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ABSTRACT

This paper describes the design, testing, and analyzing of a model to improve science teaching and student learning in the classroom. The model centers on empowering classroom teachers enrolled in a graduate course with knowledge of the research literature in a way that improves their ability to teach science and to bring the world of research and practice closer together. The paper describes how the model was implemented in a doctoral level course, Advanced Science in the Elementary School (EDCI 683). The study involved pre-course interviews with K-12 teachers enrolled in the course, analysis of teachers' research papers, videotapes of presentations they made at the end of the course, post-course surveys, and post-course interviews. The results suggest that once the teachers see a connection between the research world and their classroom, research becomes of value to them, and they introduce changes into their classroom which improve student learning in science. Three appendixes present: information on EDCI 683, titles of research papers, and the post-course survey. (SM)

Changing Teaching Practices by Empowering Teachers with Research Knowledge

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Presented at:
MSERA Annual Conference
November 15 – 17, 2000

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I. Abstract

Changing Teaching Practices by Empowering Teachers with Research Knowledge

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We have designed, tested, and analyzed a model to improve science teaching and student learning in the classroom. This model centers on empowering classroom teachers enrolled in a graduate course with knowledge of the research literature in a way that improves their ability to teach science and also to bring the world of research and practice closer together. This presentation will describe our model and how it was implemented in a doctoral level course, Advanced Science in the Elementary School (EDCI 683). Our analysis includes the work of twelve K-6 grade teachers enrolled in this course, videotapes of presentations they made at the end of the course, follow up responces and interviews. Our reseults suggest that once the teachers see a connection between the research world and their classroom, research becomes of value to them and they introduce changes into their classroom which imporves student learning in science. We anticipate that the possitive changes documented in this study will spread to other classrooms since the teachers involved in this course have leadership roles in a NSF-funded K-6 hands-on scienc reform project involving 3,000 teachers in Middle Tennessee.

II. Setting the Stage: A gap exist between research in education and the classroom.

Several reasons:

Research Side

- Research is not always relevant to a classroom teacher
- Funding and publications drive research
- Amount of Research published is immense
- Type and method utilized

Practice Side

Policy makers decisions

- not trained to separate good from bad research
- can implement policy without a research basis
- their decisions affect teachers

Classroom teacher

- few have good and consistent exposure to relevant research literature
- few posses the skills and time it takes to locate, examine and apply research to their classroom
- attitude towards research

According to the National Science Education Standards

-Research Should Matter to the Classroom Teacher-

"Teachers require the opportunity to study and engage in research on science teaching and learning, and to share with collogues what they have learned." (Page 56)

Other Reasons:

