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ABSTRACT

A study examined items selected by preservice teachers for inclusion in an assigned portfolio. Twenty-nine third-year and twenty-eight fourth-year preservice elementary school teachers in a science methods course were asked to complete portfolios that reflected course competencies. Seven items, on average, were selected by each cohort, with 76% of the third-year (winter semester) preservice teachers selecting a group concept map to illustrate the relationship between professional development and teaching standards. Fourth-year (fall semester) students also selected seven items, with lesson plans being the item most often selected. Selections from portfolio comments show the differing approaches of these students. Results show that the assignment of portfolio development allows preservice science teachers flexibility in documenting their learning. Even when subjects selected the same artifact, the meaning could be quite different. (Contains 2 tables and 13 references.) (SLD)

Preservice Methods Students' Response to A Performance Portfolio Assignment

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Preservice Methods Students' Responses to a Performance Portfolio Assignment

Introduction

Portfolios have emerged as a powerful assessment tool to replace/supplement traditional assessment practices in teacher education program. Portfolios have been used to evaluate individuals, program, and candidates for employment. According to Wolf (1994), portfolios can capture the complexities of teaching while still being robust and flexible. As a preservice student prepares his/her portfolio, this future teacher becomes more reflective and promotes personal learning since the individual has to assume more responsibility for their learning (Anderson & DeMeulle, 1998).

Anderson and DeMeulle (1998) synthesized the literature about portfolios and identified four major purposes of portfolios in teacher education programs. They were: promoting student learning and development, encouraging students in self-assessment and reflection, evidence for assessment and accountability, and documenting personal growth. Subsequently, they surveyed 24 teacher education programs in California about their uses of portfolios. The major uses identified were: 1) encouraged students to be reflective about their work in greater depth and thoughtful ways, 2) required students to take greater responsibility for their learning, and 3) practice for a job interview using their portfolio. In addition, there were three unrecognized benefits for faculty who used portfolios: 1) more student-centered instructor, 2) increased use of professional standards, both state and national, and 3) personally reflecting on their own teaching to inform their own practice.

Portfolio development research at Stanford noted that when practicing teachers used portfolios they became more reflective about their teaching practices (Vavrus & Collins, 1991). Collins (1992) argues that portfolios should be used by practicing and preservice teachers. She identifies four categories of evidence that are useful in portfolio. They are: artifacts, reproductions, attestations, and productions. Dana and Tippins (1998) collapsed artifacts and reproductions into one category called artifacts (evidence of the products of teaching). Collins recommended that each portfolio should have a table of contents that provided a focus and overview by the portfolio developer. According to Collins, attestations are documents produced by others (faculty, practicing teacher, or other individuals who can attest to some professional aspect of the portfolio developer). She also recommended that each production should include a goal statement, caption (brief explanation that describes how this particular piece of evidence contributes to the portfolio) and reflections with a caption. In addition, a reflective statement at the end of the portfolio would summarize the learning, growth, and development included in the portfolio.

Sparapani, Abel, Edwards, Hertster, and Easton (1997) noted several potential concerns associated with portfolios in various teacher education program. These concerns included: faculty members time to evaluate the portfolio and provide feedback, establishing reliability and validity, and "authenticeness" of the portfolio assessment itself. Mayer, Tusin, and Turner (1996) studied 20 elementary education majors in their method courses, subsequently as student teachers, they did not incorporate portfolios when working with K-6 students. They encouraged faculty to provide greater linkages in the use of portfolios. While Naizer (1997) reported a strategy for having reliable and valid assessment of preservice students portfolios in a combined mathematics/science methods course. Earlier, Erdman and Duschl (1995) noted middle school students' in their study of floatation and buoyancy portfolios, that particular items are critical for students' in demonstrating their conceptual understanding. Bartley (1997) recommends faculty to enhance the validity of portfolio assessment by examining the intent and consequences of the assessment. He recommends involvement by the students in the development of the portfolio scoring guide. In addition, Bartley recommends that faculty develop strategies that facilitates preservice students in clarifying their personal design for all items in the portfolio.

