# A proposal for technology integration

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This proposal presents a plan for technology integration in an online higher education science classroom. The goals of the plan are to increase student learning in the arenas of both science discipline content knowledge and technology literacy skills required for success in the 21st century workplace. It is common for educators to accept the pervasive presence of technology in modern society and thus in education. Educators demonstrate this acceptance by permitting laptops in classrooms, by administering tests online, and by using digital media to support their lectures. These are examples of technology use that imply technology is a tool to access and deliver information, but they fall short of true technology integration and constructive learning principles. Technology integration involves a holistic acceptance of technology use as both a tool and a learning outcome (Courts & Tucker, 2012). When technology is fully integrated into the curriculum, the students become self-driven learners in the technology environment, creating and learning from technology, rather than simply receiving information from technology.

Technology integration is a potentially challenging reality for some educators because it implies that the traditional educational framework is no longer a central concept in the classroom. In the Harvard model of education, the educator is the elite member of the academic society (Thelin & Gasman, 2003). The educator is the keeper of information. The educator must remove the hubris inherent to this hierarchical framework to allow students to explore and discover information that is available on the ever-expanding Internet in constructive ways for optimal student success. For example, scholars report that laptop programs promote student engagement, and improve student writing and technology skills (Zucker & Light, 2009). If using the Internet and related technology tools becomes part of the course learning outcomes, all members of the learning community are capable of being authors and deliverers of information. Indeed, it is possible that technology integration can expand the technological knowledge of the educator in addition to that of the students, by providing experiential, multimodal opportunities for both to gain knowledge in constructive, technology-assisted ways (Ajjan & Hartshorne, 2008).

In order to achieve the goals of this proposal, educators need to facilitate procedural technological learning. This is a break from the traditional model in which the learning outcomes for a course are oriented towards to the discipline-specific course (Lizzio, Wilson, & Simon, 2002). It is essential to academic and professional success to have the capacity to access and employ self-discovered information. Professional jobs in the 21st century require employees to have a suite of skills (Milman & Kilbane, 2013). An example of this was just described in the professional world of education. It is no longer sufficient for the educator to be a content area expert; the educator must also be a proficient user and educator of educational technologies (Ajjan & Hartshorne, 2008). In turn, the singular goal of discipline-specific training in an academic course is no longer appropriate. Therefore, the academic environment should attempt to mirror this diversification by incorporating technology literacy into the course learning outcomes.

A recent trend in institutions of higher education is the promotion of institutional goals which frequently include technological literacy (Johnson, Becker, Estrada, & Freeman, 2014). Although institutional goals are noble in design and seek to characterize the key skills students should expect to have upon graduation, there is a wide gulf between the administrative realm in which institutional goals are developed and promoted, and the specific realities within myriad classrooms where students are nurtured towards these institutional goals. Therefore, at the level of course learning outcomes, technology literacy needs to be implemented. This is a major shift that may require administrative and/or legislative interventions. Therefore in the development phase, it is likely that the steps described in this proposal will be adopted and implemented at the course level, initiated by the educator designing the specific course learning experience.

This proposal intends to inform online science learning environments at the higher education level. Within higher education, it is assumed that elementary technology skills will be promoted in lower division courses while more advanced technology skills will be relevant in higher division courses. In this way, the students will learn and grow in a progressive fashion, just as is customary with regard to discipline-specific course learning outcomes. For example, freshman science students would not be expected to demonstrate higher order biological knowledge like describing the specific biochemical pathways in mitochondria in a 100-level course without first obtaining *a priori* knowledge of what mitochondria are.

Educators should not assume that enrollment in online learning courses confers a certain competency level with technology. Quite the contrary: students enroll in online learning courses for myriad reasons that likely have nothing to do with their technology skill level, but instead relate to their personal and professional realities (Romero & Barberà, 2011). Therefore, while online learning is in itself a technology-based learning experience, no assumptions can be made about students' technology skills. In acceptance of this reality, this proposal presents the elementary technology skills that should be incorporated into the course learning outcomes for maximum student success at the start of the academic career.

