

# Encouraging Critical Reflection through Action Research Projects in Agriculture and Natural Resources Teacher Preparation: A Case Study

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## Abstract

This case study summarizes curriculum revision to foster critical reflection among teacher candidates in an Agriscience and Natural Resources Education (ANRE) teacher preparation program at Michigan State University. Specifically, we analyze the usefulness, applicability, benefits, and drawbacks of student-designed action research projects during the internship (student teaching) year. We review the theoretical evolution of and frameworks for reflective teaching and teacher action research. Student assignments included deep reading and dialogue around problems of practice that could be studied using action research in the classroom, reflective journaling, design of the research projects, and poster presentation of findings and implications for teaching practice. This case study describes how we provided guidance to foster an inquiry-oriented professional learning environment to allow teacher candidates to explore problems of practice relevant to the settings of ANRE. Students initially demonstrated resistance to this approach, but then reported that they developed inquiry processes that they believed would be beneficial in their careers. We conclude with benefits and weaknesses of this approach, and recommendations for fostering reflective practice orientations among agriculture and natural resources undergraduates to address increasingly complex social problems.

## Introduction

Most of the U.S. Agriculture and Natural Resources Education (ANRE) teacher preparation programs are situated within a state Land Grant University; this common context provides the agricultural and natural resources content and teacher education curricula needed to address complex, contemporary, applied science problems. Changes in recent years have put agriculture and natural resources at the crossroads of local as well as global economic development (Committee on a Leadership Summit to Effect Change in Teaching and Learning and The National Research Council, 2009; Association for Career and Technical Education,

2008). More than ever, complex issues exist for agriculture, our natural resources, and sustainability; interdisciplinary and transdisciplinary approaches to problem-solving are being incorporated into curricula and new modes of inquiry in Land Grant universities (Baker et al., 2009). Many teacher candidates interested in teaching at the secondary level about society's important issues related to agriculture and natural resources face daunting challenges in addressing these issues in a core-content-driven and standardized-test-based context. Altogether, these changes present an increased need for developing habits and skills for critical reflection among teacher candidates. Today, ANRE programs at the secondary level require teachers who are critically reflective in order to prepare youth to be effective citizens for sustainable food and fiber production, natural resource management, and decision making that positively affects their communities.

*Reflective practitioner and teacher inquiry*—these terms are regularly used in secondary education teacher preparation institutions, and have been since the 1980s. By the 1990s, most colleges of education began to restructure teacher preparation programs to foster critically reflective practice on the part of undergraduates. In addition, in science education especially, a renewed focus emerged on pedagogies for developing inquiry capacities among both K-12 students and teacher candidates. Yet, at our institution, a conceptual gap had widened between other secondary teacher preparation programs (i.e. science education) and the Agriculture and Natural Resources Education (ANRE) teacher preparation program. The ANRE program, housed in the College of Agriculture and Natural Resources, had not adapted to this change in the wider field of education and teacher preparation.

We noticed this lack of adaptation during our first semester teaching the 800-level courses during ANRE students' internship year. Early in the fall semester of 2007, we noted the conceptual gap when we presented our course syllabi; the behavior of ANRE students demonstrated their aversion to the assignments tied to the College of Education's specific desired outcomes for this 5th year (graduate level)

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learning in areas such as reflective practice, inquiry-based learning, and teacher leadership. Students could not critically reflect upon—or inquire about—problems and opportunities of teaching practice.

Fostering critical reflection for all students is a process that takes years. We undertook this case study as part of a larger programmatic change for the ANRE teacher preparation program at our institution—moving from a traditional curriculum that mirrors Tyler's rational curriculum model (1949), to one that is progressive, developmental, and pedagogic in its basis (Ross, 2000).

We have three purposes in presenting this case study. First, we outline the integration of reflective practice as conceptualized in colleges of education with our College of Agriculture and Natural Resources (CANR) secondary teacher preparation program. Second, we report on the course design we initiated to focus on reflective inquiry processes and to engage student interns (student teachers) in action research projects to inform and strengthen agricultural and natural resources teaching practice through reflection. Finally, we summarize our work, discuss the benefits and weaknesses of our approach, and provide recommendations for agriculture and natural resource teacher preparation and for undergraduate learning in today's Land Grant systems.