Barrow (1992) reported four categories that preservice elementary science methods students were to address in their performance portfolios. They were: competency in elementary science, attributes for successful science teaching, hands-on science instructional strategies/models, and attributes for K-6 science curricula which promotes learning. Dana and Tippins (1998) noted that selecting evidence for inclusion in a science portfolio was a difficult task for preservice students. This evidence must be organized and presented to document the individual's growth about teaching science. Creativity was exhibited by items as well as containers (Author, 1993; Dana & Tippins, 1998). However, substance is more important than presentation, since a portfolio's purpose is to encourage the developer to be reflective and gain additional insight about effective teaching.

Bartley (1997) in his preservice elementary science methods class utilized assignments that were valuable in their own, while contributing to underlying structure of the portfolio. These assignments and subsequent discussions facilitated the preservice students potential growth as teachers of science and enabled them to consider possible entries for future portfolio. Each portfolio entry was to have a caption that explained the selection in relation to the total portfolio. Bartley encouraged a concise timeframe with adequate time for preservice students to think about their learning. As mentioned earlier, the students involvement in designing the scoring guide plus the above strategies allowed Bartley to consider his use of a valid portfolio assessment.

Potthoff's (1996) study of 127 portfolios at Wichita State University reported a sameness in self-selected entries with significant differences in who submitted units, lesson plans, and assessment activities. Bartell, Kaye, and Morin (1988) consider that there are many ways for individuals to structure their portfolios and "... many forms of evidence or artifacts that are appropriate ... (p. 7). Dutt-Doner and Gilman (1988) reported that preservice students had problems in determining what to keep and what to omit in organizing their performance portfolio. In addition, this data reduction process was important as the preservice students personalized their portfolio so it was representative of themselves. However, some developers considered there was considerable ambiguity about portfolios in the initial compilation, evaluator's priorities might be different than the developer, end of semester is hectic in a student's life so best effort is difficult, and hesitancy of developer to include previously criticized work. This study was undertaken to determine what self-selected items were used by preservice elementary science students over a two semester sequence. The Author's, (1993) original categories were modified for this study to be competent in standards and elementary science since the National Science Education Standards [(NSES), National Research Council, 1996)] was now one of the textbooks for the elementary science methods course.

Methodology

During the winter semester, 1998, a cohort of 29 third year (25 females and 4 males) and fall semester 1998, a cohort of 28 fourth year (27 females and 1 male) elementary education students were enrolled in a three semester hour science methods course (ED 327). Both groups were members of the same cohort. ED 327 met five hours per week with a 15 hours field placement with an elementary science specialist during the semester. A constructivist orientation served as the driving focus for the class. The cohort was considered traditional undergraduates. No member of the cohort was married or had children. In addition, the cohort members were enrolled in two additional education courses - elementary mathematics methods and literacy courses (totaling five semester hours) with associated field experiences. The portfolio assignment was given in the last half of the course and was due at the end of the semester. Modification of Barrow's (1993) scoring guide was used with optional conferences. The value of the portfolio was 5% of course grade.

Results

The course components, both instructors' assignments and student responses with the frequencies for each of the four ED 327 course portfolio competencies are listed for the winter cohort (Table 1) and fall cohort (Table 2). Regarding competencies in standards and elementary science, only seven items were identified with 76 % selecting their group concept map illustrating relationship between NSES professional development and teaching standards for the winter semester. In contrast, the fall cohort group also selected seven items with lesson plans being the most frequent. Only four individuals selected their concept map to illustrate their competency. Attributes for successful science teaching was more diverse with 11 and 10 items being selected by at least one cohort member of the winter and fall groups, respectively.

The hands-on science instructional strategies/models included on the list was a long-term seeds project being most frequently mentioned by the winter group and a short term electricity project by the fall group. The portfolio item on attributes for K-6 science curricula which promotes learning was the most diverse in items selected for both groups.

To further illustrate the diversity a series of captions are provided for each of the four categories.

Competency in standards and elementary science:

Interpretation: How well I show proficiency and mastery of the standards and how they apply and guide elementary science.

When thinking of what I could use to show my own competency in the standards and in overall elementary science, I thought of the Seed Journal. The Seed Journal not only study some concepts that all elementary students will encounter, such as the study of organisms, but it also addresses assessment, measurement, inquiry, and model of teaching.