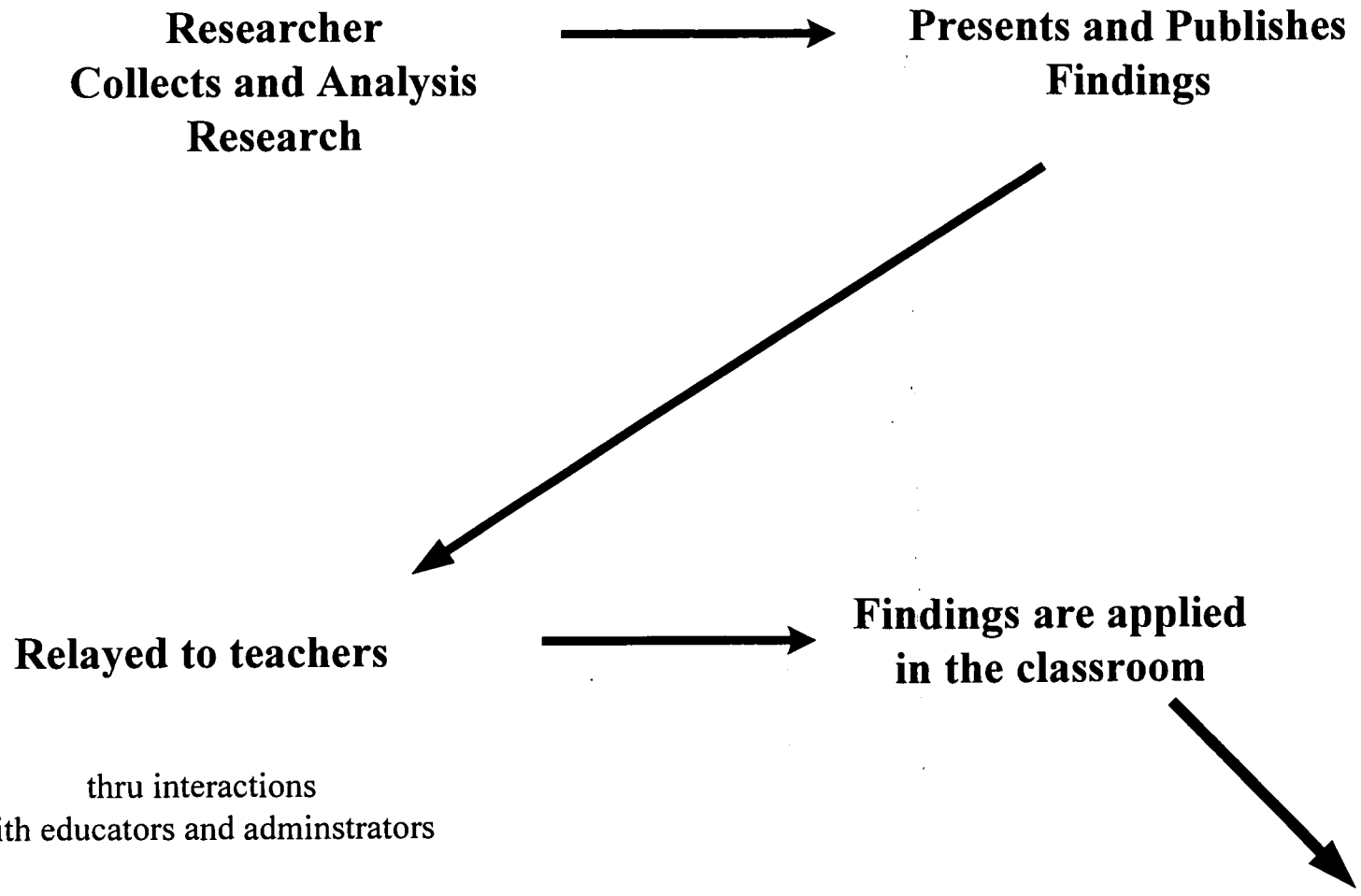
- Education is a changing and evolving field
- Teachers need to keep current as professionals
- Teachers can become the sources of their own growth as well as supporters of the growth of others

How bad is the Problem or Gap?

"There is such a chasm that separates research from the field. My colleagues don't have a clue what's being done in the research field." (Classroom teacher)

The Chronicles of higher education, August 6, 1999 The failure of Education Research. Why don't scholars play a large role in school reform. A17-A18.

