Interactive Instruction: Creating Interactive Learning Environments Through Tomorrow's Teachers

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Technological innovations provide new possibilities to transform the teaching and learning process. It is important that teacher education programs not only add courses that teach about integrating technology, there must also be a movement for comprehensive programmatic change. The change should reflect a transformation in teaching methodology to influence teaching pedagogy. In this paper, a rationale, framework, and examples of new teaching methodology are presented.

Keywords: Interactive boards; teaching/learning strategies; interactive teaching; interactive learning

INTRODUCTION

An interesting question was posed by Smith, Higgins, Wall, and Miller (2005) in an article that asked what the intersection between technical and pedagogic interactivity looks like in reality. The short answer to this question is the combination of interactive teaching and interactive learning supported by technological tools. Bull and Bull (2005) suggest that projection systems with an Internet connection provide a window on the world for students and teachers. Expanding this notion with two innovations creates an interactive learning environment. Innovations that accomplish this include interactive boards and Web 2.0 tools. Combining these tools creates an interactive window on the world, allowing teachers the opportunity to teach in an interactive learning environment. In the next section, the following information is discussed: rationale for transforming teaching pedagogy and methodology, a framework to support the change, and examples of interactive teaching and learning supported by technology.

Teacher Education programs must focus on developing teachers with an interactive pedagogy that promotes implementing interactive teaching and learning with digital tools. Several tools support an interactive teaching and learning framework, however; there is a danger that teachers will not use the tools as they are intended. Without appropriate training and support, teachers may use the technology to support a traditional teacher-oriented paradigm that does not take advantage of the interactive capabilities of various technologies. For example, many k-12 educators are adopting interactive board

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technology to support classroom instruction. Researchers have found that interactive boards are not necessarily used interactively (Levy, 2002; Kennewell, 2004). Traditional teaching pedagogy is not based on an interactive model; therefore, it is possible that teachers will use technological tools to support traditional pedagogy rather than an interactive pedagogy. A problem is that teachers are not trained to think about teaching and learning as an interactive process that encourages the use of technology to create interactivity in the classroom. Traditional models of teaching require a teacher-centered approach; however, with new technology, there is support to transform the teacher-centered approach to a student-centered approach. In the student-centered approach, interactive teaching and learning are supported by tools that actively engage both teachers and students.

The emergence of new technology and research about how people think is changing the classroom. New generations of educational technology are moving towards models and theories that are expected to provide the insights necessary to advance educational technology research in promising new directions (Samaras, Giouvanakis, Bousiou, & Tarabanis, 2006). New tools are thought to empower educators to change the way teaching and learning occurs. As current social trends require citizens to be more analytical thinkers and to synthesize information, current teaching practices must develop these higher order thinking skills. This should start with a teacher's philosophy and pedagogy development during preparation for the profession.

If the goal of teaching with technology is to transform the teaching and learning process, this must be a foundation in teacher preparation programs. Teachers need time and guidance when using technology in general; however, when the interactive board is integrated, teachers need to develop a particular philosophy about how to use the interactive board, who will use the interactive board, and when it will be used. The interactive board is both a powerful teaching tool as well as a platform to integrate other technology to support instruction such as Web 2.0 tools. For example, teachers use the interactive board to access interactive Web-based tools such as tangram activities from the national library of virtual manipulatives. Both Web 2.0 tools and interactive boards have the unique feature of readily assimilating classroom environments coupled with interactive capabilities. While the tools readily assimilate the classroom, there is a much more complex pedagogical process that must occur for teachers if the tools are to be used in an interactive manner. This does not mean that teachers must wait to master the technology. The shallow learning curve for interactive board technology makes it similar to a plug and play device. With some basic training, a teacher can use an interactive board in about 30 minutes. For students, the learning curve is just as shallow. While conducting research in an elementary classroom, observations revealed second grade students using advanced features of the interactive board with as much ease as playing a video game. Further, students in this study used the board to conduct independent learning. Students were using technology as Alfred Bork suggested which is to use technology as tool to learn with (Bork, 1980).

