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Multimedia Teacher Research

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Abstract

In this qualitative study, two teacher educators and course instructors in a Masters of Education (M.Ed.) program explored beginning teacher researchers' use of multimedia to support action research. Fifty-eight teachers (36 in spring 2010 and 22 in spring 2011) completed teacher research as the capstone in their M.Ed. program. Teachers utilized the MERLOT website (Multimedia Educational Resource for Learning and Online Teaching) to develop and submit their research as an alternative to traditional paper submission. As teachers conducted their research, course instructors investigated how the teachers' use of multimedia strengthened or limited their teacher research work. Data from teacher researchers (questionnaires, observations and reviews of final projects) were analyzed for emergent themes. All teacher participants were able to use multimedia successfully in their teacher research projects. Technology difficulties were few, and findings suggest that multimedia options encouraged the use and development of technological skills, increased time teachers spend editing and revising work, and facilitated organization of the research process. The authors conclude that traditional paper submissions may be replaced by a multimedia format without detracting from the teacher research project and may serve to enhance the action research process.

Introduction

Over the past twenty years, the teacher research movement has substantiated the potential for practitioner inquiry to support teachers as reflective practitioners and improve teaching and student learning (Dana & Silva, 2003; Falk & Blumenreich, 2005; Hendricks, 2009; Hubbard & Power, 2003). Teacher research, also called practitioner inquiry, classroom research, and action research, has taken shape in learning communities, various school districts, and M.Ed. programs as a well-respected, rich professional experience for practicing teachers. Historically, teacher researchers have followed an action research model that is well established and supported in action research and practitioner inquiry communities (Bingham, 2006; Cochran-Smith & Lytle, 1993; Dana & Diane Yendol-Silva, 2003; Falk & Blumenrieck, 2005; Hendricks, 2009). The integration of technology and 21st century skills in K-12 classrooms and in teacher education has simultaneously expanded teaching and learning opportunities though there are contextual

differences in access, knowledge and skills training, and support for integration of technology in classrooms (Ertmer, Ottebreit-Leftwich, 2010; Wood, Mueller, Willoughby, Specht, & DeYoung, 2005). Multimedia experiences have been suggested as necessities that support and match contemporary learners' needs (Lemke, 2010), applicable to K-12 learners, teacher education students, and practicing teachers. Still, there are few studies in teacher research that examine the use of multimedia and technology for beginning or experienced researchers. Moving a traditionally paper-based process to a multimedia format presents a unique opportunity to enhance and update teacher research.

During the past several years, we have begun to integrate teacher research and technology with teachers pursuing the M.Ed. in Applied Studies in Teaching and Learning at our university. Since 2010, we have been investigating how the use of multimedia might inform and shape the work of beginning teacher researchers. While other universities and teacher research groups use electronic systems for the submission of traditionally formatted research projects, we have moved beyond this to a multimedia portal where teachers develop, construct and submit their research projects through a password protected website. The traditional action research methodology is employed, however, the multimedia website provides a unique opportunity for teachers to capture their research contexts, manage data collection and analysis stages, and integrate raw data in the form of video, audio, graphics and images towards the presentation of research findings.

The multimedia website complements the traditional teacher research semester during which teachers in our program complete research projects in their classrooms or schools as the culmination of their master's degree. The course, Teachers as Classroom Researchers, is co-taught during each spring semester and provides teachers with intensive support and multiple perspectives on their research. Typically our teachers determine research topics during the fall semester, after they have spent time with their pre-Kindergarten to twelfth grade students. This allows questions about teaching and learning to arise naturally from their teaching contexts. During the spring semester, teachers complete an action research study.

We began co-teaching the course each spring semester in 2007. Teachers developed and submitted paper-based research projects during 2007, 2008 and 2009. In the spring of 2010, we replaced traditional paper submissions of our students' teacher research projects with a multimedia website where teachers could develop and submit their teacher research projects. During 2010, we piloted the use of MERLOT (Multimedia Educational Resource for Learning and Online Teaching) <http://www.merlot.org/merlot/index.htm> with the intention of bringing the research process into alignment with existing technologies teachers use in their daily teaching. MERLOT allows teachers to share their work selectively with classmates, course instructors and their school administrators via password protected sites. We used the MERLOT site again in 2011 with a second group of teachers and adapted our teaching in response to the first year's pilot data. In 2012, we transitioned to a different program, Weebly, weebly.com to extend teachers' options for integrating multimedia in their work. With each cohort, multimedia websites allowed us to develop a research template that incorporated the stages of teacher research methodology and encouraged students to apply and develop their technological skills or engage in learning more sophisticated skills. Because we agree that modern day teachers should know how to use technology to help students learn, as well as technology's status as a contemporary and essential element of instruction (Kauchak & Eggen, 2012; Hramiak, Boulton, Irwin, 2009), we have structured our work with beginning teacher researchers in a way that helps them use their skills

in multimedia applications as they complete their classroom inquiry projects. Our ongoing inquiry into teachers' use of multimedia in their beginning research is the focus of this article.