## Theoretical and Conceptual Background on Reflective Practice in Teaching

### *Evolution of Reflective Teaching*

Critical reflection has been an educational practice dating back to the early 1900s. Dewey (1904) favored the idea of the reflective practitioner, where the student is thoughtful about his/her work rather than focusing rotely on methods that are good or bad. However in the mid-60s through the 1980s, Dewey's assumptions were challenged and Competency-Based Teacher Education (CBTE) and Process-Product Research began to drive most teacher preparation programs, especially vocational education programs (Richardson, 1990). Both CBTE and Process-Product Research assume that if the teacher candidate completes a certain set of courses and completes a student teaching experience, they will be ready to teach (Haberman and Stinnett, 1973). This linear, operationalized, rational behavioral paradigm assumes that there is a set of “correct” behaviors in teaching. Around the mid-70s, educational researchers began to challenge the CBTE and Process-Product Research models. Doyle (1977) found that CBTE and Process-Product Research ignored factors such as classroom climate, teachers, student attitude, and learning contexts in the processes of teacher preparation. He stressed that the CBTE paradigm was led by policy makers and administrators to standardize the education field (Doyle, 1988). Renowned thinker Donald Schön (1983a) also finds

fault with approaches such as CBTE, and considers such paradigms a “technical rationality” model of professionalism (1983b). Schön coined the term *knowledge-in-action*, which takes into consideration teacher experiences interacting with specific situations. Schön refined and extended this concept into *reflection-in-action*, a process by which professionals integrate diverse perspectives as they act (1983b).

In the mid-80s, reflective practice influenced teaching and teacher preparation programs, as noted in the theme for the 1986 American Education Research Association conference. However, teacher preparation for agricultural education continued to rely on competency-based learning models. This is still evidenced by the limited inclusion of critical reflection in research regarding agricultural education teacher preparation (e.g., Ewing, 2009), and its absence in the most recent overview of agricultural teacher preparation (Torres et al., 2010). Yet, according to the National Standards for Teacher Education developed by the American Association for Agricultural Education (AAAE), “All agricultural education faculty instruction encourages the development of reflection, higher order thinking, and professional disposition of teacher candidates” (AAAE, 2001; 4b). Furthermore, Career and Technical Education (CTE) including agricultural education, has been challenged to “change or die,” (Medrich, 2005) and strategy documents call for new focus on interdisciplinary critical thinking capacities to increase rigor and relevance of CTE for learners of the future (Brand, 2003).

In teacher programs during the 1980s-90s, Grimmitt et al. (1990) note that reflective practice had three major characteristics. The first was that reflection was seen as an instrumental mediator of action. This type of action assisted teachers to put into practice research findings. This view of reflection followed the belief that knowledge was driven by external authority using tested theories, expert advice and scholarly journal articles. However, the mode of knowledge was technical, rarely taking into consideration the contextual aspects of teacher, student, and classroom (Johnson, 2005). The second major characteristic was that reflection was a tool to deliberate among competing views of teaching. This view of reflection recognized that knowledge is deliberative and consequences develop from different actions. The third characteristic was that reflective practice was contingent on context. This notion took into consideration that teacher self-identity promotes teacher self-reflection. This ontological viewpoint was concerned with ways of being in the world, and it allowed the teacher to deconstruct and reconstruct experience in the process of making meaning. It is this third notion of reflective practice that has driven its inclusion in current teacher preparation programs.

Reflective teaching developed as a peer teaching technique to help teachers examine the process of teaching (Cruickshank, 1985). This programmatic

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model considered internal and external variables influencing student learning, and resulted in the increased use of videotape assignments in teacher preparation programs. Throughout the 1980s, programs began to develop inquiry activities to encourage student teachers to explore relationships between knowledge, theory, and practice. This was noted in assignments such as action research projects, case studies, and curriculum analysis. Reflective writing (journaling) also was a tool used to encourage students to critically analyze and provide reasoning for actions in the classroom.

Both reflection and criticality strengthen with practice; therefore, these areas of development are needed early in teacher preparation programs to allow them to become habits of mind and practice. Importantly, reflection is not a behavioral competency to be checked off a list of requirements in teacher preparation programs. Development of reflectivity takes time and multiple iterations, as well as much dialogue and deep thinking. Ultimately, as teacher educators, we strive to provide students with the language and capacities to evaluate their learning, and to observe and make sense of their situations, over and over throughout a career; we also strive to take learning a step deeper, by assisting teachers to make sense of problems of practice throughout a lifetime of teaching.

