Technology and Teacher Preparation: Creating Learning Environments for Increasing Student Involvement and Creativity

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***Objective**: The purpose of this study was to determine if a specific instructional strategy consisting of action, brainstorming, and development would encourage teacher education students to develop creative uses of technology as a tool for promoting active student learning.*

I. Introduction

The literature in the area of teacher preparation clearly describes the need to provide adequate preparation in the use of technology if we expect preservice teachers to feel prepared to enter into school systems ready to teach with the available technology (Dyrli & Kinnaman, 1994; Munday, Windham, & Stamper, 1991; Sheingold, 1991; Siegel, 1995). As a result, many colleges of education responded to this need by creating a required introductory course for all preservice teachers. As thinking in the area matured, educators realized that teaching about technology was not sufficient. For example, in 1995, the now defunct Office of Technology Assessment reported that technology courses in most colleges of education focused mainly on teaching *about* technology as a separate subject and not on teaching *with* technology across the curriculum, or integrating technology into instruction. The push for curriculum integration and using technology to support the curriculum has become more common, as technology courses are being revised to include more K-12 curriculum-related examples and applications.

However, while much attention has focused on *what* is taught in these introductory courses, less time has been spent on exploring the impact of *how* technology preparation is provided. Even in cases where curriculum integration is emphasized, students own "lived" experiences of classroom life have an important impact on teaching styles and support the adage that "teachers teach the way they are taught." The indirect apprenticeship of schooling that students are accustomed to seeing – with a focus on direct instruction, lecturing, and transferring information – dominates their thinking as they prepare to assume the role of a teacher. As an NCREL policy report described,

> Critics of higher education also are frustrated with the way teachers are trained – specifically, the didactic approach to undergraduate instruction. They contend that, because teachers teach the way they were taught, the passive lectures that students experience in college leave them ill-prepared for the active learning approaches (with the teacher serving as coach) that are being adopted in schools throughout the country. (NCREL, 1994)

Technology integration requires that teachers change from the way they were taught. Researchers (Sprague, Kopfman & de Levante Dorsey, 1998; Wetzel, 1993) report that the greatest impediment to infusion of technology into curriculum is the *lack of vision* as to how or why to use technology in the classroom. Further, Roblyer and Edwards (2000) propose that technology integration must be an *active process* with participants being exposed to hands-on training that focuses on how to use technology as a resource for instruction. Findings in the long-term Apple Classrooms of Tomorrow (ACOT) project indicate changes in teaching practices do not happen instantaneously, but rather go through a series of stages of integration. Special conditions must take place for technology integration to be successful: (1) teachers must be ready to make some changes in their teaching methodologies, (2) teachers must see technology as a collection of tools that can facilitate *innovative thinking*, (3) a supportive environment must

be in place which will encourage teachers to take risks, and (4) changes must be expected to occur over time, and with dedication and effort (Sandholtz, Ringstaff & Dwyer, 1995).

If we expect preservice teachers to teach with computers in ways that support the curriculum, then we ourselves must model approaches that we would like our preservice teachers to use. As result of immersing ourselves in the literature, we were particularly interested in two areas. The first dealt with vision and innovation in the use of technology, and the second focused on the importance of active learning in educational settings.

II. Purpose of the Study

The primary objective of this pilot project was to determine the impact of teaching strategies on enabling prospective teachers to apply technology to enhance teaching and learning, especially in terms of creativity and active engagement. Creativity is a very complicated construct with more than 100 definitions (Amoroso & Eriksson, 2000). For the purpose of this study, we were interested in focusing on assessing product creativity. In particular, we were interested in studying ways to stimulate the development of creative classroom lesson ideas in ways that include attention to active classroom participation.

The following research questions guided our inquiry:

- What is the impact of a technology preparation course on the ability of preservice teachers to develop lessons that involve high levels of interactivity?
- Can teacher preparation courses successfully teach preservice teachers to develop creative uses of technology that enhance content area specialties (i.e., math, science, language arts, social studies, music, etc.)?

