

Planning, Teaching, and Assessing Elementary Education Interdisciplinary Curriculum

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This paper describes an innovative teaching collaboration between two university professors to prepare undergraduate preservice teachers for planning, designing, and assessing interdisciplinary curriculum. Specifically, we were interested in whether deliberate efforts to integrate social studies and assessment methods courses would facilitate our students' learning compared to when such courses are taught in isolation (traditional instruction). Fifty-nine undergraduate elementary education preservice teachers served as participants. Approximately half received integrated instruction, the other half traditional instruction. In both instructional formats, preservice teachers were required to design and implement interdisciplinary units (i.e., lessons, assessments) during their clinical experience. Examination of interdisciplinary units revealed that preservice teachers receiving integrated instruction outperformed their nonintegrated coursework peers in developing, assessing, and reflecting on interdisciplinary content.

Research throughout the 20th century has suggested that students from high schools that employ interdisciplinary or integrated approaches do as well or better in academic achievement than students exposed to non-interdisciplinary curriculum (Aikin, 1942; Drake & Burns, 2004; Hartzler, 2000). At the university level, there is evidence also that interdisciplinary instruction improves student outcomes (Klein & Newell, 1997). Yet despite such findings, educators still question whether interdisciplinary curriculum actually leads to *more* learning than traditional, discipline-based curriculum (Wineburg & Grossman, 2000). Additionally, it is uncertain to what extent integrating university coursework and deliberate modeling of interdisciplinary instruction has on preservice teachers' ability to acquire the knowledge and skills needed to effectively design, implement, and evaluate interdisciplinary curriculum.

As university professors assigned to teach separate methods courses in assessment and social studies (i.e., social studies as an integrated approach to studying history, geography, government, culture, and economics), we were interested in examining the pedagogical benefits, if any, of integrating such coursework. Specifically, three questions were investigated. First, we wondered whether preservice teacher skills in designing and assessing interdisciplinary content would be better if their social studies and assessment methods coursework were integrated rather than taught in isolation. Second, we were curious about what difference, if any, preservice teacher participation in integrated versus non-integrated methods coursework would have on kindergarten through grade eight students' self estimates of their perceived understanding about interdisciplinary topics. Third, we wondered if there would be a difference in preservice teacher skill at using assessment results to think reflectively about the quality of curriculum and

assessment, instructional effectiveness, and student learning.

Interdisciplinary Curriculum

The popularity of interdisciplinary and integrated curriculum has ebbed and flowed for more than 100 years. In the late 1800's, Herbart and his followers promoted the integration of studies around cultural epochs. A problem-based "core curriculum," as defined by Harold Rugg (1936, 1939) and L. Thomas Hopkins (1941, 1955), was popularized in the 1930's and 1940's. In the mid-twentieth century, integrated curriculum often examined social problems from a variety of perspectives.

In the last 20 years, numerous authors have debated the definition of interdisciplinary curriculum (Beane, 1997; Fogarty, 1991; Hayes-Jacobs, 1989). Lyons (1992) vividly describes the confusion over the meaning of "interdisciplinary" at the university level. She calls for rejecting the territory and border-crossing metaphors and instead proposes viewing "interdisciplinarity" as a stream that flows through a wider terrain of disciplines with its tributaries and currents forming a greater whole. While we liked Lyon's metaphors, we looked for more concrete frameworks to introduce to our preservice teachers.

Aimed primarily at the kindergarten through secondary school arena, Fogarty (1991) described 10 "views" of curriculum integration ranging from connecting subtleties of a particular discipline to webbing thematic units or networking experts in different fields. Fogarty's visual representations of integrated curriculum resonated with preservice teachers searching for ways to understand integration. Fogarty's metaphor of "binoculars" as focusing the study of two disciplines' overlapping content and skills applies most directly in this study. At the university

level, social studies and assessment were merged. Assessment decisions and subsequent methods were contextualized within an interdisciplinary framework.