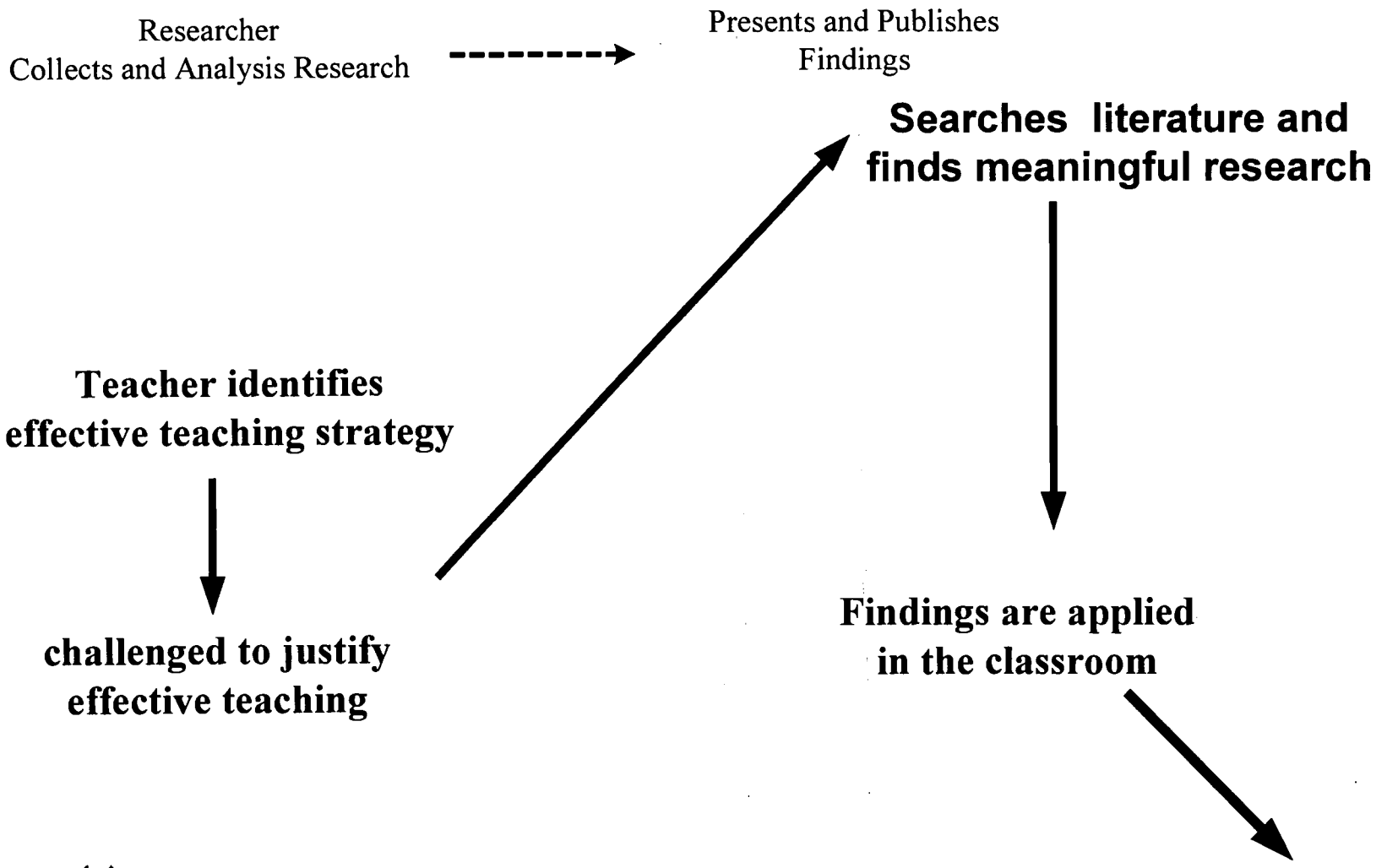
Current Model



Are there any Solution?

- Professional Development
- Courses designed to incorporate relevant research

Model used to design Graduate Course EDCI 683 at TSU



III. Designed a Graduate Course at TSU to address this concern

- One goal of this course was to challenge teachers to make a meaningful connection between the research literature and effective classroom teaching strategies.
- This presentation will focus on our analysis this course

Information on the Course and Students

- 12 teachers
- Women in 40's with 15 years teaching experience in a leadership role in a K-6 hands on science reform project.
- Course was a semester long

Eight assignments including a research paper

TSU - NSF Hands On Science Project or Schools for Tomorrow Project

- **NSF-funded Systemic Reform project in Science Education in Middle Tennessee**
- **Converting from a text, lecture-based to a hands-on inquiry-based program**
- **Involves 128 K-6 schools in 4 counties (Each counties has 1 school district)**
- **Involves over 3,000 K-6 teachers and 80,000 students**

Teacher Leadership

	6 Teachers-in-Residence	**(full time)**
	128 School Facilitators (1 per school)	**(+ 5 PD Day/ year)**
Teachers	**~ 3,000**	**(100 hrs PD over 5 years)**

PD = Professional Development which focuses on Hands-on Inquiry-based Science Education (Pedagogy, Content, and system wide change).