Getting to the level of students using technology in this manner is not easy but it can be accomplished by preparing future teachers to think interactively and to teach interactively. Creating an interactive learning environment is paramount as learners are changing and as information is becoming more accessible to all.

THEORETICAL FRAMEWORK

Similar to technological innovation, education constantly changes. Changes in values take place, new curricula are introduced, and new technologies redefine how we teach and learn (Provenzo, 1999, p. 1). Using technology in the classroom has existed with

such devices as televisions and overhead projectors. These presentation systems offered new hope for delivering better instruction at the time of their introduction. The transformative nature of technology integration changes the process of teaching and learning to an interactive learning environment. The framework applied to the new form of teaching, known as interactive teaching and learning, represents the intersection of theory (constructivism), interactive hardware (interactive boards), and Web 2.0 tools such as Kids and Cookies. The framework in Figure 1 displays the components and actions of teachers and students. This framework is applied to all levels of k-12 and is a flexible framework that can include any tools that naturally produce interactive learning environments. The framework is a combination of learning theory and tools including constructivism, interactive teaching, interactive learning, interactive tools (hardware & software), and interaction between students and teachers. The following discussion provides an explanation of the framework foundations.

Figure 1. Components of the framework.
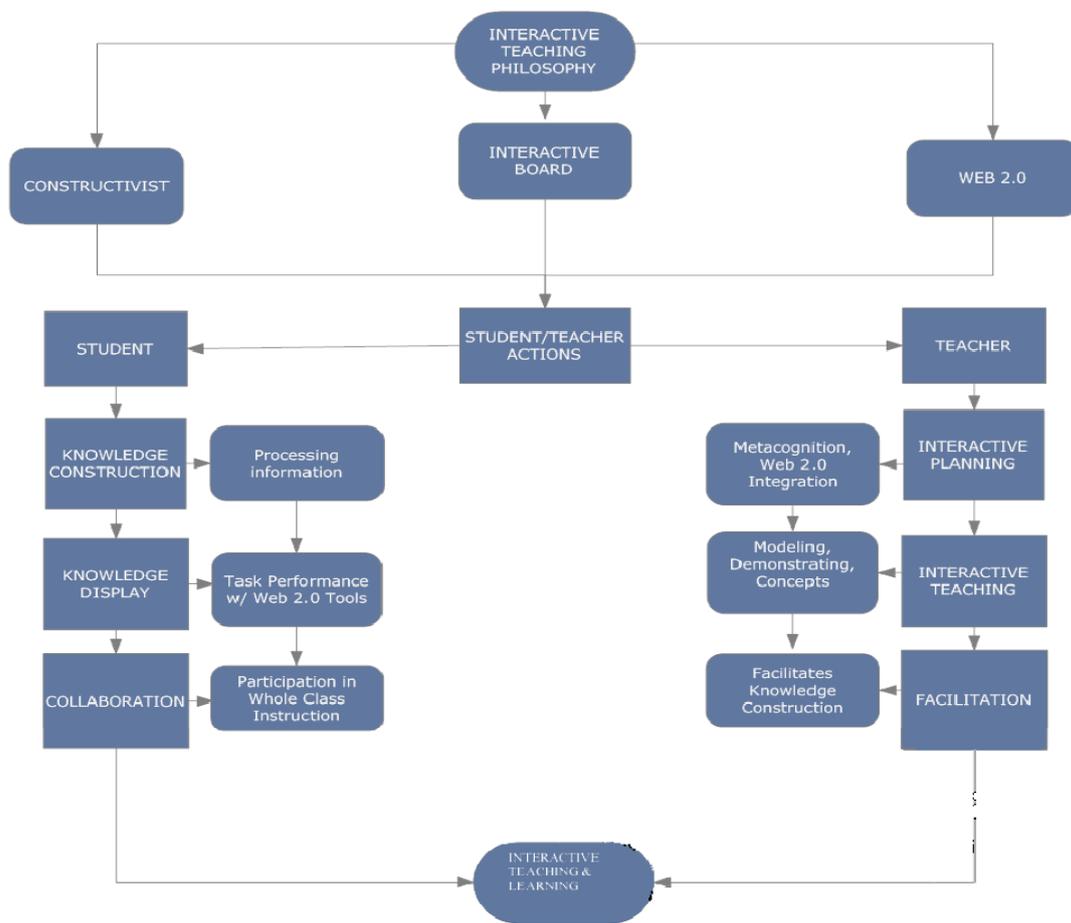
CONSTRUCTIVISM

