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ABSTRACT

This paper presents a reflection on how the research program conducted in the Maryland Collaborative for Teacher Preparation (MCTP) informs the evaluation of the project. Three sections present an overview of the MCTP and the MCTP research program, a review of the literature on evaluation and research, and reflections on the use of MCTP research to inform evaluation. This paper centers on three researcher assumptions: (1) a research group's activity is public and evaluation is private; (2) a research group can inform evaluation within a project; and (3) although daily decisions are made through the internal evaluation group, many of the principal investigators feel that the research products will be a longer lasting legacy. The MCTP is an undergraduate program for students who want to become mathematics and science specialist teachers in upper elementary or middle level teachers. (Contains 15 references.) (Author/DDR)

The Use Of Research To Inform The Evaluation Of The Maryland Collaborative For Teacher Preparation

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Abstract

This paper presents a reflection on how the research program conducted in Maryland Collaborative for Teacher Preparation (MCTP) informs the evaluation of the project. Structurally, the paper is presented in three sections. An overview of the MCTP and the MCTP research program are presented in the first section. Next, a review of the literature on evaluation and research is conducted in section two. Two sources for this review are NSF documents and publications of evaluation theorists. Lastly, in section three, reflections-on-practice of the use of MCTP research to inform evaluation are presented by the MCTP Co-Directors of Research. Discussion centers on three researcher assertions: 1) By necessity, a Research Group's work is a public activity within a project; Conversely, an Evaluation Group's work tends to be a private activity; 2) The efforts of a Research Group can inform the evaluation within a project although tensions remain if the sole purpose of evaluation is perceived as for accountability; and, 3) While the information that most shapes the PIs daily decisions about the project comes from the internal Evaluation Group, many of the PIs state that a lasting legacy of project are the Research Group products.

The MCTP is a National Science Foundation (NSF) funded statewide undergraduate program for students who plan to become specialist mathematics and science upper elementary or middle level teachers. Higher education institutions involved in this project include the majority of higher education institutions within the Maryland System responsible for teacher preparation, including community college representation. In addition, several large public school districts are active partners. The primary goal of the MCTP is to promote the development of professional teachers who are confident teaching mathematics and science using technology, who can make connections between and among the disciplines, and who can provide an exciting and challenging learning environment for students of diverse backgrounds.

The Use Of Research To Inform The Evaluation Of The Maryland Collaborative For Teacher Preparation

Introduction

This paper presents a reflection on how the research conducted by a Research Group in Maryland Collaborative for Teacher Preparation (MCTP) informs the evaluation of the project. The MCTP is the only funded project within NSF Collaboratives for Excellence in Teacher Preparation Program (CEPT) program that includes in its organizational structure both an Evaluation Group and a Research Group. This reflection by the Co-Directors of MCTP Research is conducted as a way to generate grounded theory (Glaser & Strauss, 1967) that will contribute new insight into the role of research and evaluation in CEPT projects, in particular, and in all funded education projects, in general.

Structurally, the paper is presented in three sections. An overview of the MCTP and the MCTP research program are presented in the first section. Next, a review of the literature on evaluation and research is conducted in section two. Two sources for this review are NSF documents and publications of evaluation theorists. Lastly, in section three, reflections-on-practice of the use of MCTP research to inform evaluation are presented by the MCTP Co-Directors of Research.

Section One: An Overview of the MCTP and the MCTP Research Group

The MCTP. The MCTP is a National Science Foundation (NSF) funded statewide undergraduate program for students who plan to become specialist mathematics and science upper elementary or middle level teachers. The MCTP was funded in 1993 for up to a five year period. It is a funded project in the NSF Collaboratives for Excellence in Teacher Preparation Program (CEPT) program. The CEPT program "supports large scale systemic projects designed to significantly change teacher preparation programs on a state or regional basis and to serve as comprehensive national models" (EHR/NSF, 1996, p. iii). Teacher

candidates selected to participate in the MCTP program are, in general, representative of all teacher candidates in elementary teacher preparation programs in academic ability. MCTP teacher candidates are distinctive, however, by expressing and interest in teaching mathematics and science. Recruitment efforts have attracted many students traditionally underserved in the teaching force, most notably African Americans to the MCTP.

Higher education institutions involved in this project include the majority of higher education institutions within the Maryland System responsible for teacher preparation. Several community colleges also participate. In addition, large public school districts are active partners. The goal of the MCTP is to promote the development of professional teachers who are competent to teach mathematics *and* science using technology, who can make connections between and among the disciplines, and who can provide an exciting and challenging learning environment for students of diverse backgrounds. This goal is in accord with the educational practice reforms advocated by the major professional mathematics and science education communities (see, for example, National Council of Teachers of Mathematics (NCTM), 1991; American Association for the Advancement of Science (AAAS), 1993; National Research Council (NRC) of the National Academy of Sciences, 1996).

