trap of depending upon faulty, inaccurate, or even malicious sources (e.g. Wiki-based). This may not only hinder the learning process, it may negate what students have already learned.

As with virtually every technology adoption model, educational technology ultimately possesses its dark side. While all students and learning environments may not fall prey to the trap of decreased interest in learning, or excess dependence on technology, these dangers clearly exist. It seems unlikely that all students will lose their ability to think and reason for themselves as a consequence of technology, but such arguments raise credible concerns about the role technology has in education. Traditional learning occurs under the guidance of instructors who present accurate and reliable information, promoting investigative activities. This is the very definition of pedagogy. Uncontrolled access to information (both reliable and unreliable) may change this process dramatically by shifting the locus of learning control away from the competent instructor to unknown resources that are easily accessible with modern technology. Technology-augmented learning may rapidly tend towards androgogy, synonymous with educational anarchy in environments where students are not yet qualified to be peers.

Increased Distractions

Many educational institutions require students to use mobile computing technologies, presumably as a means to improve the learning experience. Representative examples would include Seton Hall (Collins, Easterling, Fountain, & Stewart, 2004), Temple (Wurst et al., 2008), and the Darden Graduate School of Business at the University of Virginia (Leibowitz, 1999). This is increasingly common at the secondary education level as well. Presumably, students and faculty will use information technologies to enhance communication, collaboration, and understanding (Collins et al., 2004). Unfortunately, besides interfering with student interest in learning, technology has the potential for significant distraction, which has a negative effect on the very areas it was intended to improve.

Technology in learning environments requires multi-tasking. In pre- or non-technology environments, students have had a single, interactive resource (the instructor) and various passive resources (texts, handouts, etc.). Technology introduces several additional interactive information resources that have the potential to draw student attention away from learning objectives.

Humans have a finite capacity to process information. Dealing with concurrent sources of information can create cognitive overload, resulting in distraction (Fried, 2008). Multi-tasking and multiple information sources greatly increase the likelihood that humans become distracted, shifting their attention from one source to another and not giving certain sources the attention that they deserve. Fried (2008) notes that when attention is divided and attention demands exceed capacities, task performance suffers. Indiscriminately adding technology into the classroom mix may cause students and instructors alike to become distracted from the intended task at hand: learning.

Unfortunately, technology distraction and its effects are not limited to immediate users and may spread to anyone in the vicinity. Fried (2008) suggests that laptop use in the classroom is more likely to cause distraction than other common sources of disruption such as private conversations, students entering and/or leaving a class environment, or the time of day. The nature of certain devices invariably allows for observation and potential interaction by indirect users or observers. When students engage in non-academic activities with technology, others nearby will almost certainly notice. This draws attention away from the intended activity. Students may actively share disruptive activities, such as an amusing image or message (Schwartz, 2003). Similar opportunities exist with text pagers, cell phones and smart phones which, apart from ringing and going off in class, allow messaging and Internet browsing (Bugeja, 2007). Even a moderate number of such devices in a single classroom may severely disrupt the normal flow of information from instructor to student.

Distractions in classrooms are nothing new. Students have always talked, passed notes, daydreamed, slept, or just doodled (Bugeja, 2007). However, technology greatly increases the potential and opportunity for disruption, as well as the potential to spread to others. In the

past, students might have been limited to a relatively small number of distractions; however, this number has exploded. A single technological device brings many more distractions to the classroom now than any other single item. Students may now play hundreds of games, check e-mail, chat, and view photos, and they can watch full-length movies (Schwartz, 2003). There is a concern that we have provided students with a multimedia contraption and a challenge to remain focused on learning (Meierdiercks, 2005). Instructors who once enjoyed the luxury of a relatively captive audience now must frequently compete for attention with something highly entertaining, and often lose.

The presence of interactive technologies in teaching environments makes increased distraction inevitable. The necessity of multi-tasking, an increased number of information sources, informational content, the technology itself, or other people using it, all serve to make the learning environment more complicated. Distractions have always existed, but technology pushes the limit, preventing students from paying attention when they should. Many claim that technology may be sufficiently controlled to prevent distraction from corrupting the learning process (Young, 2005), but there is a constant threat that students will find alternative uses for the technology more compelling or entertaining than the topic at hand. When this occurs, it affects not only one individual, but all others in range. Technology cannot always be thoroughly controlled and focused on educational objectives. This introduces widespread opportunities for deviation from the primary educational objectives.