In the kindergarten through eighth grade context, preservice teachers used the binocular metaphor to integrate and overlap concepts and skills from social studies and other content areas such as science or language arts. Hayes-Jacobs (1989) advocated a “continuum of options” for integrated curriculum varying from sequencing the presentation of a discipline to offering independent, student-directed complete programs. Perhaps best known at the middle school level, James Beane (1997) defined integrated curriculum as organizing learning “around significant problems and issues, collaboratively identified by educators and young people, without regard for subject-area lines” (p. 19). Taken together, these models of integrated curriculum would seem helpful to inform teachers’ practice in the classroom.

Although the literature is replete with descriptions of middle school units that integrate technology and social studies, science and language arts, or as many as five core subject areas (McDonald & Czerniak, 1994; Popovich, 2000; Schlenker & Schlenker, 2001), to our knowledge no study directly compares the effectiveness of integrated versus traditional instruction for kindergarten through grade eight. Special activities (e.g., field trips, reading novels) have been used to bring together a variety of disciplines as a way for children to learn overlapping core concepts, but again, research data is slim about differences in student perceptions (Erickson, 2001). A consensus seems to be forming that knowledge is becoming increasingly interdisciplinary, calling for more interdisciplinary learning (Kalantzis, Cope, & the Learning by Design Project Group, 2005; Klein & Newell, 1997). An interdisciplinary tack suggests a non-traditional approach to learning that often includes collaborative teaching and assessment and curriculum designs that are more topic, issue, place, or problem-based rather than discrete bodies of knowledge or skill-based. In our own teaching we emphasized concepts that could be approached in an interdisciplinary manner (such as change) and differing approaches to studying issues (such as examining pollution from a scientific lens, social science lens, or mathematical perspective).

Integrated and interdisciplinary curriculum have been promoted at all levels of education but rarely studied systematically at the university level in a way that is connected to kindergarten through college-level learning (Klein & Newell, 1997). Although the advantages of multidisciplinary and interdisciplinary instruction at the university level have been written about theoretically and descriptively (Klein, 1996; Klein & Doty, 1994; Kline, 1995), we wanted to preliminarily examine the pedagogical impact directly

by comparing the performance of our university students (i.e., preservice teachers) in traditional versus integrated coursework when designing, implementing, and assessing interdisciplinary curriculum in their kindergarten through grade eight field placements.

Method

Instructional Context

To gauge the usefulness of integrating social studies and assessment methods coursework, preservice teachers experienced either integrated (i.e., methods professors working collaboratively) or non-integrated course instruction (i.e., methods professors working in isolation). In the integrated format, together we planned and sequenced course content, activities, and assignments in an attempt to make the interconnectedness between social studies and assessment methods more transparent to our students. Overlapping content, and assignments in particular (what Hayes-Jacobs (1989) might define as interdisciplinary and Forgarty (1991) might call a shared instructional model), allowed for discussions to be revisited and built upon in both courses.

Preservice teachers attended their university methods courses once weekly to discuss and practice how to teach and assess social studies to 5 – 14 year olds. They examined general principles of assessment, specific applications of assessment in social studies, and unique ways of evaluating interdisciplinary learning. Models of interdisciplinary curriculum that focused on interdisciplinary issues such as the impact of the Three Gorges Dam in China and the influence of the Nile on Egyptian life and culture were examined. Preservice teachers developed lesson plans that exhibited a shared focus between two content areas (e.g. social studies and science), drawing from Forgarty’s (1991) binocular metaphor of interdisciplinary curriculum.

At the university where we teach, the preservice teachers’ median age is 21 years, and most are middle class white women. Toward the end of the 16-week instructional term, teacher education classes at the university go on hiatus in order that these preservice teachers can spend all day for three full weeks in kindergarten through eighth grade classrooms. During this time, preservice teachers are expected to teach and assess the interdisciplinary lessons they developed in their social studies and assessment methods courses.