The MCTP was funded to create teacher education programs that contain (see Figure 1):

- Specially designed courses in science and mathematics, taught by instructors committed to a hands-on, minds-on interdisciplinary approach.
- Internship experiences with research opportunities in business, industrial and scientific settings, and with teaching activities in science centers, zoos, and other institutions.
- Field experiences and student teaching situations with mentors devoted to the interdisciplinary approach to mathematics and science.

- Modern technologies as standard tools for planning and assessment, classroom and laboratory work, problem-solving and research
- Placement assistance and sustained support during the induction year in the teaching profession
- Financial support for qualified students.

In practice, the MCTP undergraduate classes are typically taught by senior faculty in mathematics, science, and education who make efforts to focus on developing understanding of a few central concepts and to make connections between the sciences and between mathematics and science. In some instances doctoral students who have interned with a faculty member in an MCTP class and have expressed a keen desire to teach in a reform-based manner also teach MCTP classes. Faculty strive to infuse technology into their teaching practice, and to employ a instructional strategies recommended by the literature to be compatible with the constructivist perspective (e.g., student-centered, address conceptual change, promote reflection on changes in thinking, and stress logic and fundamental principles as opposed to memorization of unrelated facts) (see, for example, Cobb, 1988; Driver, 1989). Faculty lecture is diminished and student-based problem-solving is emphasized which requires cross-disciplinary mathematical and scientific applications. The MCTP teacher candidates, selected by using criteria developed at each institution, take the reformed undergraduate mathematics, science, and education classes and have the opportunity to participate in summer internships in mathematics and science rich environments (e.g., museums, zoological parks, and private companies).

The MCTP Research Group. The proposal submitted to the NSF for the MCTP project included statements for both an Evaluation Group and a Research Group (The University of Maryland System, 1993). Typically, the proposal included a "Support Group for Project Evaluation" section that stated that the project would conduct formative and summative evaluation. Innovatively, the proposal also included a "Support Group for Research on Teacher Education" section that stated the "project's innovative approaches to

teacher preparation will be studied by a research group...." (p. 19). These two support groups were displayed in a diagram that delineated their roles in the project structure (see Figure 2). In late July 1994, Jim Fey, MCTP Project Director, asked J. Randy McGinnis (Science Educator), University of Maryland (UM), and Tad Watanabe (Mathematics Educator), Towson University (TU), to share the leadership of a Research Group of the MCTP. Anna Graeber, UM, and Co-Director of the MCTP Methods Group, agreed to act as a mentor to the Research Group. Amy Roth-McDuffie, doctoral mathematics student at UM, was recruited to serve as a full-time, graduate research assistant to the Research Group. Other doctoral students who have assisted the MCTP Research Group include Karen King, Mary Ann Huntley, and Steve Kramer. In addition, Gilli Shama, an Israeli mathematics educator collaborated with the MCTP Research Group. The leadership of the Research Group identified and recruited Institutional Research Representatives (IRR) who would coordinate research efforts at the participating institutions offering MCTP courses.

In essence, the primary purpose of research in the MCTP was articulated as being directed at knowledge growth in undergraduate mathematics and science teacher education. The unique elements of the MCTP (particularly the instruction of mathematical and scientific concepts and reasoning methods in undergraduate content *and* methods courses that model the practice of active, interdisciplinary teaching) were targeted for longitudinally documentation and interpretation from two foci: the faculty and the teacher candidate perspectives.

The following questions served as the *a priori* research questions:

1. What is the nature of the faculty and teacher candidates' beliefs and attitudes concerning the nature of mathematics and science, the interdisciplinary teaching and learning of mathematics and science to diverse groups (both on the higher education and upper elementary and middle level), and the use of technology in teaching and learning mathematics and science?

2. Do the faculty and teacher candidates perceive the instruction in the MCTP as responsive to prior knowledge, addressing conceptual change, establishing connections among disciplines, incorporating technology, promoting reflection on changes in thinking, stressing logic and fundamental principles as opposed to memorization of unconnected facts, and modeling the kind of teaching/learning they would like to see on the upper elementary, middle level?

Answers to those questions were thought to address the following global research questions driving teacher education research:

1. How do teacher candidates construct the various facets of their knowledge bases?
2. What nature of teacher knowledge is requisite for effective teaching in a variety of contexts?
3. What specific analogies, metaphors, pitfalls, examples, demonstrations, and anecdotes should be taught content/method professors so that teacher candidates have some knowledge to associate with specific content topics?