Decreased Classroom Participation

Increased technology-based distraction in the classroom is negatively correlated with classroom participation. Many universities have invested heavily in smart classrooms which feature high-tech components in hopes of creating more interactive and enriching learning environments (Schwartz, 2003). Such environments are believed to be more conducive to constructivist teaching methods, an instructional paradigm emphasizing the ability of a student to construct unique mental representations of material rather than recording and remembering it (Wurst et al., 2008). These environments are allegedly more active, dynamic, and collaborative than their conventional counterparts. Technology usage would be expected to complement this model (Wurst et al., 2008). Unfortunately, neither traditional nor constructivist environments are immune to the adverse effects of technology. Indeed, constructivist environments may be at greater risk due to the focus on technology-facilitated collaboration. Instructors in both types of environments are witnessing the adverse effects of technology on student participation.

Student participation typically enhances the learning process by promoting new ideas and fostering critical discussion. It also gives instructors feedback on student comprehension of course material and progress. However, Professor Dennis Adams at the University of Houston grimly notes the dark side of technology:

> You can be in the front of the classroom and your hair could catch on fire and they'll never see it because their eyes are glued to the 14-inch screen at the end of their nose (McWilliams, 2005).

Technology distraction can cause students to miss the 'give and take' of exchanging ideas via discussion (Schacter, 1999). Such discussions are fundamental to understanding content and developing thinking skills. However, simple technology distractions are not the only obstacle to participation. June Entman, a law professor at the University of Memphis, states that laptops in the classroom create a wall of vertical screens that hampers the flow of discussion between the instructor, the class, and among the students (Young, 2006). Mobile technologies may create physical, as well as logical, barriers to participation. However, rather than removing the barrier, technology remains because of its perceived value. This persistent barrier to participation and learning should at least raise concern regarding the universality of technology in learning environments.

In addition to missing important classroom discussion and information interchanges, lack of student participation affects instructor control of the classroom. Kenneth Brown, a professor at the University of Iowa business school, notes that even in larger lecture classes the instructor is very sensitive to whether people are paying

attention, and uses that information for appropriate delivery of the material (Young, 2006). If student attention is focused on technology rather than instructors, valuable feedback regarding instructional effectiveness is lost. Lack of participation makes it harder for instructors to "read" a classroom and determine how to proceed. For example, students may clearly understand presented material, but impaired feedback due to technology distraction may skew instructor perceptions, reducing instructor efficiency, effectiveness, or both. This becomes a vicious circle as students subsequently find the instructor's presentations boring or repetitive.

As previously noted, constructivist learning environments encourage investigation of topics with high levels of collaboration and cooperation, with instructors providing directions and guidance, as opposed to dictating information (Wurst et al., 2008). A study at Temple University considered the effect of laptop computer usage in the classroom on constructivist activities. The use of laptops presumably would allow students to instantly retrieve information which would be helpful for classroom discussion and activities (Wurst et al., 2008), and this would enhance constructivist teaching. Contrary to expected outcomes, laptop computer usage did not increase constructionist activity in the classroom, and may in fact have significantly reduced it (Wurst et al., 2008). The surprising findings of this study suggest that, despite the ability of technology to provide instant information which could be used to promote learning, it does not necessarily do so. One student interviewed during the study (Wurst et al., 2008) indicated that the laptop environment was beneficial to learning but it did have its drawbacks. Specifically, it was hard to pay attention when able to email friends or talk to them online while in class. Undoubtedly, the student noticed that while information accessible via the laptop was helpful, it caused classroom attention and participation to suffer.

The potential for technology enhanced processes is not always realized. Technology has the potential for positively influencing classroom discussion and participation. However, students frequently fail to learn from and participate in classroom discussion and activities when technology intervenes. Instructors are unable to get proper feedback from students about how to conduct the class. Students frequently prefer interacting with technology to participation in their classroom environments. Data from the field suggest that technology diminishes classroom participation, increasing the difficulty for instructors to obtain feedback required to tailor their teaching to the classroom environment.

Increased Complexity of Knowledge Dissemination

Using technology in higher education increases the complexity of learning, due to the complexity of the technology, and the ambiguity concerning its benefits. Traditionally, instructors have used blackboards (or whiteboards) and overhead projectors in order to convey information to their students.