**Reflective Teaching at Michigan State University**

During the mid-80s, Michigan State University's College of Education received a grant from the Office of Educational Research and Improvement and the U.S. Department of Education to develop the Institute for Research on Teaching, now the Institute for Research on Teaching and Learning (IRTL). Work from the Institute, along with research conducted by the secondary teacher education faculty and the findings of the 1980 Holmes report, *Tomorrow's Schools*, were influential in the development of a three year teacher preparation program. The three years consist of two upper-level, undergraduate years on campus engaged in course work and small field studies, then a final yearlong student teaching internship (Table 1). Research has shown that the yearlong internship allows the needed time for student reflection as compared to the intense 10-14-week student-teaching assignment at the majority of universities (Carroll et al., 2007).

During their internship year, MSU ANRE teacher candidates are in a school placement where they instruct a focus class throughout the year. Interns have two periods of short-term "Guided Lead Teaching," during which they teach a small number of courses, not a full load (Table 1). In between these periods of Guided Lead Teaching, interns have a short period during which they teach only their focus class, allowing time for in-depth reflection outside of teaching responsibilities. Finally, the interns teach a full course load (including their focus class) during a 10-week period in the spring. This Lead Teaching period coincides with the regional FFA events, the Annual FFA Convention, and Career Development Events. Throughout the academic year, interns attend 20 on-campus class meetings to participate in reflective discourse with peers in a facilitated setting to deconstruct their experience and their associated assignments.

**Table 1. Model for the Intern Year- Teaching/Reflection Cycles in ANRE at MSU**

Timeframe (Semester 1)	Teaching/Reflection Roles of ANRE Interns
Weeks 1-3	<b>Focus Class</b> – Teach one class consistently throughout entire Internship Year
Weeks 4-8	<b>Guided Lead Teaching I</b> – Teach 2-3 classes (including Focus Class)
Weeks 9-10	<b>REFLECT</b> on Guided Lead Teaching I (teach Focus Class)
Weeks 11-15	<b>Guided Lead Teaching II</b> – Teach 3-4 classes (including Focus Class)
Weeks 16-19 (before and after holiday break)	<b>REFLECT</b> on Guided Lead Teaching II (teach Focus Class); Prepare for Lead Teaching
Timeframe (Semester 2)	Teaching/Reflection Roles of ANRE Interns
Weeks 20-29	<b>Lead Teaching</b> – Teach 4-5 classes (including Focus Class) FFA Annual Convention and Career Development Events
Weeks 30-31	<b>REFLECT</b> on Lead Teaching -- Transition to employment

Note. Adapted from the Secondary Intern-Mentor Teacher Handbook 2006-2007. Retrieved January 1, 2007 from <http://ed-web2.educ.msu.edu/team>

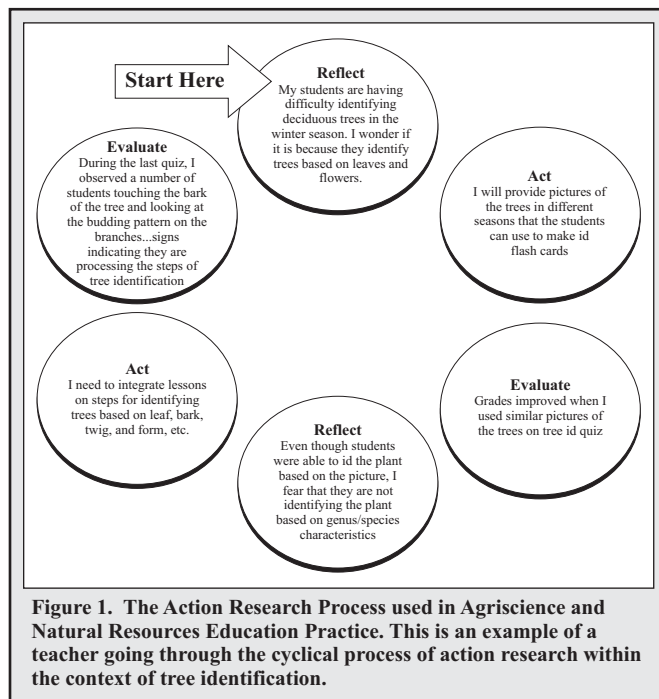
**Action Research in Teacher Preparation Programs**