Constructivism consists of learning or knowledge construction emphasizing learners as active participants in making sense of their environment and their experiences within that environment (Abdal-Haqq, 1998; Vygotsky, 1978).   Interactive boards highlight the

fundamental notion of constructivism, which is "active participants". Active participants are encouraged to complete the knowledge construction sequence as outlined by Piaget. The learner constructs knowledge through a process whereby currently held belief systems and understandings (*schemata*) are challenged through technology based interactive learning environments (*disequilibrium*) requiring the learner to subsequently change (*accommodation*) or expand (*assimilation*) those belief systems to match their experiences or equilibrium (Piaget, 1954). The interactive board helps facilitate the interactive learning environment by affording students the opportunity to engage with content in multiple ways. The visual nature of interactive boards allows for students to develop the necessary schemata necessary for creating new learning. The interactive nature of the board allows students to learn by doing, thus reaching what Piaget called equilibrium. In combination, visualization, interactive boards, and interactive tools allow learners to create knowledge through a 21st century constructivist paradigm.

INTERACTIVE TEACHING

Interactive teaching begins with a philosophy about teaching with technology and results in a new process of interactive teaching and learning. A combination of constructivism, interactive boards, and Web 2.0 tools is one model for thinking about new ways of teaching. In this framework, both students and teachers are central to process. Teachers are responsible for planning, teaching, and facilitating sequences integrated with technology. Students are responsible for constructing and demonstrating knowledge as well as collaborating with peers to create knowledge. In the planning phase, teachers reflect on what tools will enhance cognitive expansion for students such as the implementation of Web 2.0 tools that aid students in accessing and processing information. In the interactive teaching phase, teachers model uses of technology to construct knowledge and demonstrate concepts through dynamic interactions. In the third phase, teachers facilitate knowledge construction through discourse as students participate in whole class instruction. This is a reciprocal process of using technology to demonstrate and present knowledge. Figure 2 displays a comparison of traditional teaching with 21st century teaching and learning. The changes are based on interactive components of technology enhanced teaching and learning. The column titled "New" represents what pre-service teachers need to understand as they matriculate through a teaching program. If first column of Table 1 represents Web 1.0, a static version of the internet, then traditional teaching represents a more static version of teaching. This is not to say that all traditional teaching is static; however, the philosophy of traditional teaching does not make certain assumptions about today's learners. Web 2.0 represents a new approach to interacting with content which is more participatory and interactive. This is represented in column 2. The descriptions in column two represent multiple levels of student and teacher interaction. Both the learner and teacher are active in the process of learning as described by the experience of Web 2.0 pedagogy. Additionally, the tools that facilitate this transformation are interactive by nature and must be studied as part of a systemic body of knowledge. This may be the only to imbue pre-service teachers with appropriate pedagogy and experiences with technology integration to create interactive learning environments. These tools allow teachers to create the interactive learning environment via theoretical considerations and practical applications.