The proliferation of technology has manifested itself in a larger scale use of more technically sophisticated methods such as animated PowerPoint presentations, Blackboard course-management software, and interactive websites (Young, 2004). Widely touted as the way of the future, these changes are not necessarily resulting in improved outcomes. The use of such technologies inherently complicates a process which had previously been quite direct and simple. A problem domain once limited to a lack of chalk or an eraser, or a dried out transparency marker, now includes malfunctioning technology, forgotten passwords, slow login times, version incompatibilities, and complicated presentation software.

Other than student laptop computers, another of the ubiquitous technology components is the video projector hooked up to a computer station with presentation graphics software. The undisputed leader of this market segment is Microsoft PowerPoint. Originally developed for commercial and business use, PowerPoint quickly displaced the previous de facto academic standard, Harvard Graphics, and is the preferred method of visually presenting information in the classroom (Szabo & Hastings, 2000). PowerPoint allows for the display of text, graphics, and multimedia content to illustrate points, organize lectures, and generally disseminate information to the occupants of a classroom or conference room. Such presentations are generally well received by students. Research by Bartsch and Cobern (2003) indicates that students prefer such

presentations to the use of traditional (static) overhead transparencies and the blackboard. Unfortunately, research regarding the effectiveness of PowerPoint presentations with respect to learning outcomes has been inconclusive. Szabo and Hastings (2000) found positive effects upon learning performance, Bartsch and Cobern (2003) contradict their findings. PowerPoint presentations do not have a universally positive effect on outcomes, otherwise these conflicting results would not be observed. There is the grim sarcasm that the use of PowerPoint lowers the effective IQ in a room (Tufte, 2003).

With very few exceptions, students *prefer* PowerPoint presentations over other traditional forms of presenting material due to their interest in the technology itself – not because of the positive effect it has upon their learning. Szabo and Hastings (2000) caution that PowerPoint should not be viewed as a replacement for the blackboard, but rather as an efficient auxiliary medium, otherwise, it will only serve to entertain - rather than educate - students. It seems clear that this situation must occur frequently for such disparate results to be found by multiple studies such as those discovered by Szabo and Hastings (2000) and Bartsch and Cobern (2003). PowerPoint and similar software packages do not provide the benefits to learning so often attributed to them.

While presentation software muddles the question of benefits to learning outcomes, it also unnecessarily complicates the learning process. Multimedia presentations often fall victim to a widespread practice known as 'PowerPoint abuse' (Young, 2004). The ability to create presentations does not necessarily mean that they are interesting or helpful to learning. Simply copying lecture notes into presentations without adapting or organizing them may actually diminish their value. Alison Lesht, a student at Connecticut College, expressed dislike for her professor's presentations saying, that her professor: "would write on the PowerPoint slides complete sentences, which she would then read. It didn't really add anything to the lecture. It just made everything more complicated and convoluted" (Young, 2004).

In addition to poor construction, presentations often lack interactivity. Most presentations are very static and are simply displayed without the ability to modify them easily, contrasting with overhead projector transparencies which can be easily annotated and marked up. Such changes and additions to notes or diagrams may be very helpful for illustrating points or enhancing student understanding. PowerPoint presentations offer no such convenient feature. Multimedia software presentations may be posted on class websites or course management systems. While seemingly helpful, this can reduce both attendance and focus on class materials. PowerPoint may allow students to disengage instead of becoming more engaged in the topic being covered (Young, 2004), potentially contributing to decreased classroom participation as previously discussed. Multimedia software presentations introduce additional complications to the learning process that may reduce their actual value. Like many other educational technologies, improper use will cause far more harm than good, and is usually overlooked by advocates of the technology in question.

Aside from poorly constructed presentations, technological malfunctions often prevent effective use of technology in the classroom. Wrienne T. Mitchell, a student at Ohio University, admitted that it becomes distracting when sitting in a class for only an hour, and 15 minutes of that time is spent with the professor tracking someone down to make the technology work (Young, 2004). While malfunctions do not render technology completely useless, they serve to complicate and annoy both students and instructors. Since no technology will work perfectly all the time, complexities and annoyances associated with problems are worthy of consideration. With students less interested, more distracted, and less participatory than ever before, time wasted on technological malfunctions becomes critical, and the potential burden on the classroom learning experience must be weighed against the asset value of any instructional technology.