The seed project shows the overall goal for the students is to learn about a plant's parts and functions, its needs and life cycle, but it also remains flexible, allowing the concept's issues to be visited when they are experienced and promoted by student inquiry.

The teacher will take into consideration whether his/her students are ready for the responsibility and cognitively ready for the content involved with the activity. This will help insure learning success. "Inquiry into authentic questions generated from students experiences is the central strategy for teaching science"[from NSES] this statement fits with the seed project directly. The questions brought by the children's experiences will support the students understanding of the plant's needs and life cycle. With this project the teacher can easily focus and support the inquiries the students involve in the classroom based on their seed observations and he/she can also show enthusiasm for learning using this project, because the result is always somewhat unexpected. (Student #1)

"How the students know what they know and how their knowledge connects to larger ideas" is important for the child to grasp. By having the students record their plant observations and promoting communication, the teacher is helping the student determine what they know and about their plant and how they can apply what they know this will also show the Students that they will need to take responsibility for their own plants. Anyone can grow a bean seed from the experienced gardener to the black-thumbed planter. All students will be able to participate whatever their handicap, and thus all elementary students can learn using this project. (Student #2)

The students can learn about what is needed for a seed to grow, what the parts of the seed are and their functions, and they will learn how to keep records of observations and apply those observations to gain a better understanding of the concepts and content standards involved with the study of plant life. (Student #3)

The concept map illustrates these standards extremely well. Not only does the concept map supply a variety of the standards, but it also illustrates the relationship between the different standards. Examples are also provided to further explain the standards and their uses. In addition, the concept map also shows how the standards apply to teachers, as well as the students. (Student #4 included their group concept map showing relationship between NSES on teaching and professional development.)

While throughout the entire semester, we learned about the NSES, their importance and their applicability to our teaching; I feel that the concept map itself is the most obvious example of competency that I could present. This included [modified in size for the portfolio] map forced us as a group to actually pry for understanding of individual teaching and professional facets of the standards themselves. We researched first hand how both these standards were independent and dependent of each other through links and related concepts. This device [concept map] not only gave us the opportunity to understand for ourselves the importance of the standards, but it formulated a practical outlet for ourselves the importance of the standards, but it also allowed us to collaborate and prepare a demonstration for other professionals of the importance of the standards and their inquiry based link. This alone provided us the skills to develop a strategy and structure of demonstrating abstract concepts to professionals which, while retaining the importance of the concept, "dumbs it down" for the fast paced professional. If anything the grading of our project itself was a learning experience in itself. We learned that in order to develop a good map, we should have included more specific examples to support our concepts and linking words. Nevertheless thanks to this map, I feel I have not only gained important knowledge, but I have learned how to teach that very same material. (Student #5)

Attributes for Successful Science Teaching:

I chose to include this piece [constructivist paper] from early in the year because it represents the concepts we had both learned and seen in our prior field experiences. The paper allowed me individually to focus on several different models of instruction, which I had been, fortunate, or less fortunate to observe. These previous varying models of instruction gave me typical examples of both behaviorist and constructivist implementations in the elementary classroom. Because I was not able to recall as many prior experiences, I drew from my current experiences with a teacher who had been transformed from a behaviorist to a constructivist teacher in her 20 years of teaching. Mrs. Evans provided me with a terrific model of how I want to be as a teacher and it was not hard for me to focus on attributes not only for successful science teaching, for successful teaching of any kind in the classroom. (Student #6)

For this competency area I chose to include an entire science lesson from the Insights teaching module. I chose this because it is a lesson that I have had extensive contact with. I have had experience with actually teaching it and I have thoroughly evaluated its effectiveness. I know which parts of it are competent for the standards and which parts aren't. I felt an actual example (with notes explaining it's competency with the standards written throughout it) of a lesson would give me a more clear idea of how to create my own lessons in the future that will also be competent in the standards as well as successful. (Student #2)

The microteaching lesson clearly taught me many qualities I must possess in order for successful science teaching. After watching my microteaching, I noticed many aspects in which I need to implement during my presentation of a lesson in order to establish a successful science classroom. Critiquing my microteaching, I feel was the most beneficial project I participated in all semester. I knew the characteristics of a good lesson and a good teacher, but until I witnessed it first-hand, I did not know exactly how to implement them. (Student #7)