One complaint about current teaching is that it is lecture based (didactic), thus creating a teacher centered learning environment. Interactive Teaching is not void of lecture; rather, lecture is used in combination with active demonstrations. A chemistry teacher using an interactive board might teach a lesson about balancing equations by manipulating elements with his/her finger to demonstrate the concept visually. In an

integrated approach, discourse is used to describe the process. Interactive teaching also involves the teacher integrating multiple forms of media within a lesson to encourage cognitive participation. An elementary teacher might teach students how to construct creative sentences using text to describe a digital image; then students are asked to manipulate text using the interactive board to create appropriate sentences.

Figure 2. An illustration of an electronic form of an ancient Chinese puzzle.
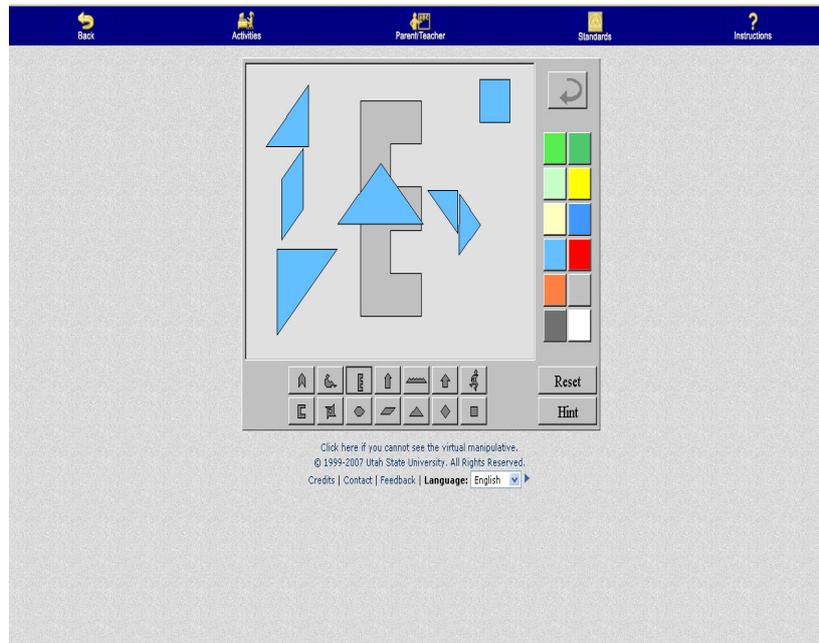

Table 1. Differences between traditional and new technology enhanced instruction.

TRADITIONAL (Web 1.0)	NEW (Web 2.0)
Teacher-centered instruction	Student-centered instruction/learning
Single-sense stimulation	Multisensory stimulation
Single-path progression	Multipath progression
Single-media	Multimedia
Isolated work	Collaborative work
Information delivery	Information exchange
Passive learning	Active/exploratory/inquiry-based learning
Reactive response	Proactive/planned response
Isolated, artificial context	Authentic, real-world context

Interactive can have various definitions. For example, when you use certain Internet sites, interactivity might mean clicking a link and accessing text. In a classroom, interactivity might mean completing a worksheet. With the interactive board, interactivity means that the teacher and student perform a physical activity such as translating a geometrical figure or words to create sentences. Both activities create interaction with cognitive processes facilitating knowledge construction. Interactivity also means that

teachers and students are actively engaged in discourse. The interactive nature of the interactive board provides an advantage to the teacher when it is used in this manner. Reflecting on past tools for educators, there has not been a tool created specifically for content interaction through mental processes and physical attributes. Most tools simply require students to merely watch but not participate. Using interactive boards is a new phenomenon in teaching and much is not understood about how to use the interactive board as a teaching tool. The interactive board is a tool that provides a new way of performing the task of teaching and should be addressed in the development phase of teaching.