Participants

Fifty-nine undergraduate preservice teachers majoring in elementary education from a large university in the Mid-Western region of the United

States served as participants. Thirty three participants were enrolled in (1) a social studies and (2) an assessment methods course in which aspects were deliberately integrated across the two courses. The remaining 26 participants also were enrolled in separate social studies and assessment courses; however, each course was taught traditionally (i.e., in isolation without integration). Preservice teachers were assigned to the social studies and assessment course sections by their professional advisors (who were unaware of the study). Participants receiving integrated instruction were exposed to interdisciplinary (shared) instruction, common assignments, integrated activities, and accountability across their social studies and assessment courses. Participants receiving non-integrated instruction completed coursework that focused on a single content area, with the social studies and assessment courses operating independently. Both groups of preservice teachers were required to create and implement grade appropriate interdisciplinary lessons during a three week clinical placement, as well as assess their students' perceived learning of such lessons.

Both groups of preservice teachers were programatically similar (i.e., completing the last of their coursework before student teaching, enrolled in the same methods courses, required to develop, teach, and assess interdisciplinary lessons during a three week clinical placement) and assigned to cohort blocks ranging from 20 – 30 persons. All students agreed to participate in this sample of convenience.

Approximately 180 elementary and middle school students served as participants in the preservice teachers' interdisciplinary instruction and assessment. Males and females were approximately equally represented among the school children.

Interdisciplinary Teaching and Assessment

Recognizing the lack of consensus in the field regarding what constitutes interdisciplinary or integrated curriculum, we operationally defined interdisciplinary curriculum as the shared planning and teaching of two disciplines to illuminate overlapping skills and concepts. In this case, we integrated or "shared" instruction by joining together to collaboratively teach undergraduate elementary education preservice teachers how to design and assess interdisciplinary lessons. We used what Fogarty (1991) called a shared curriculum because we guided the development of their interdisciplinary units using a variety of strands in the two disciplines of social studies and assessment. Although preservice teachers from our institution have long been required to create interdisciplinary lessons during their last semester of

coursework, explicitly integrating this process across methods courses is rarely undertaken.

To ensure inter-rater reliability and valid inferences about preservice teachers' skill at designing interdisciplinary lessons (i.e., to assist in drawing meaningful inferences about the effectiveness of integrated versus non-integrated instruction), together we developed a detailed scoring rubric (see Appendix A for a general overview of point apportionment across criterion). Percentage points earned on the units were used as a measure of preservice teacher skill in designing and assessing interdisciplinary lessons and were compared across the two groups. As part of modeling interdisciplinary instruction and assessment, together we evaluated and scored the interdisciplinary units, discussing and sharing our areas of expertise in the written feedback provided back to preservice teachers.

To identify their pupils' perceived estimates of learning following interdisciplinary instruction, each preservice teacher interviewed three elementary/middle school students following a structured format. Elementary and middle school students were identified by their classroom teachers and had parental permission on file. To provide a uniform way for thinking about students' *general* educational performance across the three interviews, classroom teachers were asked to identify students they consider to be "average," "above average," and "below average" in achievement.

Following implementation of their interdisciplinary lessons, preservice teachers used an interview protocol to query three elementary students (i.e., one from each of the three groups identified by the classroom teacher and with parental permission on file) about their perceived knowledge of the interdisciplinary topic taught. Preservice teachers met individually with each student in a "distraction free" area of the school.

Because articulating "what they think they know" can be an abstract activity for young children, during the assessment methods course prior to their three week clinical placement, preservice teachers learned about and practiced ways to capture elementary students' metacognition. The method used by our preservice teachers to identify metacognition in young students involved creating an assessment protocol in which a wide strip of white poster board was cut to 28 inches in length. On the poster strip, preservice teachers drew a single, straight, horizontal line 20 inches long. At the beginning and end of this line, a one inch vertical line was drawn to represent the beginning and end of the line. At the left base of the horizontal line, preservice teachers glued a small printed picture illustrating the topic of the interdisciplinary lesson taught. At the right base of the horizontal line, they placed the very same picture, greatly enlarged in size.