Inquiry and Research Methodology

During spring 2010 and 2011, teachers constructed their research projects using the MERLOT website. Simultaneously, we engaged in our own structured inquiry, seeking to understand teachers' use of multimedia in their work as beginning teacher researchers. In spring 2010, we piloted the use of the multimedia website with thirty-six students. Following analysis of student work and feedback, we revised the MERLOT teacher research template that we developed for our course. We also engaged three students, who demonstrated outstanding use of multimedia in their research projects, in the construction of a course-based user's manual for the website. In spring 2011, twenty-two teachers completed research projects, using a revised template on the MERLOT multimedia website and the user's manual developed by our previous students. In both 2010 and 2011 teachers employed an action research methodology as they constructed research questions, reviewed the related literature, developed classroom interventions, collected data throughout an eight-week period, and analyzed data for significant findings. Prior to beginning their research, teachers had course instruction in the research methodology and ethical practices for teacher researchers. Teachers completed the National Institute for Health (NIH) Human Subjects online training course and secured necessary permissions for their research projects from school sites and participants. At our university, instructors of action research courses file applications with the IRB Human Subjects committee stating that research conducted by M.Ed. students will not be disseminated beyond the class. Alternatively, research projects in which participants are not identifiable do not need to undergo IRB review. As an additional precaution, websites used with teachers are restricted-access, password-protected sites, and teachers use pseudonyms to protect participant identities.

All teachers collected a minimum of three sources of data. Sources of data were selected in accordance with each teachers' research question and design and typically included: (a) observations of students using unstructured or structured observation protocols; (b) children's work samples; (c) surveys or questionnaires completed by students, colleagues, or parents; (d) pre-test and post-test data; (e) interviews (f) focus groups; and (g) historical data. Teachers constructed research conclusions and suggested implications for their future teaching. Each stage of the research process was developed through their multimedia websites, and as course instructors, we had access to teachers' sites throughout the semester. As teachers completed their research projects (see sample listing of teacher research topics in Table 1), we collected data about their use of multimedia throughout the research process.

Table 1 Selected Sample Research Questions/Topics and Research Context

Research Question or Topic	Grade Level and Subject Area
Integrating Music into the Kindergarten Communications Curriculum: The Experiences of Four Title I Students	Kindergarten Reading/Language Arts
How Does Play Support Early Literacy Development?	Kindergarten Reading/Language Arts
Literature Circles for Reading Instruction	1 st Grade Reading/Language Arts

Implementing Student-Directed Inquiry Research Topics in a Grade 1 Classroom	1 st Grade Interdisciplinary
Writing Workshop in Second Grade	2 nd Grade Reading/Language Arts
How Do I Successfully Differentiate My Math Instruction to Meet the Needs of My Second Grade Students Using a Balanced Math Approach?	2 nd Grade Mathematics
Teach the Literacy Skills of Alliteration, Personification, and Onomatopoeia in a Third Grade Classroom	3 rd Grade Reading/Language Arts
Literature Circles in Reading: Structured and Unstructured Talk in a Third Grade Classroom	3 rd Grade Reading/Language Arts
How Does a Classroom Culture of Environmental Awareness and Action Shape Fourth Grade Children's Attitudes and Behaviors About Recycling?	4 th Grade Science
What Happens to Student Motivation, Engagement, and Achievement When Academic Choice is Utilized in Fifth Grade Language Arts Instruction?	5 th Grade Reading/Language Arts
Using the 4-Square Writing Method with Struggling Fifth Grade Writers	5 th Grade Reading/Language Arts
Academic Choice is Utilized in Fifth Grade Language Arts Instruction	5 th Grade Reading/Language Arts
How Can I Move Basic Performing Students to Proficiency in 6 th Grade Reading Using a Literature Circle Model?	6 th Grade Reading/Language Arts
What Happens When Writing Skills are Integrated into Inquiry-Based Science Instruction?	6 th Grade Science
Impact of Kinesthetic Learning in a 6 th Grade Earth Science Classroom	6 th Grade Science
What Happens When the Simple Solutions: Basic Math Skills Maintenance Program is Introduced as a Supplement in a School Math Classroom?	6 th and 7 th Grade Mathematics
What Happens When I Allow Students the Option To Use Strongest Multiple Intelligence for Projects?	10 th -12 th Grade Learning Support