A recurrent theme in academics is that simple things should remain simple, while accomplishable things become doable. Complexity does not always indicate a problem, but use of technology in education has clearly demonstrated a potential to inject excess and avoidable complexity into the mix. While higher education has collectively pushed an aggressive technology agenda, it seems that less concern has been given to how much student learning actually benefits from this, or that negative

results are being disregarded for various reasons. While students certainly prefer technology in the classroom, it may not be providing the best learning experiences and outcomes.

Despite numerous applications where benefits are self-evident, technology is not a panacea. We now turn our attention to considerations of identifying where and how technologies should be deployed to maximize their intended benefits.

4. EDUCATION TECHNOLOGY BEST PRACTICES

With millions of dollars spent on high-tech campuses (Bugeja, 2007), and more people using mobile devices than ever before (Schwartz, 2003), the use of high technology in higher education is well entrenched and will not be disappearing anytime soon. Large investments and long-term commitments guarantee a technology presence. Since technology brings a host of potential benefits and potential shortfalls to the table, the best practices for the optimal use of technology will be some form of informed compromise.

The "silver bullet" technology does not and will most likely never exist. Appropriate technologies should always be drawn from a set of candidates on a contingency basis. Institutions and instructors must learn to exploit the strengths of technology while mitigating the risks. Bluntly shouldering unpopular technology out of the way may work for a time, but this will mask rather than solve the problem. A complete ban on technology in the classroom is inappropriate, and would simply result in justifiably outraged students (Read, 2006), as well as negatively affecting learning processes for which the technologies are appropriate. The proper solution requires managing technology and its risks, to maximize value added for the learning process. In order to accomplish this, certain practices and methods can be followed. We now consider selected strategies as the basis for investigation and further discussion, noting that our selections are a potentially incomplete set.

One key to using technology successfully is actually using it to solve an identifiable problem. Robert Zemsky, chairman of the Learning Alliance for Higher Education mentions that no one had identified the problem that e-learning was expected to solve. This is counter to the core principle that a problem must be identified to apply a technology solution (Bray, 2007). Technology should be used for a very specific purpose. Many technology vendors classify themselves as solution providers, but a generic "solution" in search of a "problem" may represent an even larger problem in the making. Rather than trying to replace a working model, technologies should be used to enhance existing models suffering from problems appropriate for the technologies.

As an example, Zemsky comments on the purpose and intent of the Internet as a wonderful distribution system - a communications device - not a learning device (Bray, 2007). Although the Internet may be used in learning environments, it does not make learning occur. This may make technology very useful for some environments, such as virtual classrooms which tie together physically distanced professors and students (Young, 2005), but it does not benefit all classrooms. In the case of the virtual classroom, technology solves the problem of connecting people across long distances and allowing them to communicate as if they were in close proximity. However, if they are already in close proximity, it can add layers of unnecessary procedural complexity and communications overhead, rendering the learning environment less effective.

Unfortunately, it is not easy to determine whether technology actually solves a problem. Carol Twigg from the National Center for Academic Transformation suggests that the critical idea is to figure out what techniques really do improve student learning, be they software or a particular teaching style (Young, 2005). The key to successfully integrating technology into the classroom rests upon determining the appropriateness of its presence, and the specific functions it should perform when present.

In addition to using technology to solve actual problems, institutions must be made collectively aware of when and how to appropriately utilize technology. Without such awareness, instructors will continue to waste class time fumbling with projectors or software, or devoting too much time to teaching students some quirky Web tool at the expense of delivering course material (Young, 2004). Technology training

sessions for educators tend to focus on technical and mechanical aspects of the technologies rather than maximizing technological effectiveness (Young, 2004). Training would be more useful if focused on strategies which maximize technology effectiveness in the learning process. Technology by itself will not enhance learning. It must be used correctly to do so. According to Howard J. Strauss, technology-outreach coordinator at Princeton University: "what we really need instead of smart classrooms is smart teachers and smart learners" (Young, 2004). Instead of having expensive 'smart' classrooms which showcase high-tech devices, classrooms should feature minimal technology which should only be used if it actually benefits the learning process. Carol Twigg also notes that in situations where technology has been used successfully in the classroom, the key to the success of the course was the faculty members' creativity and ingenuity in the way in which they designed the learning activities for students, rather than a specific device or product (Young, 2005).