For example, a preservice teacher whose interdisciplinary unit was on “navigation” placed a smaller and a larger picture of a compass at the left and right end of the 20 inch line, respectively, to represent a topic within the unit. The rationale for having a smaller and much larger picture at each end of the 20 inch line was to visually present on a continuum a “less” to “more” representation about students’ perceived learning. The rationale for having the left end of the line represent “less” and the right end to represent “more” was that organizing in this way is consistent with the structure of a number line (thereby increasing the likelihood that the task would be conceptually more understandable). To identify student perceptions about learning following instruction, preservice teachers read the following prompt to each of their three students selected for interview:

[Student and preservice teacher sitting side by side at a table. Poster strip placed horizontally on table facing the student and preservice teacher. Preservice teacher pointing to the left side of the line, slowly moving index finger across the right end of the line and back says the following] “Imagine that this line symbolizes how much you know about (insert topic taught).” [Preservice teacher pointing to the right side of the line with the larger picture says] “This end of the line means that you know a lot about (insert topic taught), and [Preservice teacher pointing to the left side of the line with the smaller picture says] this end of the line means that you know only a little bit about (insert topic taught). Point to the place on this line [Preservice teacher sliding finger from left to right/right to left across the 20 inch line] that shows how much you know about (insert topic taught).”

As the script was read to the children, preservice teachers pointed directly to the horizontal line, noting both ends, so that students would better understand what they were being asked to think about. Students indicated their perceived knowledge about the interdisciplinary topic by pointing to the place on the line that represented their understanding. Once identified, preservice teachers would then draw a vertical line at the position pointed out by the student. After the metacognitive assessment/interview was complete, preservice teachers determined the “amount of student understanding about the interdisciplinary topic” by measuring the number of inches between the left end of the line (‘0’) to the place on the line pointed to by the student. To ensure that all preservice teachers were measuring in a consistent way, measurements, other than whole numbers, were rounded up to the nearest quarter inch. For example, if a student pointed to a position that measured 18 and 3/16 inches, a score

of 18.25 would be recorded. If a student pointed to a position that measured 17 and 14/16 inches, a score of 18 would be recorded. Consequently, students’ perceived “knowledge about the topic” was set to a quarter-inch interval scale ranging between 0 and 20.

After the children pointed on the poster strip to indicate their own perceptions of their knowledge about the topic studied, the children were then asked to verbally explain what they learned about the topic that the preservice had teacher taught them. The preservice teachers also asked the children to verbally share what they learned about social studies and what they learned about another content area that was integrated during interdisciplinary instruction. The preservice teacher wrote down verbatim how the children described their learning about the topic and their learning in the two content areas (e.g., social studies and science).

Although preservice teachers’ interdisciplinary lessons included both formative and summative assessments to evaluate student progress and learning, drawing inferences about elementary and middle school students’ direct learning across units based on assessment results and students’ self-reflection was not possible for two reasons: (1) created units were diverse in content area, topic, and grade level, and (2) time did not allow for baseline data regarding student metacognition to be collected during the 3-week clinical. Despite these limitations, however, we felt that having preservice teachers collect estimates of their students’ perceived self understanding was a useful pedagogical exercise to (1) underscore the importance of encouraging young students to think about their own thinking [metacognition], (2) introduce a method for quantitatively capturing metacognition, particularly for young students, and (3) gauge their own instructional effectiveness through student reflective feedback.

Finally, preservice teachers were required to submit an end-of-semester written reflection regarding their own teaching, learning, and understanding about interdisciplinary curriculum and assessment. These reflections served as an additional opportunity for the preservice teachers to synthesize their learning from their methods courses and clinical experience.

Analysis of Learning

An independent-samples *t* test was performed to compare the percentage points earned on interdisciplinary units by preservice teachers whose social studies and assessment methods courses were integrated, with those earned by their peers, whose courses were not integrated. Similarly, elementary and middle school students’ estimates about their own perceived understanding of interdisciplinary content were compared through an independent-samples *t* test (i.e., estimates by students whose preservice teacher

received integrated instruction compared to estimates by students whose preservice teachers received traditional instruction). Additionally, an independent-samples *t* test was used to compare percentage points earned on reflective essays between integrated and non-integrated instruction groups (i.e., to investigate difference in preservice teachers' ability to use assessment to make inferences about curriculum, instruction, and student learning). Finally, we reviewed the qualitative data (interview results) documenting the children's learning.

Results

The percentage scores earned on interdisciplinary units designed by preservice teachers who received integrated instruction were significantly higher ($p < .01$), indicating that their units were better in overall design. Although performance in both groups was less than would be desired, preservice teachers from the integrated course experience earned an average of 76% on their interdisciplinary lesson plans, whereas participants from a non-integrated experience averaged 65%.