III. Methods

A mixed-methods research design was implemented in order to gain information and insight from students regarding their experiences with the project. Sources of data included open-ended questions and product analyses by two independent raters. While the initial research method called for focus group feedback, time constraints prevented the implementation of this aspect of the study. In lieu of conducting focus groups, participants were asked to fill out an open-ended questionnaire regarding their participation in this study. The open-ended responses were transcribed and entered into a computer program designed to aid in the coding, search and retrieval of qualitative data. Coding schemes were applied, organized, and reorganized. The resulting categories were formed and defined by properties and dimensions found in the data.

Participants

The sample for this pilot project consisted of twenty-two preservice teachers who had been admitted to the teacher education program at the University of Tennessee. As part of their teacher preparation program, students enrolled in an introductory computing course and met twice a week to examine methods for using technology to support teaching and learning. There were six sessions of this course taught in the Spring 2000 semester and this study focused on two of the six sections. Students did not know in advance that one group would be receiving a different type of instructional model. Group One received traditional instructional methods, and Group Two received the novel instructional method, which included use of the SMART Board. Although there were a total of twelve students enrolled in Group One and eighteen students enrolled in Group Two, two students in Group One and six students in Group Two declined to participate in the study. Their information was removed from the data set prior to data analysis. The remainder of the students signed permission forms indicating their consent for using their work in research studies. Permission to conduct research on instructional strategies in a university classroom was obtained from the Institutional Review Board for research involving human subjects at the University of Tennessee.

Project Description
For the purpose of this project, we focused on a segment of the course that teaches students to develop instructional slideshows in the classroom. Group One participated in a class using traditional instructional strategies to teach basic skills. In the past, we have taught students about PowerPoint by introducing basic features to illustrate how the multimedia tool might be used in the classroom. Following basic instruction, these students were asked to develop an instructional slideshow project tied in to a curriculum area of their choice.

Students in Group Two participated in the SMART Board section. These students also learned basic technology skills necessary to create a slideshow but were then exposed to a model designed to promote divergent thinking. This consisted of three components: (1) Action – completing assigned tasks that were targeted to students' teaching areas, (2) Brainstorming – using the SMART Board to facilitate a group session to develop ideas, and (3) Development – designing individual projects that demonstrate their understanding about student-centered uses of technology.

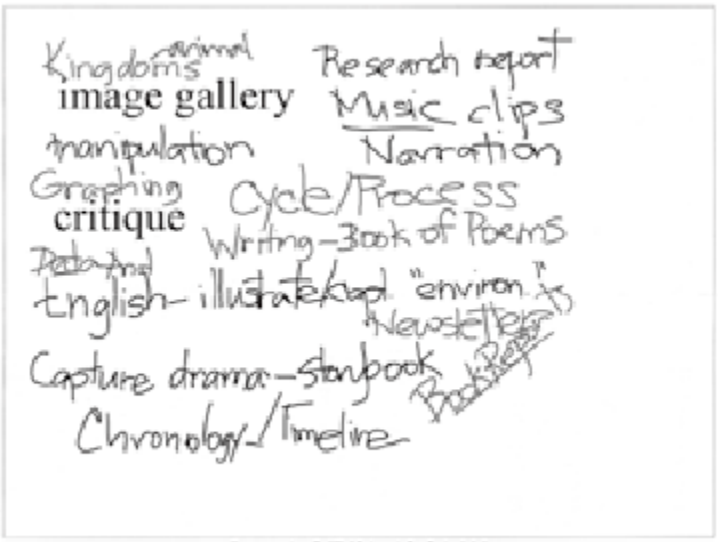
Phase One: Action

At the beginning of the semester, instructors for every section were asked to have students fill out Information Profile Sheets identifying students' majors and content area foci. The information provided in these Profile Sheets was used for two major purposes for Group Two activities. First, the information was used to assign students into smaller sub-groups with similar interests, and second, the information allowed the researcher to create meaningful tasks embedded in contexts that were relevant to students' respective teaching areas (e.g., elementary education, science education, deaf education, etc.). For example, art education students were grouped together and the slideshow Task Sheet that was given to this group dealt with a topic related to art education. As a result of this type of planning, groups engaged in tasks that were relevant to the different grade levels and content areas. These activities described in the Task Sheets were designed to model collaborative and active learning experiences (see Appendix A). Participants were divided into groups and completed activities outlined in Task Sheets to simulate a student-centered slideshow activity. They were taught to use planning sheets (Appendix B) as a scaffolding tool to guide their thinking and structure the content of their slideshows. By participating in activities that model student-centered uses of technology (Action), we felt that students would begin to think about the possibilities for using technology in creative ways to support active learning in the classroom.