IV. Results gathered in 3 Different Areas

A. Teacher's prior knowledge about research

B. Teachers found research to be meaningful

C. Evidence for classroom application

Prior Knowledge

1. Precourse interviews
2. First assignment:
   Identify effective teaching strategies (in science)

Increased Understanding

1. Analyzed research papers
2. Surveys
3. Videotaped presentation
4. Course evaluations

Application to the Classroom

1. Post-course surveys
2. Post-course interviews
3. Videotaped presentation
4. Course evaluations

V. Results: A. Teacher's Prior Knowledge

1. **Teachers were resistant to write research papers.**

2. **Teachers can identify effective teacher strategies but not the research basis.**

Initial Resistance

- Most teachers did not want to do a research paper.
  Only 1 expressed an interest.

- Primarily too much work, not sure if worth their time, not sure what instructors wanted.

"Too much work."
"Too formal. What is APA?"
"Prefer to meet and discuss with other teachers."
"How many pages? How many references do we need?"
"I don't have time!!"

Teachers could identify effective teacher strategies, but not the research basis.

"What are effective teaching strategies in science education?"

1. **The Learning Cycle**
2. **Cooperative Learning**
3. **Habits of the Mind**
4. **Authentic Assessment**
5. **Portfolios**
6. **KWL Strategy**
7. **Journal Writing**
8. **Process Skills**
9. **Inquiry-based learning**
10. **Constructivism**

Note: These topics are important to both teachers and researchers

How were Teachers Aware of these Topics?

Personal Experience **"They work in my classroom"**
From Peers **"They work in other teacher's classroom"**
From Professional Development **"These strategies were presented at the Hands-on Science Institutes."**

V. Results: B. Teachers found Meaningful Research

1. Research Papers
2. Surveys: End of course and post-course
3. Videotapes of their presentations
4. Post-course Interviews

Topics Selected for Research Papers

Student Learning	Assessment	Pedagogy
Bloom's Taxonomy	Portfolio Assessment	Constructivism
Habits of the Mind	Authentic Assessment	Cooperative Learning
Gender Bias	Performace-Based Assessment	Less is More
	Concept Mapping	Inquiry-Based Instruction
		Race-Base

Some Examples of Titles*

Inquiry Based Learning: What is it and why do we need it?

Authentic Assessment: Do we really want to go there?

Still Blooming After All These Years: Is Bloom's Taxonomy outdated?

Is Performance-Based Assessment a Sound Way to Assess Students in Hands-on Science Programs?

Is Less Really More: Will teaching fewer topics with greater depth improve student learning in science?

*All titles are listed in the appendix.

V. Results: B. Teachers found Meaningful Research

2. Post-course surveys (10 of 12 returned)

100% Considered research paper most relevant assignment (see appendix)

How?

"The research paper was beneficial to me. It forced me to do research and compile it. I often want to know more but find that there is limited time."

"It changed the way I teach!!"

3. Videotape of Classroom Presentations

A. Example: VH (Kindergarten Teacher)
Describe what she has learned about Constructivism

Describes historical content.

Defines schemata and student understanding
Teachers must challenge the existing schemata of students.
Planning to implement this.

First time she has heard "Teachers must change from a sage on the stage to a guide on the side".

V. Results: C. Evidence for Classroom Application

1. Videotapes of their presentations

2. Post-course surveys and interviews

Conclusion:

1. **If teachers see research as having meaning in the classroom they will embrace it.**

2. **A New Model for designing a course to bridge the gap between research and practice.**