Comparing elementary and middle school students' estimates of their perceived understanding about interdisciplinary topics following instruction of preservice teachers from integrated versus non-integrated methods courses revealed no significant general group difference ($p > .05$). In addition, no significant difference in estimates of perceived understanding was found ($p > .05$) when comparing demographic differences (i.e., gender, achievement level, grade) across elementary and middle school subgroups. Moreover, examination of pupils' oral interview responses about what they learned from interdisciplinary lessons showed no notable qualitative differences.

Examining the percentage points earned on the reflective essay between preservice teacher groups indicated that preservice teachers exposed to integrated methods courses were better able to use assessment results to think about curriculum, instruction, and student learning than their peers whose assessment and social studies methods courses were taught in isolation ($p < .05$).

Discussion

From an instructional point of view, it was encouraging to find that preservice teachers whose social studies and assessment methods courses were integrated created significantly better interdisciplinary units and assessments than preservice teachers without such instruction. The relatively low average scores on the interdisciplinary units suggest that developing an interdisciplinary unit with a strong focus on assessment can be a very challenging task. Because preservice

teachers intentionally exposed to interdisciplinary curriculum in their integrated methods courses likely received twice as much direct feedback about their interdisciplinary understanding than peers without such experience, we were not surprised that they designed better interdisciplinary units. Yet because we knew which students were from integrated versus non-integrated methods courses, it is possible that despite using well-designed scoring rubrics, evaluation bias may have occurred. Replication using a blind review process is recommended.

Although no significant difference was found in the children's perceived understanding of interdisciplinary topics, more research is needed to evaluate the effectiveness of interdisciplinary curriculum, particularly with respect to grade and achievement level. If teachers and their students find interdisciplinary curriculum more enjoyable than traditional instruction (a claim not tested in this study), it may be worth promoting interdisciplinary curriculum. On the other hand, considering that integrating coursework and modeling interdisciplinary instruction requires more planning and effort than discipline-specific instruction (Henning & Campbell, 2005), the lack of difference in students' perceived knowledge was disappointing.

Perhaps the finding that interdisciplinary instruction did not make a difference in the children's knowledge estimates could be explained by interdisciplinary instruction in general – exposure to multiple perspectives on a given topic. Children taught well-designed interdisciplinary curriculum may grapple with more and varying questions than students learning a “traditional” curriculum. In this way, children exposed to challenging interdisciplinary lessons may experience feelings of cognitive dissonance, recognizing that they have more to learn about a topic than children learning topics from the perspective of a single content area.

Another explanation for the lack of difference in children's perceived understanding may relate to having limited experience estimating their metacognition. Because younger children are better able to judge their skill in areas that they have more experience or are familiar with (e.g., estimating how far they can jump or throw a ball), the finding of “no difference” was not completely surprising. Moreover, perceived understanding, as an indirect indicator of learning, may not reflect *actual* understanding, unlike a more direct assessment of content knowledge through a criterion-based measure. Research examining the direct effects of instruction on student learning through pre- and post-tests comparison of achievement is recommended.

Because the purpose of assessment is to improve educational decision making, higher quality reflective essays (i.e., ability to draw inferences from data) by

preservice teachers from integrated methods courses is noteworthy. This finding suggests that the integrated experience may be useful in promoting reflection about the teaching/learning process. Moreover, the opportunity to observe their professors' collaboration may have encouraged these preservice teachers to think more deeply about curriculum, instruction, student learning, and assessment. As university professors, we found that our interdisciplinary collaboration seemed to enhance thinking about our own disciplines, the interconnection between our disciplines, as well as regard for the work of related content areas. Although not an intended goal of this study, our anecdotal impression aligns with research suggesting that interdisciplinary study promotes intellectual maturation (Klein, 1995; Klein & Newell, 1997).

Implications

While this study presents mixed evidence regarding the advantages of integrating social studies and assessment methods coursework within teacher education programs, we believe that more deliberate investigations of interdisciplinary curriculum and instruction is warranted. Ideally, a control group of elementary and middle school students receiving instruction from preservice teachers receiving traditional instruction would be compared to elementary and middle school students receiving instruction from preservice teachers who had benefited from more intensive interdisciplinary instruction.