Phase Two: Brainstorming

After completing their tasks, the groups shared their Task Sheet assignment as well as their resulting slideshow projects with one another. This provided students with a variety of ideas for using slideshows in non-traditional ways. After this portion of the class was completed, students gathered in small groups to brainstorm additional uses for this particular application. Following small group collaboration, the instructor facilitated a large group discussion to elicit all ideas, using the SMART Board to document all entries. Students used the SMART Board as a tool to facilitate the brainstorming process and refine ideas. A sample product from the SMART Board brainstorming session can be seen in Figure 1. Final output was then printed for all class members to aid in the next phase of the instructional model.

Figure 1: Sample SMART Board Brainstorming Output



Phase Three: Development

During the final development stage of this instructional process, students were required to create a sample slideshow project and an accompanying lesson plan, which was tied into a curriculum area of their choice. Due to the ease with which data from the SMART Board can be saved and printed, the final brainstorming session was printed for each class member in order to share class ideas and provide a starting point for developing their own ideas.

Instrumentation

A panel of experts assessed and rated preservice teachers' lesson plans and products for evidence of student participation and creativity of design. A total of ten statements were used in the scale to diminish the effects of rater fatigue. Appendix C contains the test instrument used in this study.

In researching possible instruments, the researcher came across a description of the *Creative Product Semantic Scale* developed by Besemer and O'Quin (1989) to evaluate creative products based on objective, analytical measures of creativity rather than intuition (Besemer and O'Quin, 1989, 1993). The researcher chose to adapt and use the *"Original"* subscale for this study given the existing research on this instrument's validity and consistent reliability measures.

The researcher was unable to identify any existing instruments to assess a product's design to promote active learning. As a result, after delving into the existing literature on active learning, the researcher noted consistent themes and constructed a 5-item scale that operationalized the concept of active learning. Internal consistency alpha was reported at .99 for this sample. A factor analysis did reveal, however, that almost all of the variance could be attributed to two questions in this subscale, thereby making the inclusion of the other items redundant. The results from this pilot study can be used to further refine the active participation portion of the instrument.

Two raters were contacted to conduct the product assessment. Both raters had a background in instructional technology, and both have had classroom teaching experience. Raters were looking for evidence of a creative instructional slideshow activity that promoted active participation of K-12 students. Raters were asked to read all twenty-two lesson plans and slideshow projects. To help establish inter-rater reliability, both raters participated in a training session where they were informed about the purpose of the scale, taken step-by-step through rating a project, and had opportunities to clarify definitions and procedures.

IV. Results

Using the Pearson correlation coefficient, inter-rater reliability was .85 for the creativity subscale and .94 for the active participation subscale (n=22). Preliminary data analyses run to determine the normality of the data set revealed that the distribution was not normal and the tails were heavy. Raters tended to evaluate projects at either the high or low end of the instrument used. As a result, the researcher selected a non-parametric test for two independent samples to see if there were significant differences among the means of the two groups.

Ranks

	Group	N	Mean Rank	Sum of Ranks
CREATIVE	ABD method	12	16.08	193.00
	Traditional	10	6.00	60.00
	Total	22		
PARTICIP	ABD method	12	15.79	189.50
	Traditional	10	6.35	63.50
	Total	22		

Test Statistics[b]

	CREATIVE	PARTICIP
Mann-Whitney U	5.000	8.500
Wilcoxon W	60.000	63.500
Z	-3.630	-3.407
Asymp. Sig. (2-tailed)	.000	.001
Exact Sig. [2*(1-tailed Sig.)]	.000[a]	.000[a]

a. Not corrected for ties.

b. Grouping Variable: Group

		N	Mean		Std.
Group		Statistic	Statistic	Std. Error	Statistic
ABD method	CREATIVE	12	5.5167	.4400	1.5242
	PARTICIP	12	6.0750	.4737	1.6410
	Valid N (listwise)	12			
Traditional	CREATIVE	10	1.7400	.2557	.8086
	PARTICIP	10	1.5600	.2544	.8044
	Valid N (listwise)	10			

The Mann Whitney *U* test revealed significant differences between the two groups for creativity ($p < .001$) and active participation ($p = .001$).

