The Virtual Classroom: Theory to Practice

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Introduction

The opportunity for collaboration between professors and practicing teachers is one of the many benefits of laboratory school settings. The idea for this collaborative project began with a kindergarten teacher and university early childhood professor, and expanded to include the university's director of technology. As with most ideas for projects, the birth of this virtual classroom was the result of discussion and brainstorming. This particular brainstorming session occurred during the annual faculty breakfast for the College of Education and University Laboratory School (K–12) at East Tennessee State University (ETSU). This event allotted time for faculty from the two departments to connect in an effort to find areas of interest for collaborative projects. The question of how to tie theory learned in the university classroom with practice demonstrated at the lab school was our topic of interest. We wanted to include an additional component that not only involved observation of a kindergarten classroom, but also included discussions among an early childhood professor, a kindergarten teacher, a group of early childhood teacher candidates from field experiences and student teaching, and occasionally including kindergarten students.

We concluded that one of the best ways to bridge theory and practice at our university was to build an electronic bridge between the university and laboratory school classrooms. This article will share our experiences with this bridge, providing background on virtual classrooms, the virtual classroom environment, funding the project, technology needs, project implementation, results, and future implications.

Virtual Classrooms

The use of video-conferencing has increased as technology has advanced. Transmitting live video and audio simultaneously over the internet (or telephone lines) is referred to as the 'virtual classroom' in this project. The virtual classroom, or compressed video, is delivered in real time. One of the fastest, most popular modes of delivering instruction is via live video (Ostendorf, 1997). Vygotsky's (1962) theory of the social nature of construction of thought is a key element utilized in practice, both in the university classroom setting and in kindergarten classrooms. Incorporating communication, collaboration and reflection via the virtual classroom extends the social construction of knowledge for pre-service teachers beyond the four walls of the university classroom.

The Virtual Classroom Environment

This virtual classroom environment consisted of a kindergarten classroom at a laboratory school and a designated early childhood classroom in the university's College of Education. Although the laboratory school, built in 1929, was not designed with technology in mind, this type of project utilizing advanced technology does not necessarily require a state of the art building with the latest technologies already installed.

A year prior to the implementation of this project, the kindergarten teacher and early childhood professor worked together to redesign the kindergarten classroom to include developmentally appropriate learning centers. The quieter side of the room consisted of a listening center, writing center, technology center, and area for small group literacy instruction and assessment. The louder side of the room contained science, math, art, blocks, and sociodramatic centers. The kindergarten teacher embraced constructivist theory and incorporated the seven principles of constructivist teaching into her daily practice: 1) establishment of a cooperative, socio-moral atmosphere, 2) appeal to children's interest, 3) teach in terms of the kind of knowledge involved, 4) choose content that challenges children, 5) promote children's reasoning, 6) provide adequate time for children's investigation and in-depth engagement, and 7) link ongoing communication and assessment with curriculum activities (DeVries, Zan, Hildebrandt, Edmaiston, & Sales, 2002).

The College of Education's designated early childhood classroom contained seven tables that accommodated small groups of four to five students, white board areas for

group work documentation, a Smart Board, projector and technology cart (awarded from an on-campus technology grant), storage cabinets, and shelves containing shared materials for group and presentation work. The college classroom contained varied lighting, plants, areas for collaboration and areas for individual work, and is demonstrative of a brain-compatible classroom.

Funding the Project

Each year the University offers faculty an opportunity to apply for an Instructional Development Grant. This grant provides funding for special activities and projects directly related to improving instruction and curriculum. The project idea met the criteria for the grant, so the project was launched. The overall rationale is the early childhood education (ECE) teacher candidates participate in virtual field experiences in the laboratory school kindergarten classroom from their college classroom setting. They, in turn, extend their understanding of theory as they immediately experience the implementation of theory into practice.

Goals and Objectives of Project

The university Early Childhood Associate Professor and laboratory school Certified Early Childhood Teacher conversed back and forth as they co-taught how children learn through the implementation of "Developmentally Appropriate Practice" while meeting national and state standards. This virtual field experience serves as an extension to the required off-campus primary field placement for the Curriculum Development class. It bridges the gap between the college classroom and field placement, offering the opportunity to explain and enrich the ECE teacher candidate's understanding of practice.

It is standard practice for ECE teacher candidates to learn theory in the college classroom and observe in the field, however, the missing link was the clarification and explanation of what was being observed. This grant served as a pilot project for collaboration between the University Laboratory School teachers and ETSU professors in order to strengthen the understanding of knowledge, skills and dispositions being taught in the College of Education. It was expected that as a result of this experience undergraduate and graduate ECE teacher candidates would be stronger teachers utilizing knowledge and skills in order to meet the required standards of learning in a developmentally appropriate manner. It was hypothesized that when teacher candidates observe and have greater understanding of appropriate practice, the children in their future classrooms would benefit from this higher level of teaching. This project allowed the college professor and practicing teacher opportunities for professional dialogue and development through continuous collaboration and reflection of theory and practice.