Data were collected from a total of fifty-eight participants (36 in spring 2010 and 22 in spring 2011) and included: periodic semi-structured reflections embedded in the website templates (2011) or submitted via paper (2010), structured questionnaires, anecdotal records of small group discussions with course instructors, and completed teacher research websites developed through MERLOT. Participants included teachers in public, private or parochial pre-Kindergarten through high school settings. Data were analyzed for emergent themes in relation to our inquiry into teachers' use of multimedia in their work as beginning teacher researchers.

Discussion

Data collected from questionnaires, ongoing semi-structured reflections, and final projects suggests various ways teachers' use of multimedia strengthened their work as beginning researchers. As teachers used the website rather than traditional binders to construct multimedia

presentations of their work, they improved their aesthetic presentation, used and developed technology skills, and spent more time editing and revising. The data also provides evidence that teacher researchers were not limited by the electronic format. However, they acknowledged some difficulties in the functionality of the multimedia website. Here we discuss ways in which multimedia strengthened and limited teacher researchers’ work and suggest implications for our future practice.

Theme One: Multimedia Strengthens Teacher Research

Upon completion of their research projects, teachers were asked to consider how the use of technology may have strengthened and limited their work. Questionnaires, course reflections and evidence from final projects revealed teachers’ perceptions of how their work was strengthened by the use of the multimedia website. Teachers suggested that the web-based process strengthened their work by: (a) supporting strong organization; (b) providing opportunities for ongoing review--independently or collaboratively—leading to improved writing; and (c) enhancing the visual appeal by offering opportunities for creativity.

Organization. In past semesters, teachers were given a paper outline of required elements that included steps in the teacher research process. With the transition to the website, we created a template for each step of the research process (See Table 2).

Table 2 Website Components for the Teacher Research Project

Project Section	Required elements to be included in final research project	Additional multimedia components included by participants
Home Page	<ul style="list-style-type: none"> -About the researcher - Ethical considerations as teacher and researcher -Instructions to insert student certificate of NIH human subjects training -Context/research site -Background of the research question/sub-questions -Research abstract 	<ul style="list-style-type: none"> -Photograph of teacher researcher, family, teaching context or other personal references -Image of NIH training certificate
Context	<ul style="list-style-type: none"> -Research setting -Description and images of the research setting, including district, school, community and classroom information -Reference list 	<ul style="list-style-type: none"> -Photos of teacher’s classroom, students, school, district, community -Links to webpages including: teacher’s website, school district website, public city or county website, information about the topic under investigation, articles or materials that illustrate the intervention or topic of inquiry
Review of the Literature	<ul style="list-style-type: none"> -Section for Topics and Graphic representation of topics, key authors and connections to the research question 	<ul style="list-style-type: none"> -Figure or graphic organizer depicting the topics, key authors and dates of the authors’ works as used in the literature review

	<ul style="list-style-type: none"> -Review of the literature body of the paper—text embedded or linked -Reference list 	
Data Collection Methodology	<ul style="list-style-type: none"> -Preliminary Data Collection Plan -Graphic organizer listing sources of data, dates for collection, description of each source of data, purpose in collecting these data (intended learning) -Final Data Collection Methodology— Final graphic organizer depicting data collection methodology, referencing changes made to their original plan and reasons for these changes. -Participants, descriptions of participants, rationale for selection -Data Sources, rationale for selection 	<ul style="list-style-type: none"> -Figure or graphic organizer listing data to be collected, identifying which research question or sub-question may be addressed through each data source -Photographs of raw data (student work samples, surveys, questionnaires, research logs, teachers’ observational recordings), transcriptions, etc... -Photographs of data collection instruments used or electronic documents of data collection instruments designed by teacher researchers -Photographs of participants (if allowed by school policy) or of participants’ typical learning contexts (classroom desks, areas of the classroom)
Data Analysis Methodology	<ul style="list-style-type: none"> -Initial plan for data analysis, methodology or approach to analysis of qualitative and quantitative data -Final data analysis methodology 	<ul style="list-style-type: none"> -Figure or graphic organizer indicating the methodology each teacher researcher selected for data analysis -Photographs of data analysis process in progress (ex. Organization of data, color and numeric coding of data)
Findings and Conclusions	<ul style="list-style-type: none"> -Major themes or findings, discussion of each theme -Raw data to support statement of findings -Conclusions -References 	<ul style="list-style-type: none"> -Raw data (completed questionnaires, surveys, student work samples, researcher journal, pre or post-test, interview transcriptions, field notes, etc...) included, embedded as links or images in text as teacher researchers identify emergent themes and support their findings with raw data
Implications & Final Synthesis	<ul style="list-style-type: none"> -Implications for teacher researcher’s classroom and future teaching -Final synthesis/reflections on the teacher research project 	<ul style="list-style-type: none"> Various images to support future changes in classroom teaching (ex. Photographs of intervention components that the teacher researcher will continue to utilize)