Educational research consists of two main forms— traditional educational research and action research. Action research is aligned to reflective teaching and, if applied properly, to teacher education programs. Action research can help teachers connect theory and practice, may improve educational practice, will empower teachers, and may help teachers grow as professionals once in the classroom (Mertler, 2006). Johnson (2005) found that it was more difficult for teacher candidates to make every day decisions regarding the classroom than for practicing teachers. He noted that action research helps the teacher candidate identify aspects of the classroom climate that he/she would have never noticed before, which in turns speeds the process of assimilation into the classroom and helps the teacher to make better decisions. Another noted benefit of action research is that it allows the mentor, intern,

and faculty supervisor to work together on a common goal to improve teaching and learning in the classroom, through evidence-based reasoning.

Action research models in teacher preparation programs date back to Lewin (1952), who proposed a spiral process including planning, execution, and reconnaissance of teaching and learning. Creswell (2005) proposed a dynamic process focused on identifying a plan and problem, followed by implementing the plan, and then reflecting on the problem and plan of action. Mertler (2006) highlighted four processes in action research—planning, acting, developing, and reflecting. Hendricks (2006) highlighted action research as an ongoing process based on systematic inquiry and reflection (Figure 1). Taken together, similarities among these models of action research include the following:

1. All models feature cyclical versus linear processes of thinking, reflection, and change in practice;
2. All identify a problem or opportunity of practice;
3. All involve analyzing and interpreting data;
4. All involve reflection as a key component of the model.



## Methods

In our two courses for the ANR teacher interns, entitled *Reflection and Inquiry in Teacher Education I & II*, we re-designed the syllabi to include readings in critical reflection, teacher leadership, and educational action research (Table 2). Likewise, we incorporated activities to enhance critical thinking, dialogue, and personal reflection. We also required students to conduct an action research project at their placement schools during the second semester. These activities were developed to empower interns to:

- a. Make informed decisions about what teaching practice to change and what not to change;
- b. Link prior knowledge to new information;
- c. Learn from experiences (and failures);
- d. Ask questions and systematically find answers (Fueyo and Koorland, 1997).

We compiled observations from students' journals, field notes, samples of students' work, dialogue (both structured and unstructured) during class, and exit interviews to discern students' engagement with and reactions to the assignments that emphasized reflective practice. Pseudo-names were used when referring to the interns in our analysis to allow for anonymity. Direct quotes from student interns are used for illustrative purposes. We report on insights gained as we pursued this case study with a cohort of seven ANRE interns during the 2007-08 academic year at MSU.

Our project was deemed Exempt by our institution's Internal Review Board for Human Subjects (IRB #X08-378). This determination allowed our teacher education students to conduct action research projects in their placement schools and to use the de-identified qualitative and quantitative data to enhance teaching and learning processes.

## Description of Action Research Project Assignment

The primary objective of the assigned action research project was to encourage self-reflection in teaching and learning on the part of teacher candidates. The students were assigned to incorporate this project into on-going work at their internship placement sites, and to share their work with peers in our on-campus class sessions. Beginning in the fall semester of the students' internship year, we assigned readings in the area of teacher leadership and action research to begin introducing teacher research to the interns. (For additional information see Brookfield, 1995; Danielson, 2006; Ferrance, 2000; Fink, 2003; Knapp, 2001; Rourke, 2007.) During the spring semester, students read from Career and Technical Education (CTE) research journals and from agricultural education research and best-practice peer-reviewed journals. In addition, we read two popular books about reflective practice: Parker Palmer's *The Courage to Teach* (1998), and Frank McCourt's *Teacher Man* (2005). (See Table 2 for information regarding all course assignments as we revised our instructional model for teacher preparation in the internship year.)