In addition to this overall rationale, the following specific goals and objectives were identified:

- Rationale I: This virtual, interactive collaboration is an effort to meet National Association for the Education of Young Children (NAEYC) Standard #4: Teaching and Learning. Teacher candidates will enhance their understanding of developmentally effective approaches to teaching and learning, and to their knowledge of academic disciplines, to design, implement, and evaluate experiences that promote positive development and learning for all children (Hyson, 2003).
- Goal I: Enhance the ECE teacher candidate's understanding of planning and implementing appropriate programs for young children.
  - Objective I: Participate in a virtual field experience in a university school primary classroom.
  - Objective II: Identify instances of theory implementation in the virtual classroom.
  - Objective III: Recognize and identify the changing dynamics of actual classroom experiences.
  - Objective IV: Reflect upon developmentally effective classroom practices.
  - Objective V: Plan and implement lessons off-campus in assigned field placement as a result of this virtual guided discovery of planning appropriate programs.
- Rationale II: As a result of this project, the college professors and university practitioners will model for the ECE teacher candidates, NAEYC Standard #5: Becoming a Professional. This standard states that ECE teachers are continuous, collaborative learners who demonstrate knowledgeable, reflective and critical perspectives on their work, making informed decisions that integrate knowledge from a variety of sources. They are advocates for sound educational practices and policies (Hyson, 2003).
- Goal II: Increase dialogue and collaboration between college professors and university laboratory school practitioners.
  - Objective I: Engage in a collaborative sharing of theory and practice as it relates to Curriculum Development and designing Learning Environments.
  - Objective II: Establish goals and objectives for the teacher candidate's virtual experiences.
  - Objective III: Reflect, evaluate and assess the experience provided for teacher candidates.
  - Objective IV: Share the results of this experience with colleagues in an effort to expand upon and improve the original intentions of this project.

Technology Needs

Technology can be a great asset in implementing applied research in a distributed environment. In this case,

the primary function of technology engagement was to provide two-way observation and communication channels between the ECE teacher candidates, Early Childhood faculty and the kindergarten teacher at the lab school. Typically lab school students behaved noticeably differently because of the presence of visitors. With the virtual classroom approach, the focus was to eliminate the Hawthorne effect caused by the presence of the ECE teacher candidates in the kindergarten class which occurs during typical field experience observation periods.

A major issue with implementing technology solutions for research purposes invariably involves the limited technology infrastructure available in schools. In many situations, use of two-way video conferencing, codec compatibility and bandwidth issues dominate the choice of solutions. In this instance, peer-to-peer solution needed to be designed to address both of those issues in an unobtrusive manner. The solution had to be simple. The kindergarten teacher should not take time to adjust equipment in front of students, making them conscious of the presence of cameras and negating the advantages of remote observation. The solution also had to be in a contained environment, thus falling within the privacy requirements of the school and university.

Project Implementation

A peer-to-peer internet provider based video solution was chosen to address the situational requirements of this project. Sony PCS-11 VCNF cameras were installed in both the kindergarten classroom and the university classroom where the ECE teacher candidates could meet and observe. This particular camera model allowed a peer-to-peer direct IP dial in, over a regular IP network. Both cameras had Ethernet connections. Since both cameras were within the same network domain firewall issues were not a factor, however, the same setup has been tested across domains and by allowing traffic on a couple of specific ports, the same setup was able to communicate across multi-domain firewalls as well. Both of the cameras were pan/tilt/zoom capable and could be controlled from either end. Once the connection was established, the teacher candidates could move the wall-mounted camera to observe anything in the kindergarten classroom and vice-versa. The kindergarten teacher could manipulate the other camera to see the entire ECE teacher candidate classroom or zoom in on the instructor. Two additional Sony EVI-D70 cameras were mounted in the kindergarten classroom to provide multi-angle view to the ECE teacher candidates. For display, the university classroom used a projector to display the images on a 'whiteboard' and the kindergarten classroom had a television mounted on the wall. It was interesting to note that after the first few instances, the kindergarten students actually did not pay attention to the image of the university students on the television. The laboratory school teacher also had a wireless microphone that she wore to communicate with the university students during the observation periods. Microphones and speakers allowed two-way video and audio communication in an unobtrusive way (see Appendix). An implementation of such a setup can enable individuals at multiple locations to observe one another in the classroom at a reasonable cost (see Table 1).