V. Discussion and Conclusions

Byrum and Cashman (1993) report that, in order for preservice teachers to become competent technology-using teachers, it is necessary for them to have educational experiences throughout their preparation program that demonstrate how computers and related technologies can enhance curriculum and be used as a learning tool. However, this study revealed that exposure to teacher training in the use of technology is not necessarily sufficient. The *type* of training has an impact on the type of ways students will use the technology in their classrooms.

Students' responses to the open-ended questionnaire (Appendix D) revealed three major themes from those who participated in the novel instructional strategy. These were collaboration, student-centered learning, and time.

Collaboration
Collaboration was a strong theme that emerged from the data set. Students reported positive experiences from being able to work and share ideas with their peers. A few specifically mentioned benefiting from the brainstorming opportunities included as part of the classroom instruction. Sample comments related to this area include the following:

> "I got to see how a variety of disciplines could incorporate slideshows [into the classroom]."
>
> "We could gain ideas and knowledge from each others' projects. Really cool ideas that, in my opinion, would keep a student from being bored and make interest flourish in what subject they were gaining knowledge from."
>
> "I liked working as a team. We had a lot of fun and the brainstorming was very helpful."

Support efforts for participants play a major role in the success of technology infusion. This support can be delivered through a variety of efforts that might include teaming participants with each other (OTA, 1995; Ringstaff & Yocum, 1995) to encourage collaboration with colleagues (Oliver, 1994). Becker (1994), in a study that looked at exemplary computer-using teachers, found that teachers need to be surrounded by other teachers who are using technology. The level of expertise of the technology-using teachers does not matter, but rather the opportunity to share ideas, resources, and strategies during the learning process.

Student-centered learning
A second theme that emerged from the open-ended responses focused on the use of technology to create student-centered learning experiences. Comments related to this area included the following:

> "[The activity] enabled me to see how students can enhance their learning by being creative with PowerPoint."
>
> "[The activity changed my view of how slideshow software can be used in the classroom because] it showed me that teachers do not just have to use PowerPoint to lecture. Students can use it interactively."

Handler (1992) and Wetzel (1993) have reported that instructors who model the use of technology are considered the best teacher trainers. To extend their thinking, the results of this study suggest that if we want preservice teachers to design effective student-centered learning environments, we must do more than just talk about effective instructional strategies. We must find ways to model effective instructional strategies so students can observe and model the behaviors and strategies themselves.

Time
The third category that emerged from analyzing student comments related to the time factor that was needed to complete classroom activities. While students enjoyed the participatory tasks, many felt rushed by the time that was allocated to complete their tasks. Sample comments included the following:

"Overall, I enjoyed the project very much. The only thing I would change is the time allotted for each project."

"[There was] not enough time to really get into [the activity]."

Given more time, some students felt that their projects could have been more detailed. Time has always been an important factor in teaching survey introductory courses as instructors are faced with the dilemma to either cover a wide range of topics so students get maximum exposure, or focus on learning fewer topics in more depth (Dawson & Nonis, 1998). It is clear from this study that these new instructional strategies will require more time to implement in a classroom, especially if collaboration and group activities are to play a critical role in the instructional strategies used by course instructors. The results demonstrate that even though these strategies are more time-consuming, the resulting impact on student learning may make it a worthwhile endeavor.

References

Amoroso, D.L. & Eriksson, I.V. (2000). Use of Content Analysis for Studying the Creativity Construct in the Context of Technology-Rich Applications. *Proceedings of the 33rd Hawaii International Conference on System Sciences*. IEEE 2000.