Hands-on Science Instructional Strategies/Models:

The seed project itself was an important demonstration of hands-on instructional models to use as a teacher in the intermediate grades. The separate components of the project provided outlets for familiarity with seeds, dissecting seeds, variables in seeds planting and growth, cross-curricular integration activities and applicable demonstration of the knowledge utilized in the seed project. This month and a half-long experiment was designed to give us as students the ability to individualize our learning. While many of our projects in the class gave us the opportunity to collaborate socially, this was a good project, which involved one on one hands on time with the experiment itself. From the seed project I learned the importance of journaling and the integration of the learning cycle in formatted lesson plans. The project provided me with the models and strategies to ascertain a complete knowledge base of bean seed planting, relative to the later Wisconsin Fast Plant project. This was also the first time we were provided, as a class, with an example of integrating a lesson across curriculum. This alone was vital to me because I had not fully understood the importance of this facet of planning until now. The coolest thing about the project was that it was both an assignment and a model. While this statement may seem somewhat rudimentary, the project itself gave us as future teachers the ability to see how children learn and understand assignments given them. Above all this was a great example and model for me of how to design and implement a hands-on individualized lesson that integrates and applies the knowledge attained. (Student #8)

The seeds project was a great hands-on activity that involved an extensive period of time. This also provides the students application to realistic situations. The length of time it takes to conduct this experiment and the activities involved in the seeds project allow the students to really grasp the idea of seeds and plant growth. (Student #9)

For this competency area I chose to include the Electricity packet. I included this because I felt it was great example of hands on learning as well as collaborative learning. Hands-on because the students actually learn about electricity by creating different types of circuits. Collaborative because the students are to discuss their answers to many of the question cards with each other. I know I learned a lot about electricity from it and would like to use it (or an adaptation of it) in my future classroom. (Student #4)

Interpretation: To demonstrate that I can recognize teaching methods that revolve around hands-on techniques, self-discovery, and learning through inquiry. It is done through activities, asking questions, and manipulating materials.

When doing this electricity packet, I saw that I too learn better through hands-on instructional strategies. The packet made me ask questions, manipulate objects, discover methods, and seek information. It motivated me to learn more about electricity without relying on the instructor to feed me the information. I left with a better understanding of how electricity works and how important it is to daily life. (Student #1)

Curricula

As I was filling these bags with Peanut Brittle at work, I was reminded of our unit on measurement. Some bags contained .995 of a pound while others contained 1.005 lb. This allows for a level of uncertainty and would effect a best value.

I believe that this relates to curricula which promotes learning, because it ties process to content. Instead of talking about uncertainty and best value as vague concepts, we actually brought objects to class that represented uncertainty. This is an integral part of learning that should never be overlooked. Curricula should include active thinking on the part of the students, involve inquiry, and it should tie process to content. (Student #10)

An example of evidence showing this curriculum promoting learning is seen in the activity at the back of the [Insights] packet. With a partner, students figured out and described how it feels to walk. Doing this very slowly, one person takes a few steps and describes to their partner what muscles were used, how the weight shift feels and what it feels like to lift your foot when taking a step. By doing this, students are forced to change their perspective about this action that is second nature to most people. Using the questions on the back of the sheet, a teacher can facilitate discussion to get students to develop an understanding for how muscles work. Providing experiences like this one, which uses the body parts of the students, more interest will be invested in learning about facts and information creating an environment conductive to student learning. (Student #11)

Discussing aspects of the FOSS curriculum and reading the sample lesson has enabled me to investigate attributes of curricula which promote learning. The sample lesson gives information on getting ready for the activity, conducting the activity and reflecting on the activity. It also gives adaptations for students with disabilities and extensions across other disciplines. (Student #12)

My unit lesson plan promotes learning for science students in grades 4-6. One way to promote learning is first by doing a K-W-L chart with students to find out what they know and what they want to know. Next, I provide a hands-on activity, that occurs over a couple of days. During this time, students are to observe and record observations they are making about their two different pieces of chalk. Students are teamed up into pairs. This promotes learning because each student will get to see the views and questions of another student. The biggest part that is conductive to learning is the hands-on activity. When students are allowed to explore and construct their own knowledge, more learning is likely to take place. After students are finished observing, they write about what happened in their science notebooks. This helps them organize their thoughts and maybe might clue the student in to more information they may need to find out. Another aspect of my lesson that promotes learning are the open-ended questions that are posed at the end of the lesson. By asking open-ended questions, students are challenged about why they think something. By having a whole-class discussion, it allows students to see views of the other students and maybe result in a student changing his/ her view. This is also promoting learning. (Student #13)