At the start of spring semester, the students received a tutorial on the action research process. Our process closely followed Hendrick's model of Action Research (Fig. 1), since this model highlights the component of reflection and integrated reflective process. The action research project required that the students begin by writing journal entries about problems or opportunities of practice in their placement classroom and which they believed could be

**Table 2. Comparison of Former and New Model for ANRE Teacher Preparation Assignments during the Internship Year**

Former, CBTE (Competency-Based Teacher Education) assignments	New, revised reflective, action research and inquiry-based teacher education assignments
<b>Readings:</b>	
Textbook(s): Talbert, B.A., Vaughn, R., & Croom D.B. (2005) <i>Foundations of Agricultural Education</i> , Catlin, IL: Professional Educators Publishers, Inc.  Phipps, L.J. and Osborne, E.W. (1998). <i>Handbook on Agricultural Education in Public Schools</i> 5 <sup>th</sup> ed. Danville, IL: The Interstate Printers and Publishers.	-Peer-reviewed journal articles -Journal article critique and dialogue -Parker Palmer’s <i>The Courage to Teach</i> -Frank McCourt’s <i>Teacher Man</i>
<b>Project Assignments:</b>	
-Focus Binder -Written News Article -Bulletin Board -Required FFA Activities	-Focus Class syllabus and assessment -Action Research Project -Teaching Website -Collected Resources for lesson sequences
<b>Lesson Planning Format:</b>	
-Lesson outlines; unit outlines -Lessons correlated with Agriscience Education website, state standards and benchmarks	-Lesson plan with Big Ideas (thematic issues for instruction based on agriculture, natural resource and food systems issues in society), and Learning Progressions (based in constructivist research about science learning). -Correlations with Grade Level Content Standards
<b>Professional Products:</b>	
-Resume -Professional Teaching Portfolio	-Teaching Philosophy Statement (revised and revisited throughout the year) -Electronic Teaching Portfolio (including digital video vignettes of teaching practice, and on-line resume, samples of lesson plans) Teaching Website
Note. For assignment details and assessment rubrics, contact the authors.	

investigated in the time frame allotted. Students were to identify an educational concern—a problem or opportunity of practice within their classroom, with their FFA chapter, or with managing student Supervised Agricultural Experience (SAE) projects. Once they identified a problem, student interns were required to reflect daily in their journals about the problem and observations made, as well to record any data collected. We provided ongoing feedback to the students. Themes were noted within the journals and were used to foster dialogue in class. Once they identified a problem of practice, students dialogued in class and with fellow teachers to share why they thought it was a problem, why they were concerned about this problem, how the problem could be investigated, and what possible teaching changes could be made to address the problem.

The interns were to begin their project during the end of their first reflective period at the start of the second semester (just before starting the Lead Teaching period, as shown in Table 1). At that point in time, the students were to propose what they were planning on doing in their classrooms and what kinds of data they were going to collect. Projects were to last anywhere from one to four weeks, depending on the problem of practice being addressed and the data collection process.

Along with providing the students with resources for conducting action research projects and a template to follow to brainstorm potential projects, we also incorporated weekly reflections and time for

reflective dialogue. Students were encouraged to dialogue with other teachers, peers, and community members, about their problem of practice. These inputs were considered as students decided upon their action research methods, since they were not experts in the field that they were addressing. Course class time was given to students to discuss their action research with their peers to gain feedback. Dialogue was guided by the faculty instructors and included structured conversation.

By providing a structured format for students to journal about and discuss their action research projects, we were anticipating that we would gain some insight as to (1) what pre-service teachers view as problems of practice, (2) how they think and act when problems arise in the

classroom, (3) whether they act on prior observations and experiences when incorporating change in the classroom, and (4) whether they view educational reflection as a natural process or one that takes time to master.

Approximately three weeks into the student action research projects, we spent class time on how to evaluate the evidence being collected and how to use it to influence practice. We instructed the students to provide evidence that the conclusions that they came to were reasonably fair and valid. We also had them address how they would modify their concerns, ideas, and practice of teaching in light of their evaluations. The students then were assigned to assemble their action research work into professional poster presentations. We provided directions from the American Association for Agricultural Education website to the students and gave copious faculty input regarding their poster construction and professional writing.

Faculty members from the Department of Community, Agriculture, Recreation and Resource Studies (the department that houses the ANRE teacher preparation undergraduate program) were invited to the final poster symposium, where they interviewed students about their action research project and process and the implications of the project for future teaching practice. The faculty members were debriefed at the end of this symposium, and we recorded comments that were shared by the students and the faculty during and after the symposium.