A posteriori questions that emerged include:

1. Is there a difference between the MCTP teacher candidates' and the non-MCTP teacher candidates' attitudes and beliefs about mathematics and science?
2. Do MCTP teacher candidates attitudes toward and beliefs about mathematics and science change over time as they participate in the MCTP classes?
3. How do the MCTP faculty perceive their own discipline as well as the other discipline (mathematics/science) with which they seek to make connections?
4. How do college faculty "model" good instruction in mathematics and science methods courses for teacher candidates and how is that perceived by the teacher candidates?

5. How do new specialist teachers of mathematics and science who graduate from an inquiry-based, standards-guided innovative undergraduate teacher preparation:

   (1) view their subject disciplines;

   (2) enact their roles as teachers; and,

   (3) think about what they do when teaching science and mathematics with upper elementary/middle level students?

During the last three and a half years, the MCTP Research Group has actively enacted a research program characterized by a multitude of diverse studies to answer the first of these questions. Research efforts are still continuing to answer the latter questions. Research strategies that support hypothesis-testing and hypothesis-generation (Brause &Mayher, 1991) have resulted in findings that have been reported extensively in print, conference, and electronic forums (Table 1 includes a citation record of the MCTP Research Group's efforts). The MCTP also supports an internet site which provides obtain additional information on the MCTP Research Group (http://www.wam.umd.edu/~toh/MCTP.html.)

Section Two: Literature Review

For the purposes of this paper, two sources provide definitions of research and evaluation: National Science Foundation documents; and publications by education theorists. Each are summarized in this section.

National Science Foundation Documents. In 1981, The Joint Committee on Standards for Educational Evaluation defined evaluation as the "systematic investigation of the worth or merit of an object" (as cited in Directorate for Education and Human Resources [EHR]/National Science Foundation [NSF], 1993, p.1). The evaluation required by the MCTP to perform as a funded NSF project is described in the following manner,

> Project evaluation...focuses on an individual project funded under the umbrella of the program. The evaluation provides information to improve the project as it develops and progresses. Information is collected to help determine whether it is proceeding as planned; whether it is meeting its stated program goals and project objectives according to the proposed timeline. (EHR/NSF, 1993, p. 3)

Research in the same document is defined broadly as "the general field of disciplined investigation" (EHR/NSF, 1993, p. 95). The general tone of this NSF document is that evaluation is conducted in a three step process (planning, formative, and summative) with a focus on quantitative data.

In a more recent NSF document on evaluation, there is a broadening of acceptance for evaluation data to include qualitative information in a mixed-methodological design (EHR/NSF, 1997). Interestingly, words by Cronbach (1982) are included in that document which acknowledge that,

> There is no single best plan for evaluation, not even for an inquiry into a particular program at a particular time, with a particular budget (as cited in EHR/NSF, 1997, p. 4).

Publications of evaluation theorists. According to Worthen and Sanders (1987), research and evaluation are nothing more than hypothetical constructs that provide us the conceptual space "to speak with consistency about certain approaches to the production of information or knowledge" (Worthen & Sanders, 1987, p.22). The difference between research and evaluation is apparent, " Research has many of the trappings of evaluation and shares with it many common activities, but it lacks evaluation's explicit judgments of quality" (p. 23).

Similarly, for Smith and Glass (1987) the difference between research and evaluation is unambiguous. They state that research is "the disciplined search for knowledge" (p. 6) while "evaluation is the process of establishing value judgments based on evidence about a program or a product" (p. 30).

Guba and Lincoln (1989) propose a dramatic "mature" reconceptualizaton of evaluation which they term "fourth generation evaluation" (p. 8). This evaluation is based on two elements: responsive focusing and constructivist methodology. Responsive focusing requires determining "what questions are to be asked and what information is to be collected on the basis of stakeholder inputs" (p. 11). Constructivist methodology means "carrying out the inquiry process within the ontological and epistemological presuppositions of the constructivist paradigm" (p. 11). The product of the evaluation is not a set of value judgments, but "rather an agenda for negotiation" of those claims, concerns, and issues not previously resolved. (p. 13). Guba and Lincoln, while never mentioning research directly, do discuss various "inquiries" (p. 163) which have differing purposes. One inquiry is to add knowledge or understanding in some way. An other inquiry is intended to assess some state of affairs. Their version of evaluation seeks to "eliminate the distinction between basic and applied inquiry" (p. 264). Interestingly, they claim that new roles emerge for evaluators in this fourth generation evaluation. While the traditional roles of evaluators were technician, describer, and judge, the fourth generation evaluator would take on the roles of "human instrument and human data analyst," (p. 259) illuminator and historian, mediator of the judgment process, collaborator, learner and teacher, reality shaper, and change agent.