Discussion

The assignment of developing a performance portfolio allows preservice elementary method science students flexibility in document their learning. Through reflection, even when the same artifact was selected, its meaning to individuals was distinctly different. Also, preservice students can use a similar artifact in several different categories. In this study, the same activity was used frequently in more than one competency; thereby, supporting Barttell, Kaye and Marion's (1988) viewpoint. Only the concept map selection for standards in the winter group seemed to be the exception. The qualitative aspect of this study further demonstrates this variation. In addition, the individual selection demonstrates the personal evolution of elementary science teaching philosophy of preservice students. In contrast to Potthoff (1966), this study found great variation in selection rather than a sameness in self-selection entries.

Bartley's (1997) study of preservice elementary science methods students focused upon only one semester. Like Bartley's preservice students, this study found that both groups were able to select personal evidence to document their learning. These reflections also demonstrated an overall orientation to the teaching and professional development standards of the NSES (National Research Council, 1996).

Teacher education faculty who utilize portfolios should utilize suggestions by Bartley (1997) to provide adequate time for preservice students to be reflective. In addition, they should not expect preservice students' selection to match the faculty perception. Learning is highly personal; therefore, the submission with rationale, as recommended by Collins (1992) will allow preservice students to document their growth.

Futures studies should be conducted to determine whether other disciplines have the variations between semesters as was reported in this study. In addition, teacher education programs that use portfolios to evaluate their program need to examine the item selection and rationale to verify that several forms of evidence can be used to document personal growth of preservice students. With increased recommended use of portfolios, like NCATE certification, further studies need to be conducted to see how new graduates use portfolios in their teaching. If they are not being used, then Mayer, Tisin, and Turner (1996) results needs to be considered for the following questions. Is use or non-use do to the orientation of the school / district letter grade policy? Or is it that parents do not understand portfolios as a component of assessment? Or is it the time factor in assessing the portfolios that limits K-12 use?

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Table 1
Frequency of Portfolio Entries for Categories, Winter (N=29)

Activities	Competency in Standards & Elementary Science	Attributes for successful science teaching	Hands - on science instructional strategies/models	Attributes for K-6 curricula which promotes learning
Glob				
Operational definitions				
Pond				
Pendulums			2	2
Gobstoppers			2	
Science Education Journals			1	1
Raisin Tonic				
Magnets		1	2	2
Seeds	1		8	2
Electricity	1		5	1
Operational questions				
Concept map	22			
Readings				
Constructivist paper		9		2
Lesson Plans	1	3		2
Microteaching		2		
Wisconsin Fast Plants	1	1	1	1
Field Experience logs			1	
Curriculum Report		1	1	5
Unit				2
Inquiry notes	1	2		
Task groups			3	2
Learning cycle		2	2	1
Questioning strategies		6		3
Inquiry in context	2	1		1
Evening Science		1	1	
Piaget				2

Table 2
Frequency of Portfolio Entries for Categories, Fall (N=28)

Activities	Competency in Standards & Elementary Science	Attributes for successful science teaching	Hands - on science instructional strategies/models	Attributes for K-6 curricula which promotes learning
Glob				
Operational definitions				
Pond			1	1
Pendulums	1	1	3	1
Gobstoppers		1		
Science Education Journals		1		
Raisin Tonic	1			
Magnets	1	1	4	5
Seeds	8		5	2
Electricity			14	4
Operational questions		1		1
Concept map	4			
Readings				
Constructivist paper		7		
Lesson Plans	12	1	1	1
Microteaching				2
Wisconsin Fast Plants				
Field Experience logs		6		1
Curriculum Report	1			7
Unit				
Inquiry notes				
Task groups		2	1	3
Learning cycle				
Questioning strategies		7		
Inquiry in context				
Evening Science				
Piaget				

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