Results

The results for the teacher candidates were very positive. The electronic bridge to the kindergarten classroom gave them an opportunity to see, question and reflect on the learning as it happened. They observed theory discussed in the university classroom actually being implemented in the lab school. They were able to ask questions of the kindergarten students and their teacher in order to clarify or expand what they were seeing and learning. This real time learning was like the old one-way mirrors, but with the advantage of being able to zoom in on very small objects such as writing journals or print in the classroom.

This method also incorporated the ability to ask questions. Teacher candidates were able to observe social interactions or learning center management and could clarify by asking students questions pertaining to choosing centers and center rules. Based on the learning opportunities provided from this experience, reflections from teacher candidates were informative and positive. The following examples are representative of statements from the majority of candidates:

- "This is a great way to see how technology can be used as well as show a real life classroom, all the centers, and how they choose them. Since it is live, it is better than a movie because we get to see an unedited version of what takes place. This can be a great tool to see what the children are doing in the centers and what materials are well liked."
- "I think this is a great way for me to better understand what it is we are learning about. Sometimes we learn a concept in a class and don't really understand it. This is a great way to tie our learning to real life. It's also great for observation (running records, etc.)."
- "I think the camera in the kindergarten class is extremely helpful. When reading the text, it is often hard to visualize the children's interactions. For example, in the socio-dramatic center it is difficult to imagine the

children creating their own store. It is helpful to see this without disrupting the play, distracting the learning. We can then discuss what we've observed."
- "This is a valuable learning tool because it gives me the chance to learn and see how learning environments are set up in a classroom. I am able to see what should be included in a learning environment and how all the materials should be open to the children."

The kindergarten students also benefitted from the experience. While they did quickly become accustomed to the virtual visitors, they were aware of their own importance in the exchange. Two kindergartners conversed:

- Kindergarten student A: "Why are they watching us?"
- Kindergarten student B: "Because we teach them how smart 'K-Kids' are!"

The kindergarten students also felt a sense of community as they realized that they were part of the greater campus. When some of the teacher candidates did field placement assignments in the kindergarten classroom the younger children would ask, "Did you see my drawing", and "Did you see my structure?"

The collaboration between the college professor and the practicing teacher had positive benefits for learning of all involved. The kindergarten teacher was able to benefit through collaboration and reflection of theory and its' relationship to practice when working with the college professor. The college professor benefitted from the opportunity to collaborate with the practicing teacher by keeping up-to-date with current practice. Lastly, the technology director not only gave the project the technology tools and instruction necessary to make the project possible, but reflected upon the many opportunities for this type of project to expand to other grade levels and sites both nationally and internationally.

An additional benefit of the project resulted from the problems encountered with the use of technology. There were system problems at times that were solved with perseverance. The teacher candidates were able to identify improvements that could be made, such as the need for more microphones and a more slowly panning camera. The end result was an improved experience for all, but more importantly, it was evident that improved learning opportunities are worth the hurdles of solvable problems.

Future Implications

One of the profound implications of using a multi-point video conferencing setup is that the social aspects of education can be observed and shared in context of subject and geographical diversity. Teacher candidates can observe live, real schools on different continents or urban, inner-city and rural locations to see how teaching practices differ or how the pedagogical practices differ based on particular subjects. They can also share their best practices with teachers in the diverse locations and observe the results of the applications in real time. Such interactions are bound to generate interesting ideas and help all students build a sense of membership in a global professional community as they observe, interact and reflect upon theory and practice.

REFERENCES

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APPENDIX: TECHNOLOGY FOR IMPLEMENTATION

The mentioned setup can be scaled to include distant locations, diverse network environments and multi-party situations by introducing a networking bridge made by Codian. The Codian bridge stores and addresses all codec requirements, thus making the connectivity client codec agnostic. This allows users to connect to each other while using varied equipment, as long as the end-points are H.323 and H.329 standard compliant. The setup can be used to transmit didactic materials using the H.329 protocol. With the presence of the Codian bridge, the multipoint conversations are simplified to the point of dialing an IP address from your browser. Further advantages of engaging the Codian bridge is that the bridge automatically and dynamically adjusts the video quality based on the individual stream network connection, thus providing a video feed without the user having to adjust anything.

Table 1. Technology and Approximate Costs

TECHNOLOGY	APPROXIMATE COSTS
2 Sony PCS-11 VCNF System to IMB	$5,000.00
1 Shure Wireless Microphone w/Lavalier Microphone	$350.00
1 Shure SCM268 Mixer w/ 4 Microphone Inputs	$250.00
2 Sony EVI-D70 PTZ Camera (NTSC)	$1,690.00
2 Sony EVI-D70 Wall Mount Brackets	$200.00
4 Network Connections	$1,120.00
Approximate Total	$8,610.00

CONTRIBUTORS

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