Becker, H.J. (1994). How exemplary computer-using teachers differ from other teachers: Implications for realizing the potential of computers in schools. *Journal of Research on Computing in Education*, 26, 291-321.

Besemer, S.P. & O'Quin, K. (1993). Assessing creative products: Progress and potentials. In S.G. Isaksen (ed.), *Nurturing and developing creativity: The emergence of a discipline*, (pp. 331-349). Norwood, New Jersey: Ablex Publishing Corp.

Besemer, S.P. & O'Quin, K. (1989). The development, reliability and validity of the revised Creative Product Semantic Scale. *Creativity Research Journal*, 2, 268-279.

Byrum, D.C. & Cashman, C. (1993). Preservice teacher training in education: Problems, perceptions, and preparation. *Journal of Technology and Teacher Education*, 1(3), 259-274.

Dawson, K. & Nonis, A.S. (2000). The impact of a field-based technology infusion project on preparing preservice teachers to use technology. *Journal of Computing in Teacher Education*, 17(1), 4-12.

Dyerli, O. & Kinnaman, D. (1994). Gaining access to technology: The first step in making a difference for your students. *Technology and Learning*, 14(4), 16-20, 48-50.

Handler, M. (1992). Preparing new teachers to use technology: Perceptions and suggestions for teacher educators. *Computers in Education*, 20 (2), 147-156.

Munday, R. Windham, R., & Stamper, J. (1991). Technology for learning: Are teachers being prepared? *Educational Technology*, 31(3), 29-32.

NCREL (1994). Policy Briefs, Special Policy Report 1, Available Online: http://www.ncrel.org/sdrs/pbriefs/94/94-1ovr2.htm.

Oliver, H. (1994). Book review. Education and informatics worldwide: The state of the art and beyond. *Journal of Research in Computing in Education*, 26(2), 285-290.

OTA (1995). Teachers and technology: Making the connection. (OTA-HER-616). Washington, D.C: US Government Printing Office.

Ringstaff, C. & Yocum, K. (1995). Creating an alternative context for teacher development: The ACOT teacher development centers. ACOT Report, H#18. Cupertino, CA: Apple Computer, Inc.

Roblyer, M. D., & Edwards, J. (2000). *Integrating educational technology into teaching*. Upper Saddle River, New Jersey: Merrill.

Sandholtz, J.H., Ringstaff, C. & Dwyer, D.C. (1995). Student engagement revisited: Views from technology rich classrooms. In *Apple Education Research Reports* (pp. A29-30). Eugene, OR: International Society for Technology in Education.

Sheingold, K. (1991). Restructuring for learning with technology: The potential for synergy. *Phi Delta Kappan*, 73(1), 17-27.

Siegel, J. (1995). The state of teacher training. *Electronic Learning*, 14(8), 43-53.

Sprague, D., Kopfman, K., & de Levante Dorsey, S. (1998). Faculty development in the integration of technology in teacher education courses. *Journal of Computing in Teacher Education*, 14 (2), 24-28.

Wetzel, K. (1993). Teacher educators' use of computers in teaching. *Journal of Technology and Teacher Education*, 1(4), 335-352.

Appendix A: Task Sheets

Activity 1: That's Good! That's Bad! (Elementary Education)

Context:
Our class is reading *That's Good! That's Bad!* By Margery Cuyler. We will write and draw pictures to illustrate our own version of a *That's Good! That's Bad!* storybook to develop sight words and vocabulary. Eventually, we will share our finished product with the whole group and take it into other classrooms to share our book with other students.

What to do:

- **Read** the book *That's Good! That's Bad!* as a group to get an idea of the basic story format.
- **Planning**: Use the planning sheets to come up with a good story (in about 6 slides or less). Be sure all group members contribute.
    - **Concentrate on the text**. Follow the book's format. Begin with something that's good, turn it into something that has a bad effect, then turn it back into something that is positive. Repeat until you are satisfied with your story.
- **In PowerPoint**:
    - Create a title slide and enter the words "That's good! That's bad!"
    - Create a slide for each of the events you designed in your planning sheet.
- Work on creating drawings to add to your book/slideshow. Open the Kid Pix or AppleWorks paint program to draw your pictures. You can copy and paste your pictures into PowerPoint. Be sure all group members take turns and contribute to the different slides.