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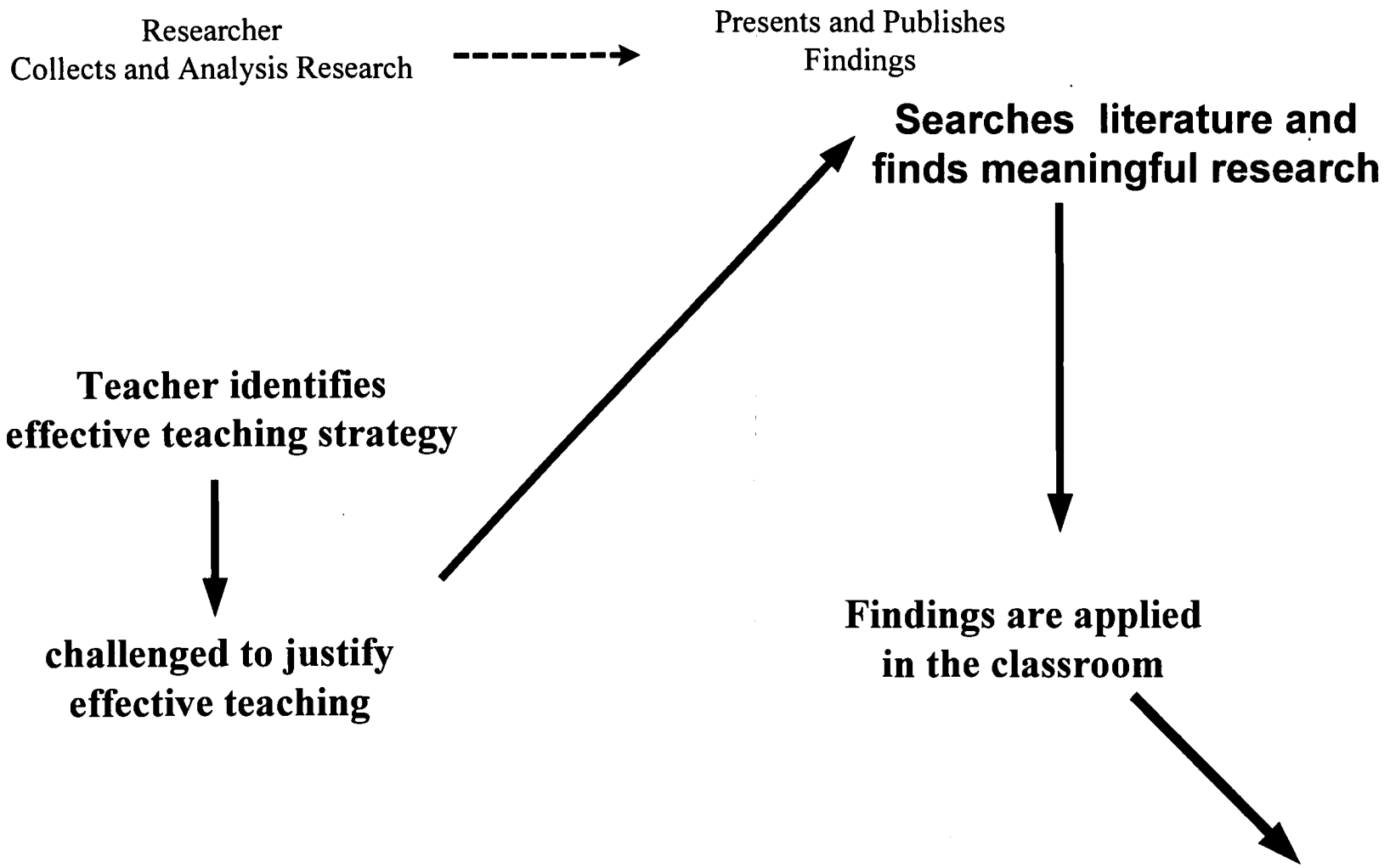
Model used to design Graduate Course EDCI 683 at TSU



Appendix

Appendix A: Information on EDCI 683

Appendix B: Title of Research Papers

Appendix B. Post-Course Survey

Information of EDCI 683:
Advanced Science in the Elementary School

What is EDCI 683?

- A graduate course for teachers in leadership roles in the NSF hands on science program
- 3 graduate credit hours (doctoral level)

What are the Goals of this course:

To strengthen the leadership of NSF project by providing an opportunity for teachers

- to grow professionally and receive graduate credit
- to examine the research literature upon which effective teaching strategies are built
- to pursue a educational topic in-depth
- to analyze and critique the NSF project

Syllabus for EDCI 683

Introduction	
Class #1	Science Content and Pedagogy
Class #2	Understanding How Learning Occurs
	Analyzing computer software for elementary science courses
Class #3	Understanding and Applying Research to the Classroom

Assignments:

1 & 2. Take home Exams

Mid-term and Final (Each with 4 - 5 questions and 2 - 3 weeks to complete)

Sample Question: Based on your knowledge, experience and feedback from other teachers, make several suggestions or recommendations which will improve the TSU-NSF hands on science program and its changes for sustainability.