## Case Study Results

### Benefits of Action Research in Agriscience and Natural Resources Teacher Education

Student-chosen action research projects were diverse, although there was some overlap in students' interests. Projects addressed the following themes:

- Teaching styles: traditional, lectured-based versus hands-on instruction
- Conjunction between test scores and teaching styles
- Student involvement in Supervised Agricultural Experiences
- Secondary student interest in Agriscience and Natural Resources
- Motivation through student-directed learning
- Internet resources and accessibility for new Agriscience and Natural Resources subjects
- The Immediate Feedback Assessment Technique in ANRE (Epstein and Epstein, 2010)

We observed a beneficial change in the interns from the first semester to the second semester in their level of inquiry and insight. The course discussions evolved from what the students referred to as “gripe sessions” during the first semester – where students shared surface-level thinking about the technical aspects of teaching. Discussions eventually (in the second semester) became a form of dialogue where students displayed higher orders of thinking and critical reflection regarding deep problems of practice and deliberated on multiple perspectives and approaches to teaching and learning (rather than focusing on “the one right technique”).

There was also a change in teaching styles by some of the interns based on their ability to conduct action research projects in their classroom. Some discovered traits about themselves that they would have never changed had they not done the project. For example, one intern instructing an agriculture and natural resources biology course realized through her research project that she was not afraid of using student-directed, active learning pedagogies, whereas prior to the project, she had typically used lecture and PowerPoint to keep students on task. In her journal observations and through her action research project, data indicated that the course was more engaging and retention of content learned was strengthened. Most interns emphasized positive changes for themselves, students, and classroom environments as an outcome of the action research project.

As noted in previous studies, we observed that action research provides student teaching interns a real-world process that students can translate into professional practice in their first employment. Regardless of whether they become teachers or if they choose a different career path, these undergraduates who are just bridging into introductory graduate-level learning, become empowered to *think* critically about problems and to self-reflect to help solve problems or determine proactive approaches to new

opportunities. Most of the student teaching interns who participated in the action research process shared that they will continue to use this inquiry approach in their future jobs. Some even said that they were doing another study to follow up on the data they collected for the assignment.

### Weaknesses of Action Research in ANRE Teacher Education

To allow student interns to have the time needed to complete an action research project, changes from past years' course syllabi had to be made. Extreme changes to courses can either be favored by the students or may cause student resistance. In the case of the action research projects for this study, at first, there was a heightened level of student resistance. The student interns did not understand the benefits of conducting research in their placement schools until close to the end of the assignment. In the early phases of this assignment, interns expressed that class time and extra readings on teacher reflection were wasteful and esoteric, and that the students would have rather been learning more practical “tips and techniques” specific to ANRE content and pedagogy. However, during exit interviews, the majority of the students expressed that the action research project gave them a new tool to take with them as they join the ANRE profession and that it provided an addition to their teaching resumes and portfolios.

To have the students conduct research during the beginning of the second semester proved to be problematic for some local ANRE programs. Interns felt overwhelmed by the added responsibilities assigned to them by their mentor teachers to prepare for the state FFA Convention and regional events (a leadership component of ANRE) and for Career Development Events (CDEs), which occurred from February to April with great intensity. Noted one student intern:

[Bob]: My school has a reputation for winning district and regional CDEs. I need to spend all my time preparing students for a contest that I don't know anything about, since I was not in FFA. This began to take over any school assignments or lesson planning that I was doing.

Even though the action research assignment was shared with the mentors to avoid scheduling conflicts, several mentor teachers also balked at the tasks, due to the intensity of ANRE programming during that window of time in spring semester. To address this challenge in the future, the action research process can be started earlier (during ANRE courses in the senior year), and the actual projects can be undertaken earlier in the internship year. Also, programming relationships between the ANRE faculty and mentor teachers need to be strengthened and clarified, with an intentional selection of mentor teachers open to action research as a means for

enhancing professional practice, in order to avoid undue stress for future student interns.

Some interns noted that the time of year for this project was bad because of the weather. Because of the large number of snow days that the state had during the beginning of the spring semester, there were an overwhelming number of school districts closed intermittently. This presented some problems as interns worked to frame their action research projects and to collect data. For example, one student noted:

[Lindsey]: I prepared my students for the test based on their learning styles and they really seemed to be getting the information. Then it snowed and school was cancelled for three days straight. When the students returned back to school and took their test, the grades were awful. I don't know if they just forgot the information for the test due to the number of days off or if studying based on learning styles did not work.