Activity 2: Popcorn (Early Childhood)

Context:
Our class is reading *Popcorn* by Frank Asch. We will write and draw pictures to illustrate a book based on this story to develop sight words and vocabulary. Eventually, we will share our finished product with the whole group and take it into other classrooms to share our book with other students.

What to do:

- As a group, read the book *Popcorn* to get an idea of the events taking place in the story.
- Your group will create a slideshow that builds on this story. Sam is planning another Halloween party and you've been invited to join in the fun. What costume will you wear and what kind of food will you bring?
- **Planning**: Use the worksheets to plan your work. Each slide should represent a different person's contribution to the party in terms of costume and food choice. A written description talking about the reasons for your choices should be included.
- **In PowerPoint**:
    - Create a title slide and enter the words "Popcorn and … "
    - Create a slide for each of the events you designed in your planning sheet.
- Work on creating drawings to add to your book/slideshow. Open the Kid Pix or AppleWorks paint program to draw your pictures. You can copy and paste your pictures into PowerPoint. Be sure all group members take turns and contribute to the different slides.

Activity 3: Poetry (English)

Context:
Apply your understanding of the structure, styles, rhythm and forms of poetry by creating a children's book.

What to do:

- Read the book *Coconut Kind of Day* to become familiar with the structure of the book and rhythm of the words.
- In *Coconut Kind of Day*, the author follows a young girl in Trinidad as she goes about her day. Pick a day in the life of a University of Tennessee student. Use poetry to make the sounds, sights, or people of UT come alive as we follow this student throughout his/her day.
- **Planning**: Use the planning sheets to come up with highlights of this student's day (in about 6 slides or less). Be sure all group members contribute. Write a poem to go along with each event. (If you have knowledge about different forms of poetry, you may incorporate them into your project.)
- **In PowerPoint**:
    - Create your title slide
    - Create a slide for each of the events you designed in your planning sheet.
- **Images**: Use a digital camera or images from Web sites to illustrate your poems.
- If time permits, record somebody reading the poem for each page.

Activity 4: Color (Art Education)

Context:
We have been learning about color combinations and as part of this area, I would like you to explore and develop an awareness of the psychology of color.

What to do:

- In your group, use the Internet to do research on the psychological effects of color (focus on yellow, green, and purple).
- **Planning**: Use the blank sheets to plan your work. Keep it short and simple – limit yourself to one slide of information for each color.
- **In PowerPoint**:
    - Create your title slide
    - Create a slideshow that demonstrates your understanding of what you've learned. Create a slide for the information you listed in your planning sheet
    - If you wish, capture any images from Web sites to emphasize your message.
- **Application and Synthesis**:
    - Each team member will create a drawing that uses any one color (varying shades may be included) of their choice as a primary means for illustrating a current event
    - Use a paint program (AppleWorks paint, Photoshop, etc.) to create your picture, save your work, and copy and paste into PowerPoint). Write a caption to go along with your drawing.

Activity 5: What am I? /¿Qué es esto? (Spanish/Sign Language)

Context:
You are going to create a book that is based on the "Who am I?" format in order to practice your growing vocabulary (Spanish and Sign Language).

What to do:

1. Read the book *Who am I?* to become familiar with the basic structure of the text.
2. You are going to create a book that follows a similar format. Use the following as a guide:

    - Slide 1: Title slide
    - Slide 2: Descriptive clue (in Spanish and English)
    - Slide 3: Picture of object with its accompanying name in English, Spanish and Sign Language (for sign language, try to find icons on a Web page OR take a picture with the digital camera if one is available).
    - Repeat (limit your work to TWO clues/objects. If you finish your work ahead of the other group, you can always add more to your project).

3. Use the blank sheets to plan your work so group members can find different pieces of information at the same time. With the finished sheet to go by, one group member can find a picture on the Internet, one can begin writing the descriptions, and one can create the sign language images.