Forty-four comments on exit questionnaires indicated that the website template provided a framework to organize the research process and supported students in their beginning research projects. Teachers commented in class that the template made it “easy” to complete the necessary components of the research assignment and was an effective organizational tool. The website template was developed to include separate web pages corresponding to typical components in

teacher research methodology. Teachers were required to post their research question or title on each page, and students shared via questionnaires and anecdotally that this task helped them keep their research question central in their work. Each of the web pages allowed for the inclusion of photos, videos, audio clips, and attachments. Furthermore, teachers noted that the organization of the website or the completion of the project electronically allowed for successful “timing and completion of work.” While this template was highly structured for alignment with the teacher research methodology, it did not differ from outlines and materials that we have used with teachers in 2007, 2008 and 2009 when teachers constructed and submitted paper-based projects. When utilizing the template in 2010 and in 2011, teachers did not suggest that the template limited their work in any way. Furthermore, teachers were encouraged to present their work in each of the stages in ways that made sense to them as the teacher researcher, met the ethical considerations and expectations of rigor for their research, and would be clear to their readers (colleagues in their course and course instructors). We identified no significant differences comparing students’ paper-based submissions (2007-2009) to the 2010 and 2011 website submissions. Teachers’ abilities to complete substantial research projects that included rich research questions and appropriate sources of data were consistent between the groups submitting paper-based projects and those submitting multimedia websites.

While in past semesters students have been given the same format and schedule for completion, we posit that the visual aspect or concrete nature of the website allowed students to feel more organized than traditional paper-based completion and submission of work. One teacher explained, “I could see all of my work on the same site,” allowing for a more complete visual overview of the entire project. Another commented on the ongoing continuous nature of their work, finding they “could continually add pertinent information” throughout the semester while a third noted that the process “helped me to organize my data.” We feel that this visual component may help teachers to understand, internalize and utilize the traditional action research stages to complete and construct better research products and is worthy of further investigation. The visual nature of the website may allow teachers to feel more confident throughout the teacher research process, allowing continual review of the process and their progress.

Continuous review and revision of student work. Teachers also identified that the website strengthened their work by providing opportunities to improve their writing through continuous revision and peer sharing. These were unexpected findings, as we did not anticipate that teachers would observe differences in their writing between an electronic format and paper, or that the ease of sharing would enhance the review and revision process. When transitioning to MERLOT, we made it clear that teachers would present information differently. We expected that the website would allow for data to be represented visually and for narratives to be more concise. We were pleased that teachers acknowledged a change in their writing. Teachers suggested that their writing improved in various ways. Several noted that their writing was “more clear” and “more concise,” that the website allowed for editing and revision of their writing, that they may have been more inclined to review and change their work more often, and that the website allowed them to “include more information.” One teacher stated, “I was able to add to my project from any computer” so that the work on the project, including editing, could be done easily and more often. Two teachers suggested that “seeing progress along the way” was beneficial and that the website appeared as a “published work” which encouraged more frequent interaction with the finished product, including ongoing revisions. As one first grade teacher explained: “I think I looked at everything more. I am more knowledgeable about it. A paper I would have looked at 5-6 times and the webpage I looked at hundreds of times.”

Two teachers referenced the nature of the website for ease of sharing with others, and suggested that the website allowed for quick references to essential sections of the research project. During whole and small group class sessions, teachers were able to display their work-in-progress for feedback and suggestions. As instructors, it was helpful to have continuous access to our students' work throughout the course by accessing students' websites. This was especially helpful in cases where teachers seemed to be struggling or falling behind on the research timeline. At those times, we could review the project with the student and provide more direct suggestions for revision and next steps. Teachers' comments about the ease of reviewing, editing, revising, and sharing ongoing work have been encouraging. We will consider additional opportunities for our students to share their work with one another as a way to support continuous editing and revision.