For faculty members in higher education who are invested in interdisciplinary curriculum and instruction, this study suggests that explicit modeling, collaborative instruction, and integration of social studies and assessment methods course content has promise for making a positive difference in preservice teachers' ability to conceptualize, develop, and reflect upon interdisciplinary curriculum. In light of the greater reflection scores of preservice teachers who experienced shared interdisciplinary instruction, we encourage education faculty to seek opportunities to create and teach courses that model and promote interdisciplinary instruction. Along with this interdisciplinary collaboration, we advocate for administrators of higher education to support these curricular changes because although interdisciplinary instruction was rewarding, administrative support is needed due to the additional time and scheduling requirements. Adopting Lyon's (1992) metaphor of a "stream" of interdisciplinarity, we found that the currents in social studies and assessment flowed together well, providing a greater level of clarity for us as well as our students. Based on the study findings, interdisciplinary teaching appeared to improve our preservice teachers' ability to develop and reflect on

curriculum, instruction, and assessment. Additionally, interdisciplinary teaching increased our collegiality (Henning & Campbell, 2005) as we negotiated the waters of the tributaries of our two curricular areas.

Further research is needed to investigate the potential benefits of interdisciplinary curriculum and instruction on preservice teachers' development within elementary education programs. A criticism of teacher education programs is that they are fractured and incoherent (Fullan, Galluzzo, Morris, & Watson, 1998; Goodlad, 1990; Zeichner & Conklin, 2005). Perhaps interdisciplinary curriculum and pedagogy in teacher education programs could develop more unity among faculty and university students seeking coherency. Our research suggests that systematic comparisons of more "traditional" programs with interdisciplinary ones may show increased outcomes for interdisciplinary approaches.

Finally, this study attempted to measure elementary students' perceived understanding of interdisciplinary topics following instruction. While no significant difference was found in perceived knowledge about interdisciplinary topics between groups, a direct study of children's actual interdisciplinary learning is recommended. As Beane (1997) has argued, most people approach life in an interdisciplinary manner, drawing on numerous areas of knowledge in a seamless way to solve problems. Standardized tests tend to compartmentalize knowledge in a way that may not adequately represent what children know or the way in which they put things together. Better measures of how children learn and process interdisciplinary problems are recommended for future research.

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Appendix A

Rubric Overview for the Interdisciplinary Unit Project

Unit Criteria	General Description	Points Possible
<i>Unit Rationale</i>	Content and value of unit is explained. Justification for real-world application identified. Connection to National Council for the Social Studies & Illinois Learning Standards made.	10 points
<i>Unit Objectives</i>	Goals of unit are identified and aligned with Illinois Learning Standards. Higher levels of Bloom's taxonomy predominate. Maximum of five unit objectives.	10 points
<i>Unit Web</i>	Overview of unit activities and interdisciplinary concepts (consider using the freeware from inspiration.com).	10 points
<i>Lesson Plans</i>	Five – eight lesson plans included. Clearly identifies and implements at least five different methods of teaching (e.g., inquiry, guided discovery, role play). Plans and details all elements of lessons including objectives, materials, introduction/motivation, sequence of lessons, closure related to objectives and appropriate assessments related to lesson/unit objectives. Please be sure your lesson plans are easy to read and follow a common format.	60 points (20 points each, grades will be averaged and converted to 60 points)
<i>Culminating Assessment</i>	Developmentally appropriate summative unit assessment. Assessment has evidence of alignment with both unit objectives and Illinois Learning Standards. Rubrics and/or answer keys for scoring are included, and are clear, relevant, and aligned to objectives – content and level.	20 points
<i>Resources</i>	Includes at least 15 multi-media (e.g., books, Internet, A-V kits, field trips, community) resources, complete with annotated bibliography. Resources balanced between children's and adult-level sources. APA, 5 th edition used.	20 points
<i>Originality</i>	Project is original, interdisciplinary, organized, and neat. Personality of authors reflected.	10 points