Activity 6: Urban Safari (Science)

Context:
Your group will embark on an urban safari in order to document evidence of human impact on the environment in your surrounding area.

What to do:

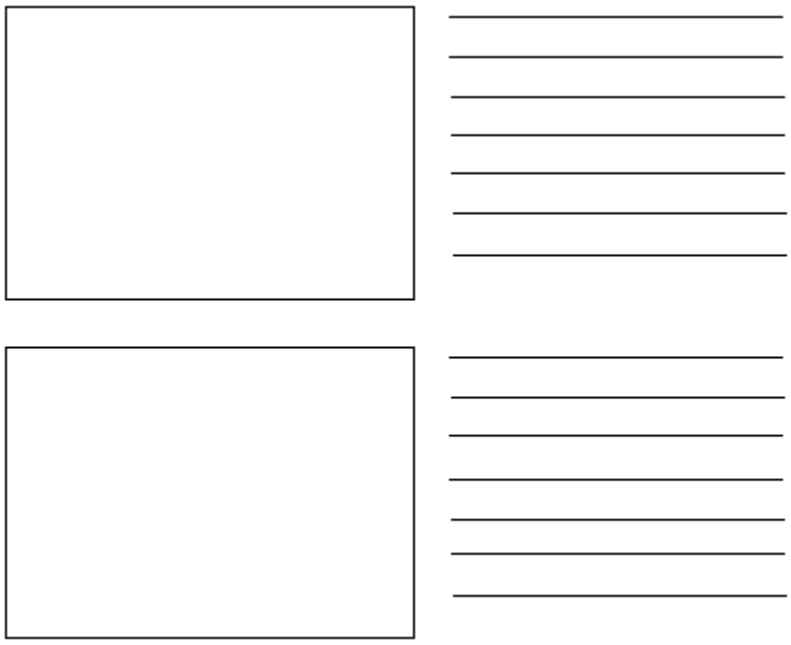
1. Take a digital camera, go outside and document evidence of human impact on the environment (both positive and negative). Be selective as you may only take six pictures.

2. **In PowerPoint**:

   - Create a photo essay/slideshow (combination of picture and words) to share your findings.
   - Create additional slides that explore the concept of interconnectedness in nature from a personal perspective. (If you are familiar with key terms and concepts in this area, incorporate them into your response)
   - If time permits, search the Internet for pictures and descriptions of well-known examples that illustrate this area (e.g., Exxon-Valdez oil spill) that you can include in your slideshow.

Appendix B: Planning Sheet/Storyboard

Note: Students were to use this storyboard to plan their ideas prior to beginning project development on the computer



Appendix C: Rating Scale

Rater: _____

PowerPoint #: _____

Creative Product and Active Participation Scale

Is Original ____: ____: ____: ____: ____: ____: ____ Is Conventional

Promotes passive learning ____: ____: ____: ____: ____: Promotes active construction of

	____: ____	knowledge
Is Over Used	____: ____: ____: ____: ____: ____: ____	Is Fresh
Requires low participation	____: ____: ____: ____: ____: ____: ____	Requires participative learning
Has teacher deliver information	____: ____: ____: ____: ____: ____: ____	Has teacher serve as a guide
Is Usual	____: ____: ____: ____: ____: ____: ____	Is Unusual
Is Unique	____: ____: ____: ____: ____: ____: ____	Is Ordinary
Based on listening	____: ____: ____: ____: ____: ____: ____	Based on construction
Is student controlled	____: ____: ____: ____: ____: ____: ____	Is teacher controlled
Is Predictable	____: ____: ____: ____: ____: ____: ____	Is Novel

Appendix D: Open-Ended Questionnaire

1. Prior to the activities we did in class on Monday, what experiences had you had with slideshow software?
2. What did you like most about the group slideshow project activities we did in class last on Monday?
3. What did you like least about the group slideshow project activities we did in class last on Monday?
4. Did your participation in the group slideshow project activities change your view of how slideshow software (like PowerPoint) can be used in the classroom? Please explain.
5. Is there anything you'd like to add about your experience in 486 with respect to using slideshows in a classroom setting?