Multimedia and creativity. On exit questionnaires, teachers referenced how the integration of multimedia enhanced their work. All teachers linked school or personal websites and added photo images. Many included video, audio, and graphics of classroom maps and utilized a variety of software applications, such as interactive online maps. Six participants said their projects were "more visual" because of the multimedia options, while four noted that the website allowed for a more "professional," "colorful," and "fresh" look. In addition to comments about multimedia options, eighteen teachers referenced opportunities for "creativity" that the website provided. One teacher wrote: "The website allowed me to display my work in a more creative fashion – charts, pictures, videos, etc.," while another teacher reported that the process was more "engaging." Using school district guidelines, teachers often posted photos and videos of their classrooms and schools. They included links to school or teacher-maintained class websites, links to township or county demographic information, aerial photos, and maps that located the school within the surrounding community. Several students remarked that the home and context sections of the template made each study unique and "personal."

Teachers used multimedia options to enhance the visual appeal of their work and used the technology in creative ways to incorporate raw data, websites, and other information in their final products that may have otherwise appeared only as text or charts in paper submissions. Teachers integrated links to student work samples, photos and videos of students working, and various types of graphic organizers for data collection and analysis. Teachers also included images of their field notes and other data collection artifacts. While teachers included similar documents as appendices in earlier paper-based formats, they also suggested that the website provided opportunities for "creativity" in how they presented their work. This is consistent with Greenhow, Robelia and Hughes' (2009) notion of "creative practices" afforded by use of Web 2.0 technologies which include "interactivity...features that do not require sophisticated technical expertise but allow users to publish, share, consume and remix content" (p. 249). Though all teachers incorporated multiple forms of media in their websites, only two students noted specific technology applications as strengthening their work. We are still curious about the following (a) whether these individual technologies feel so 'typical' that teachers do not see them as strengthening their work, (b) whether the teacher research process is so complex that it is difficult for teachers at the end of the semester to look back on how multiple technologies strengthened their work, and (c) whether teachers' initial frustrations or successes with technology influenced the number and type of multimedia components they included. We feel that each of these issues is worthy of further research.

Theme Two: Multimedia Limiting Teachers' Work

Teachers were asked to identify ways in which the use of the website limited their work. Generally, teachers were not encumbered by the use of the multimedia format. Although MERLOT was new to all fifty-eight participants, thirteen teachers stated that the website did not limit their work "at all." While we were pleased to learn that teachers did not feel that multimedia format limited their research process or product, when asked about specific challenges faced while constructing projects on the MERLOT site there were several responses indicating problems with the technology. All teachers' comments about limitations involved the technology itself and did not suggest negative effects on the teacher research process or product. Those who identified challenges referenced the absence of word processing functions and complications adding photos or videos. Three students stated that they found the technology challenging to learn or "stressful" and one student commented, "I couldn't do everything I wanted to. I couldn't add multiple photos." Of the challenges faced by teachers, adding photos or videos was identified most frequently and will be discussed in the following section.

Challenges adding photos or videos. Of fifty-eight teachers, six respondents stated that adding photos or video was challenging. Two beginning researchers, both of whom were less inclined toward technology, stated that it was difficult for them to learn how to use the multimedia options. This suggests that teachers may need more assistance with the technology. It is unclear whether teachers' difficulties were related to their existing technology skills, their computer platform (PC vs MAC), their web-browser and related compatibility (Firefox, Internet Explorer, Safari) or specific video and photo programs. In future semesters, we will address these variables. In spite of these few comments, all teachers were able to add photos or videos in meaningful and useful ways beyond our requirements and what teachers have typically included in paper-based submissions. Because there were few responses indicating that teachers had difficulty with the technology, we feel comfortable that this population found relative ease in navigating and using the website technologies.

Generally, during this pilot implementation and continuing afterwards, teachers' final projects exceeded our expectations for technology integration. We found that all teachers incorporated more multimedia options than required and did so successfully. Each teacher included visuals, photographic images, classroom maps, neighborhood or local maps, photographs of their classrooms, and photographs of themselves in their final projects. Most included scanned images of raw data and student work samples, images of students and school sites, and graphic organizers for the review of the literature and data collection methodology sections. Other students who maximized the multimedia functionality of the website included classroom videos, student audio, links to classroom websites and blogs, and videos of students. One student included audio reflections in his work, an option we would like to explore in the future which has become increasingly available since the completion of this pilot study.