INTERACTIVE LEARNING

Traditionally, students sit and absorb knowledge from teacher lecture and notes on the board. Interactive learning means that students are active participants in the learning process. In a learning environment that integrates the interactive board, students are focused on stimulus presented by the teacher on the interactive board and the student, either verbally or physically, interacts with the interactive board. In the definitions of Interactive Teaching, an example was given about students "dragging" words to compose a sentence that described a digital image. This is a form of interactive learning because students interact with the content through a combination of the abstract and the concrete. This type of student-centered learning follows the principles of constructivist learning, a building block of an interactive learning environment. Students are encouraged to control their learning and to construct meaning.

INTERACTIVE TOOLS

Interactive Boards. Interactive Boards, also known as electronic blackboards, are display monitors that are produced in various sizes by different companies such as Smart Technology, Promethean, Sony, and others. Interactive boards have two distinct functions: display and interactivity. As a display tool, teachers can display specific content related files, software, or Internet resources. As an interactive tool, interactive boards allow the user to write and manipulate objects including images and text. Interactive boards connect through a USB port to a computer (desktop or laptop) and a projector is connected to that computer. The computer screen is projected onto the interactive board and the user has access to all files, software, and Internet at the touch of a finger or a device depending on the type of interactive board. The combination of the interactive board, projector, and computer represent a dynamic system that facilitates flexibility in the classroom. There are specific advantages to using interactive boards in the classroom. Interactive boards provide more flexibility in how lessons are communicated, promote student interaction with content, provide greater visualization of concepts for students, and increases motivation among students.

Web 2.0 Tools. There is considerable debate about the actual meaning of Web 2.0. While there is no consensus on one definition for Web 2.0, there are some basic commonalities in conversations about Web 2.0. The following quotes will illustrate this point.

> "There is Enterprise 2.0 and Web 2.0. Both are, in part, about user-generated content, and increasing participation in key conversations. They are also about making all of this participation more accessible to bring more voices to enterprise decision making."(Ives, 2007)

Web 2.0 is "a term generally understood to encompass Web sites that host or allow the production of user-generated Web content…" (McDermott, 2007)

"Web 2.0 refers to a perceived second generation of Web-based communities and hosted services — such as social-networking sites, wikis and folksonomies — which aim to facilitate collaboration and sharing between users." (Wikipedia, 2007)

There are many more quotes about Web 2.0 but the aforementioned represent an underlying concept applied to Web 2.0. The concept is about community and the ability to participate through Web based interaction. Further, Web 2.0 conversations suggest that people who use the internet are searching, publishing, creating, demonstrating, etc. Many verbs describe Web 2.0 functionality. When this conversation is directed towards the classroom, these verbs define the actions of what teachers and students might do in the classroom as the teaching and learning process evolves. In the classroom, Web 2.0 can be defined as interactive uses of the internet to stimulate and support the teaching and learning process; thus aiding in the creation of interactive learning environments. Beyond the classroom, the definition extends to include the asynchronous participation in knowledge construction by students. This is evident in such tools provided by Utah State and the Center for Technology and Teacher Education at the University of Virginia. These are just two examples of how Web 2.0 tools are used in an educational context for specific subject areas.

As defined in a broad social context, McDermott (2007) refers to Web 2.0 as a way for users to host and present content in a variety of formats. From an educational perspective, the concept of Web 2.0 refers to using Web-based tools to allow students and teachers to interact with content in non-traditional ways. For example, the textbook with its practice exercises has been the format of choice for assigning problems in math classes and for homework. As a Web 2.0 application, a teacher uses flash based applets to demonstrate mathematical concepts in class. To extend the learning process, homework is assigned to students using the Web-based content. This allows students to experience interactive homework assignments that provide immediate feedback through dynamic visualization. The Language Arts teacher uses the Web 2.0 in a broader context, paralleled to current uses of the internet including the use of wikis, blogs, and podcasts. In either subject, the teacher uses the Internet to create an interactive learning experience that students would not otherwise be able to experience.