Responsibility for successful use of educational technologies rests on the shoulders of the instructor, who is ultimately accountable for learning outcomes. This reality highlights the necessity of proper awareness and understanding of technology use in the classroom. Any hope of using technology to benefit the learning process depends on organizational, as well as individual, awareness of the best ways to utilize it in the classroom. This may be accomplished through training sessions and seminars, and perhaps reducing the levels of technology present in the classroom itself.

Technology must be used at an appropriate time, for solving a real problem, and be managed by instructors. This translates to some general best practices when it comes to technology in the classroom. Among these are keeping lectures interesting and lively to combat the distractions of the technology, setting boundaries on technology use, using technology to communicate rather than teach, using technology only when it functions better than previous methods, and making the decision to cut technology when it interferes with learning. As an example, a short video presentation can be used in lieu of an entire PowerPoint lecture, to illustrate a topic.

Inappropriate techniques would include reading presentation slides verbatim, wasting time fumbling with technology instead of teaching, failing to moderate interactive classroom resources such as chat rooms, failing to set boundaries on student technology use, and using technology simply for the sake of technology. Although by no means comprehensive, these short lists should give the reader a general idea of preliminary steps to take when managing classroom technology use. The successful instructor uses technology only when it actually benefits the learning process, and will be able to mitigate the effects and risks of its use at other times.

Technology misuse can have a profound, negative effect on the learning process. However, because of its ubiquity and heavy investment, most universities and students are unlikely to forego its use. Consequently, effective technology management is needed to insure that technology adds rather than detracts value from the learning process.

Value-added technology management uses technology for solving specific problems, not simply because it has already been acquired. It applies the right tools to the right tasks, rather than attempting to shape problems to fit the tools on hand. Awareness of how to properly use technology is essential. Following certain best practices and avoiding others can be very helpful in managing technology in the classroom. In general, these will involve increasing interest in the learning material itself, while playing down technology, and ensuring that it does not distract students from the material at hand. Although institutions could ban technology, the learning process will benefit more from using it in those situations when appropriate. The error many institutions have made is to believe the fallacy that technologies are universally beneficial. The ideal solution is an enlightened compromise. This compromise mandates a better understanding of when and how to use technologies in the classroom. Student understanding of their roles in this process may increase their cooperation and the appreciation for the proper use of technology to enhance their learning experiences.

5. IMPLICATIONS FOR FUTURE RESEARCH

Current research lacks definitive proof that technology enhances the learning process. While the issue of whether or not technology belongs in the classroom may continue to be debated, it seems likely that it will never be absent. Therefore, additional research should focus on identifying strategies and methods that allow it to be utilized more effectively in the classroom. As previously noted, the key to successfully integrating technology into the classroom depends upon the appropriateness of its use, and the specific function it should perform. Future research should pinpoint situations where it is appropriate, and the function that it could serve in such a situation. Comparisons between current general practices, and specific strategies would be useful.

The current state of technology in education has come to pass largely due to an assumption of benefits. These assumptions have led to unrestricted and unquestioned adoption across all aspects of education, the belief that more is better. This may have occurred due to a lack of understanding or a lack of general knowledge. In order to rectify this situation, instructors should be given specific guidance on practices and strategies which provide the greatest value to student education. Workshops and seminars may be helpful in accomplishing this goal. However, the value of such efforts would be diminished without academia having a complete picture of how technology can be most effectively deployed.

6. CONCLUSION

Changes associated with technology in education are often assumed to be positive, and in the best interests of the student. However, there are many hidden risks associated with technology use. It would be naive to suggest that technology should be completely removed from the classroom. On the other hand, it is clear that technology must be properly managed and moderated in order to mitigate the negative aspects and bolster the positive ones. Some of the risks associated with the use of technology in education are those of decreased interest in the learning material, increased distractions, decreased classroom participation, and increased complexity of learning and teaching. Proper management and control of the technology in education can help to manage these risks. Technology should be used only when it serves a specific purpose or solves a particular problem. Simply using technology because it is 'cool' or popular results in entertainment rather than lasting educational value. Awareness of the potential problems that indiscriminate use of technology can cause in the classroom can help create a mind-set that makes technology an asset to learning rather than a liability.

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