Overall, the majority of students experienced very few difficulties. Those who voiced concerns about the challenges they faced were not limited by the technological difficulties. Still, during the next phase of the study we will continue to investigate other websites as possible formats and identify the source of challenges for specific technology concerns (platform, browser, and photo/video programs) which can be barriers to the use of technology in various settings (Wood et al., 2005). We will also explore possible factors that influence teacher researchers' decision-making and completion of their teacher research project in multimedia form.

Conclusions and Future Directions

Teachers' perceptions of the use of a multimedia website instead of traditional paper submissions are critically important as we continue to use MERLOT or other programs (e.g. Weebly, Google Websites) with our beginning teacher researchers. Most teachers stated that they preferred using the multimedia website to construct, present, and share their teacher research. The few students who stated that they would have preferred a traditional paper format identified numerous advantages of the multimedia format. In this study we sought to understand teachers' use of multimedia in their work as beginning teacher researchers. Through analyzing our data, we were confident that moving from traditional paper-based to a multimedia website environment had positive effects on our teacher researchers. We feel that there is still strong potential to enhance teacher research through more effective and efficient organization, opportunity for ongoing editing and review, and the integration of visual components and "creativity." We are confident that the difficulties with technology experienced by a few participants do not inhibit or limit teachers' work as researchers. Nonetheless, we will revise the course to incorporate additional supports for teachers who may struggle with the technology and in response to rapidly changing technology.

Teachers are ready for a complex and rigorous experience that draws on the use of 21st century technology skills. We intend to continue our investigation on the intersection of teacher research and technology. As technology and multimedia options become more accessible to teachers, school sites and universities, we anticipate even more opportunities for teacher researchers to integrate multimedia in their work. Multimedia integration may stimulate action research communities to bring their research and implications into a more accessible sharing format for audiences within and beyond the community.

References

- Bingham, S. C., Parker, S., Finney, P., Riley, J., & Rakes, J. (2006). The teachers as researchers academy: Building community, expertise, and a knowledge base for teaching. *Phi Delta Kappan*, 87(9), 681-688.
- California State University. (2009-2011). MERLOT Home Page. Retrieved [November 23, 2011] from <http://www.merlot.org/merlot/index.htm>
- California State University. (2009-2011). MERLOT About Us. Retrieved [November 23, 2011] from <http://taste.merlot.org/>
- Cochran-Smith, M., & Lytle, S. L. (1993). *Inside/outside: Teacher research and knowledge*. New York: Teacher College Press.
- Dana, N. F., & Yendol-Silva, D. (2003). *The reflective educator's guide to classroom research: Learning to teach and teaching to learn through practitioner inquiry*. Thousand Oaks, CA: Corwin Press.
- Ertmer, P., & Ottebreit-Leftwich, A. (2010). Teacher, technology change: How knowledge, confidence, beliefs, and culture intersect. *Journal of Research on Technology in Education*, 42(3), 255-284.

- Falk, B., & Blumenriech, M. (2005). *The power of questions: A guide to teacher and student research*. Portsmouth, NH: Heinemann.
- Greenhow, C., Robelia, B., & Hughes, J. (2009). Learning, teaching and scholarship in a digital age: Web 2.0 and classroom research: What path should we take now? *Educational Researcher*, 38(4), 246-259.
- Hendricks, C. (2009). *Improving schools through action research: A comprehensive guide for educators (2nd ed.)*. Upper Saddle River, NJ: Pearson.
- Hramiak, A., Boulton, H., & Irwin, B. (2009). Trainee teachers' use of blogs as private reflections for professional development. *Learning, Media and Technology* 34(3), 259-269.
- Hubbard, R., & Power, B. (2003). *The art of classroom inquiry: A handbook for teacher-researchers*. Portsmouth, NH: Heinemann.
- Kauchak, D., & Eggen, P. (2012). *Learning and teaching: Research-based methods*. Boston: Pearson Education, Inc.
- Lemke, C. (2010). Innovation through technology. In Bellanca, J., & Brandt, R (Eds.), *21st century skills: Rethinking how students learn* (pp.243-272). Bloomington, IN: Solution Tree Press.
- Wood, E., Mueller, J., Willoughby, T., Specht, J., & DeYoung, T. (2005). Teachers' perceptions: Barriers and supports to using technology in the classroom. *Education, Communication & Information*, 5(2), 183-206.