One of our major findings was the challenge of forming collaborative relationships with the schools regarding the importance of university academic assignments. Schools are a bureaucracy within which teachers must function, therefore limiting local autonomy on the part of mentor teachers and student interns. The highly-structured school day limited the student interns' ability to "stray away" from the standardized curriculum and the interns' and mentors' ability to have the time to reflect about teaching and learning. More work is needed to connect university activities with the priorities of the public school system, because currently time for reflection is not valued. The culture of reflection and inquiry needs be strengthened in schools, academia, and even society. In fact, the Holmes Group's report on *Tomorrow's Schools* (1990) comments:

Inquiry...should be a way for teachers, administrators, and professors to come together on equal footing. It should help forge a shared professional identity in schools and universities. And it should serve as a professional norm around which collaboration can take place, bringing together the many parties who are concerned for improving schools (p. 60).

One comment shared by a mentor teacher was that they were unaware of how to turn their activities into scholarly work, in turn making it difficult to help their interns with integrating the action research process into a typical school day. If the benefits can be seen by all involved during the internship year, there could be a more positive outcome of adding reflective practice to enhance student learning. Since most mentors were trained under "older," more technical/rational models of teacher preparation, it would be beneficial to instruct the mentor teachers about action research during one of their professional development meetings in order to foster a new climate of inquiry, reflection and learning among the acting teachers.

### **Discussion and Implications for the Future**

The faculty instructors, other faculty members in our Department and in the College of Education perceived positive benefits of the students' action research projects. Reflective practice was a new paradigm for ANRE at MSU, and one that was needed to help pre-service teachers *think* about educational practice. Thus, the overall problem of practice that served as the foundation for this case study was how to get students to *think critically about teaching and learning*. To be able to think critically, one has to be reflective in nature. At the start of the semester, students wanted recipes for solutions regarding any potential problem they would encounter in the school. They were frustrated with the lack of high school student engagement, yet the student teaching interns did not see themselves as a factor contributing to a lack of learning in the classroom.

This case study illustrates that the action research process can introduce new teachers to ways of becoming more reflective. The depth of critical reflection grew throughout the academic year and was displayed in student journals and classroom dialogue. Also, some of the mentor teachers shared that they saw the student teachers beginning to grow in how they processed issues in the classroom and took charge of situations, as compared to their early student teaching in which the interns always wanted directions and to be told what to do rather than ideas or suggestions upon which to reflect.

This growth was not noted in all students. Two of the students had difficulty expressing their observations and chose not to engage regularly in class discussions or daily journal writing. When asked why they chose to limit their participation, they expressed that it was a different type of learning with which they were not comfortable, and they felt it took too much time.

Even though there were observed weaknesses in incorporating action research into ANRE teacher preparation, we see this approach to developing reflective practice as an opportunity to strengthen ANRE in the future. In the future, researchers and teacher-preparation faculty could consider the following questions, based on our preliminary work:

1. Do student teaching interns continue to foster their inquiry-oriented approaches, once they are placed in "permanent employment" in their own classrooms?
2. As new teachers, do they feel empowered with decision-making capabilities and autonomy in their classrooms, as a result of their action research and reflective experiences?
3. Are they involved with other action research projects in their schools with fellow teachers? If so, what do the processes look like, and do ANRE teachers take a leadership role to get these established? If so, do these action research projects enhance evidence-based teaching and curriculum reform in secondary schools where ANRE teachers take such leadership?

Another lens for further investigation focuses on K-12 student learning – the ultimate aim of ANRE. More specifically, future research could investigate whether teacher education programs that emphasize reflective practice in turn influence youths' learning in relation to critical and complex issues regarding food, agricultural, and natural resource systems. Clearly, we can learn much from future studies of K-12 student learning and motivation within classrooms led by reflective agriculture, food and natural resource education practitioners. In addition, we have seen applications of this work in diverse teaching contexts within courses for non-formal education majors (e.g., Extension professionals), service courses, and elective or Study Abroad courses in our College of Agriculture and Natural Resources. The overarching opportunities to deepen undergraduate critical reflection are immense and largely unexplored, yet the need for reflectivity increases as our social issues become more complex.

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