INTERACTIVE BOARDS + WEB 2.0 TOOLS

Virtual Manipulatives. The National Library of Virtual Manipulatives (NLVM) is a Web-based collection of interactive tools for k-12 math instruction. The purpose of the tools is to engage students with math concepts based on a constructivist model. The tools allow students to visualize math relationships and applications. Virtual manipulatives give teachers alternative ways to introduce content as well as an interactive way to practice. Further, virtual manipulatives encourage independent practice because the tools are open source and available online.

In Figure 2, the illustration displays an example of an educational Web 2.0 concept. From the national library of virtual manipulatives, teachers access applets that allow student interaction with academic content. In the example, tangrams are used to address academic skills including critical thinking, spatial sense, and peer-to-peer collaboration. Used on an interactive board with an internet connection, this activity becomes an event to allow students to apply and develop critical thinking skills in an interactive learning

environment. A student starts by transforming and manipulating the geometric shapes to fit in the letter E template. The class collaborates with the student using the interactive board to provide strategies for solving the puzzle. An extension of this activity is assigned as an interactive homework assignment to complete other puzzles. This is an example of using the interactive board in conjunction with a Web 2.0 tool. The student investigates, manipulates, and presents using a virtual environment.

   Kids and Cookies. A second example can be seen through a more complex mathematical example in Figure 3, which is an interactive fraction game created at the University of Virginia. Kids and Cookies is an interactive game designed for elementary students. The game is an interactive way of introducing number concepts. Users simulate sharing cookies while investigating the concepts of rational numbers and division. As with the virtual manipulatives, this tools is open source and available online.

Figure 3.
A social game that encourages critical thinking and mathematical understanding.


   When the game starts, students select the number of friends and the type of cookies to share with those friends. The student also chooses how many cookies will be shared among the chosen friends. After the selection, in Figure 4, the student must divide the cookies equally among the friends.

   Used by the teacher, this is an interactive way to introduce and teach the concept of fractions. The interactive board provides dynamic visualization of content as well as the ability to physically manipulate content. Again, teachers assign extension activities to supplement classroom lessons with independent work at home. During class, the interactive board and the Internet create an interactive learning environment. Because the activity has Web-based interaction, students can use the Web as a tool to learn with. Learning with technology is an important concept and promotes 21st century skills as outlined by national standards for students and technology. Jonassen and Reeves (1998) noted that learning from computers involves having students review basic skills and

academic content on computers; whereas learning with computers presupposes an integrated approach with computers as part of a broader learning process.

Figure 4. Using the "cookie cutter" to divide the cookies among the friends.
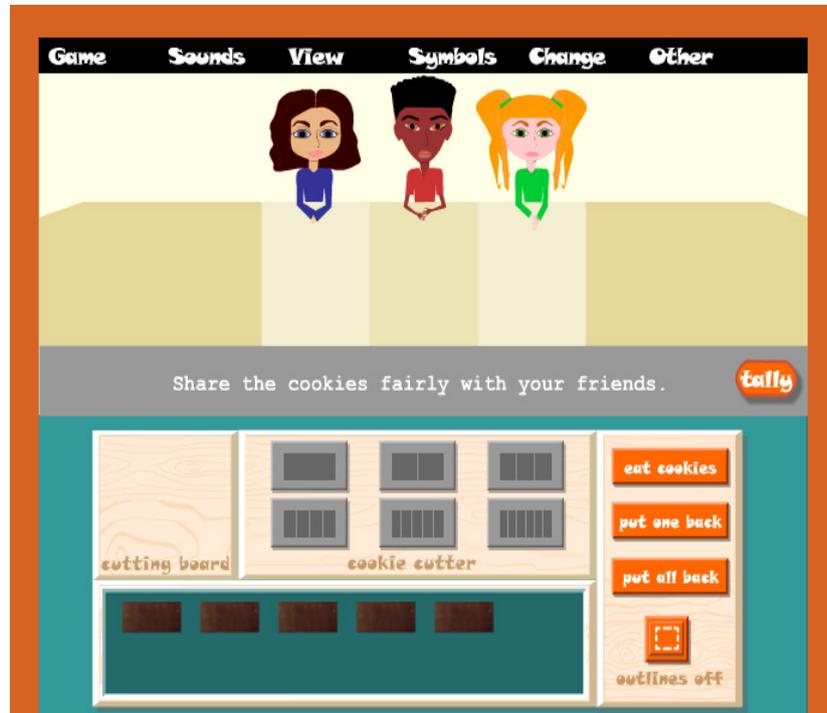
CONCLUSION