The first step to successful technology integration is the development of technology-related course learning outcomes. Since the assumption is that any administration effort to promote technology literacy faces a chasm between the administration and the teaching environment before affecting the student population, individual educators, or perhaps cohorts of educators within a specific discipline must first identify the core technology skills that students need to have for success. Once identified, a thoughtful instructional design approach is employed. For example, the ADDIE model of instructional design describes the first step of instructional design as analysis, followed by design, development, implementation, and evaluation (Molenda, 2003).

Once the learning outcomes are developed, the design of the technology integration can progress. In the case of an introductory science course, a relevant technology to integrate is the use of the Internet for academic learning and research. An example learning outcome is: *at the end of the course, students will be able to conduct academic Internet searches for peer-reviewed literature, academic websites, and images.* Although extremely simple in theory, the process of accessing information from the Internet is the cornerstone of the goals of this proposal and a significant gap in the prior knowledge of freshman students, as experienced by the author of this proposal. To facilitate this learning outcome, the educator models expert procedural knowledge to engage the students in the activity. Modeling expert strategies is a component of cognitive apprenticeship (Collins, Brown, & Holum, 1991). This engagement is delivered through an instructional video, for example. In this video, the educator takes the student through one process for information acquisition. This engagement is followed by a formative assessment opportunity in which students work together to achieve the learning outcome. For example, an early-in-the-semester online discussion in a science course might have the following prompt.

> Find one academic source from which information about genetics can be obtained. Include a complete citation for the reference, summarize the general contents of the reference, and provide rationale for why the reference is academic and reliable. Finally,

write a step-by-step summary of how you found the information. In your reply posts, critique the work of your peers and affirm or refute the academic quality and reliability of the reference.

The summative assessment of this technology skill is the appropriate use of references when completing other discipline-focused assignments, such as content-oriented essays.

Scholars suggest that the students' opportunity to share with their peers their newfound knowledge is a cornerstone for deep learning (Bandura, 2001). As the course develops, another technology literacy learning outcome to explore includes the presentation of newly acquired information to the peer group in the learning community. For example, *at the end of the course, students will be able to produce using free software their own instructional videos with which to demonstrate their newly acquired knowledge.* Once again, the educator facilitates the engagement of this learning by modeling expert procedural strategies for this technology skill. In other words, the educator produces an instructional video about making instructional videos. Another formative online discussion forum requires students to practice these skills and receive peer feedback. The summative assessment of this technology skill involves a future online discussion in which the students produce instructional videos for each other that address specific discipline-oriented topics, for example, as a capstone assignment in a course.

The second learning outcome suggested in this proposal can be executed using the free software Screencast-o-matic (Screencast-o-matic, n.d.). Screencast-o-matic is a well-known and often-used video editing software. While screencast-o-matic does not have all of the functionality that is available in some professional AV product suites, this academic endeavor not only affords students the opportunity to engage their discipline-oriented learning, it models a professional, technology-based skill that is relevant to the workplace in the 21$^{st}$ century. The screencast-o-matic software involves multimedia integration. Users can record their desktop screens, speak, and show a webcam of their live person all at the same time. When students become proficient with this integrated, multimodal technology, they can approximate a live, classroom-based learning experience in an asynchronous modality. This experience is enriching for the student who performs the task and for the other students in the learning community who can then benefit from the learning demonstrations of their peers.

A novel practice in online classrooms is student production of a course wiki (Ajjan & Hartshorne, 2008). Aligned closely with constructivism, this learning activity involves the curation of student research and authentic student demonstration of course learning outcomes. The wiki can be built anew each semester or be accumulated over several semesters. The latter provides the opportunity for students to learn from course alumnae as well as from their current learning community. Likewise, the shared publishing of authentic student work provides a model for student success. A rubric is extremely helpful for presenting the student performance criteria, but seeing other student work of exceptional quality is also an invaluable tool for students.

This proposal explores the concept of technology integration as initiated through pedagogical focus on expanded course learning outcomes. While the specific parameters for technology integration might vary widely between applications, much can be learned by applying standard processes for instructional design like the ADDIE model to the integration of technology. For technology integration to occur successfully, nothing less than pedagogical focus can be applied. By developing course learning outcomes and subsequent learning activities related to technology literacy, educators can afford their students a truly engaging opportunity to gain both discipline knowledge and technology skills.

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