3. Research Paper

An 8 - 10 page paper examining a science education or teaching strategy topic such as cooperative groups, inquiry, and the learning cycle.

4. Classroom application assignment

Applying knowledge gained in the course to the classroom.

Textbook: Elser, E.K. & Elser, M.K. (1996) Teaching Elementary Science (7th ed) New York: Wadsworth Publishing Company.

Research Papers

Teacher	Research Paper
LB	Inquiry Based Learning: What is it and why do we need it?
LG	Is Less Really More: Will teaching fewer topics with greater depth improve student learning in science?
KG	Gender bias and its impact on teachers in the classroom.
PH	Is Performance-Based Assessment a Sound Way to Assess Students in Hands-on Science Programs?
MH	Still Blooming After All These Years: Is Bloom's Taxonomy outdated?
VH	Constructivism.
BJ	Is there race-bias in science education?
DP	Can Portfolio Assessment be Successful in a Primary Classroom?
TP	Utilizing Concept Maps in Science Education.
RS	Are Two Heads Better than One: Cooperative Learning: Why and how it works.
JT	Habits of the Mind.
PZ	Authentic Assessment: Do we really want to go there?

Post-course Survey for EDCI: 683
Advance Science in Elementary School

Please rate each of the following class assignments from 1 to 6 using the following scale:

4 = Very beneficial to you and your classroom teaching
3 = Beneficial and relevant to the course and classroom teaching
2 = A class assignment which had little benefit to classroom teaching
1 = Busy work and not relevant

Course Assignment	Circle the appropriate number			
Technology in the Classroom	1 (1)	2 (1)	3 (6)	4 (2)
Harry Wong Simulation	1 (0)	2 (3)	3 (4)	4 (1)
Lesson Plan	1 (7)	2 (1)	3 (1)	4 (0)
Evaluating Science Textbook	1 (2)	2 (4)	3 (3)	4 (0)
Sharing Resource Files	1 (1)	2 (0)	3 (3)	4 (5)
Edible Science Project	1 (1)	2 (1)	3 (3)	4 (5)
Mid-term and Final Exam	1 (0)	2 (4)	3 (6)	4 (0)
Research Paper	1 (0)	2 (0)	3 (4)	4 (6)
Overall EDCI 683 Course	1 (0)	2 (2)	3 (6)	4 (2)

1. Should a course like this be offered to classroom teachers? 9 yes 1 no
Why or Why not?

- Science education is experiencing so many changes. Some teachers need to be retrained and for some attitudes towards science education need to be changed.
- Classroom teachers will benefit from additional information about science and its teaching.
- It would give new science teachers time saving information and more experienced teachers can acquire new ideas and resources.
- This course could inspire teachers to broaden their scope of knowledge.
- Teachers can benefit from learning more about teaching science.

2. What did you Like most about this course?
(100%) Meeting with other teachers and sharing ideas. "Being with other teachers who love science, love teaching science & are committed to improving science education."

3. **How can this course be improved?**

- More focus on personal research
- More sharing of research and progress
- Make it more of a research course

4. **If you found the research paper beneficial, please comment on how it benefited you as a teacher.**

- We go to pick a topic that was meaningful to us.

- The research paper was beneficial to me. It "forced me to do research and compile it. I often want to know more but find that there is limited time.

- It introduced me to facts and information and stimulated my thinking and reasoning skills. It forced me to make judgements about concepts based on learning from the research. It exercised my skills involved in communicating both written and verbal. The process of research has never been something that I look forward to. The formality of it is a nuisance to me, but I have always know that I experience the most growth when I become involved with a project that involves research. This relates to the students that I teach also. They will experience more growth in learning if they are totally invested in the process.

- Allowed me to research topic I have been interested in and see history and data supporting theories.

- There were several articles that I read that enlightened me on my subject.

- I found out more about my selected topic.

- Basically it reaffirmed some things that I was already aware of. It also gave me justification for some of the changes I have made in the way I teach.

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