Innovation has provided new capabilities that can transform the process of teaching and learning. Transforming the process of teaching and learning will mean that teachers create fundamentally different learning environments that promote interactivity. New ways of teaching will be accomplished through enhancing the skills of veteran teachers but also through future teachers. Pre-service teachers need time to sift through the capabilities of interactive technology and to understand which of those capabilities can influence teaching and learning practices. Time allows pre-service teachers to develop ways of integrating interactivity as a fundamental part of their teaching. While training and supporting veteran teachers can have a positive impact on the classroom, processing concepts of technology integration to create interactive learning environments as a pre-service teacher will provide a unique advantage. That advantage is related to the terms "digital native" and "digital immigrant". Currently, these terms are used to describe those who have grown up with technology and those who did not grow up with technology. In terms of professional growth in a formal education setting, many veteran teachers did not "grow up" with technology; however, pre-service teachers are now becoming digital natives. Schools of education have the opportunity to create these "digital natives" by infusing concepts of interactive learning environments into traditional programs. Interactive boards and various interactive tools must be to the pre-service teacher what the overhead projector is to veteran teachers.

When teachers are prepared with a sense of integrating technology to create interactive learning environments, it will be part of everything they do in the classroom. Pre-service teachers need to be trained in ways that encourage them to think of learners as knowledge producers, rather than consumers. Thinking of students as producers implies that students are actively participating in the learning process and this occurs in an interactive classroom that uses interactive tools. Producer also means that students are operating at the highest level of higher order thinking skills as they analyze, synthesize, and present knowledge to peers both locally and globally. None of this can be accomplished if pre-service teachers do not develop a pedagogy that includes interactive teaching and learning.

The tools available today have the power to provide the necessary background for this new model of teaching. While many tools exist, an interactive board is the one tool that provides an interactive platform that promotes interactive teaching and interactive learning. Many tools might provide the opportunity for interactive learning; however, very few, if any, provide opportunities for both interactive teaching and interactive learning. Teacher education programs have made progress towards integrating technology but there is more work to be done. Teachers that create interactive learning environments must be equipped with both technical skill and an integrated pedagogy with technology as the foundation.

FUTURE CONSIDERATIONS

Integrating technological understanding within methods courses fosters the development of teaching philosophies enhanced by technology. While we can and should attempt to influence veteran teachers to use an interactive pedagogy supported by technological tools, it is even more critical to begin this process with pre-service teachers. Schools of education believe that it is a good idea to have pre-service teachers intern (student teaching + observation) before actually taking the reins of an individual classroom. Similarly, pre-service teachers must grapple with the complexities of effectively integrating technologies that will create interactive teaching and learning environments for students. It is important to have technology skills but teachers must carefully think about cognitive aspects of using technology in teaching and practice creating lessons that integrate technology while taking methods courses. Methods and foundations courses must infuse frameworks that highlight technology as an integral part of planning, designing, implementing, and assessing student learning. Future methods courses should have interactive technologies available, allowing pre-service teachers to practice with interactive technology as they learn. Pre-service teachers who enter the field without a concept of creating interactive learning environments may not develop an interactive philosophy as an in-service teacher. General technology courses coupled with methods courses that integrate interactive technology will create teachers who are prepared to transform the classroom into interactive learning environments. In this way, education programs can change classroom environments through tomorrow's teachers.

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