A recently well-received publication edited by Chelimsky and Shadish (1997) offers additional thoughts on evaluation and research. Chelimsky (1997) while continuing to acknowledge the traditional role of evaluation as determining the "efficiency of programs, projects, and their component processes" also appears to support Guba and Lincoln's reconceptualization of evaluation by recognizing evaluation as a process to "gain explanatory insights into social and other public problems and into past and present efforts to address them" (p. 9). The claim now is that "all of these purposes are legitimate" (p. 9). The different purposes are thought to fall into three general perspectives: evaluation for accountability (measurement of results or efficiency); evaluation for development

(information collected to strengthen institutions); and evaluation for knowledge (acquisition of a more profound understanding in some specific area or field (p. 10). The role of the evaluator (distant to close) is dependent on which evaluation perspective is taken. Finally, key attributes of evaluation are for it to,

> Keep its skepticism about the conventional wisdom, its meticulousness about measuring achievements, its willingness to be persistent about getting the information out, and its dedication to democratic reform on the basis of knowledge. (p. 25).

Section Three: Reflections-On-Practice In The MCTP

Our insights regarding the issue of a division between evaluation and research efforts within the MCTP are presented as three researcher assertions. These thoughts flow from our reflected upon standpoint during a three and a half year period as co-leaders of the Research efforts within the MCTP.

Assertion One: *By necessity, a Research Group's work is a public activity within a project; Conversely, an Evaluation Group's work tends to be a private activity.*

Because the research grouped focused on understanding the innovative teacher education program developed by the MCTP project from the participants perspectives, our main research activity was to listen to the various stakeholders of the project: MCTP university/college faculty, MCTP teacher candidates, and MCTP mentor teachers. Moreover, because our aim is to share our findings to a wider audience, we needed to make sure that our analyses of data collected from MCTP participants were accurate and trustworthy. In order to fulfill this need, we often shared our tentative findings with the participants (member checking). This sharing sometimes happened in a group setting, such as a session during the summer workshop, and in other times member checking interviews were conducted individually. Also, since so many participants in the project contributed data to our various studies, we found it beneficial to share our research reports

expeditiously over the www in the project's internet site. This public sharing also enabled interested parties outside of our project to share in our research findings.

Thus, the activities of the Research group have been very much public with its primary audience being the MCTP participants. On the other hand, the activities of the Evaluation Group have remained somewhat private. Members of the MCTP Evaluation Group visited a number of MCTP designed/influenced mathematics and science courses, with the instructors permission, but oftentimes the instructors were the only ones who knew that the evaluators were visiting these courses. Moreover, the findings of the Evaluation Group were shared with the larger MCTP community only occasionally, and not on an easily accessible internet homepage.

Assertion Two: *The efforts of a Research Group can inform the evaluation within a project although tensions remain if the sole purpose of evaluation is perceived as for accountability.*

Although most (if not all) of the MCTP participants came to accept the major premises of the MCTP philosophy underlying the teaching and learning of mathematics and science, many of them nevertheless wanted to have a third party objectively assess their activities. Many of these participants naturally turned to the Research team for such an assessment, in part because we have been very much visible within the project, as in contrast to the Evaluation Group. In addition, the PIs began to portray the Research Group activities as a part of the evaluation of the project. The Research Group, at the beginning of the project, conceived the roles of such an assessment to be in the domain of the Evaluation group. However, as we became more familiar with the perspective put forward by Guba and Lincoln (1989) and Chelimsky (1997), we, as a group, became more willing to accept the role of evaluators in this sense. More specifically, we felt that we have something to offer in terms of evaluation for development as well as knowledge (Chelimsky, 1997). Unfortunately, the MCTP participants, as well as PIs, often came with the view of a more traditional view of evaluation, evaluation for accountability. Sometimes, they wanted

evaluation to inform their instructional activities (evaluation for development); however, they often expected quantitative/statistical data, comparing what they do against control groups. On the other hand, although the Research Group members became more willing to accept their activities as a type of evaluation, the main focus of the group has remained on evaluation for knowledge. This mismatch of foci has created some tensions between the interests of the Research Group and the MCTP participants, including the PIs. This tension most often has emerged as minor differences of opinion concerning which type of studies are of most important to conduct: studies that measure project impact as compared to exploratory studies.

Assertion Three: *While the information that most shapes the PIs daily decisions about the project comes from the internal Evaluation Group, many of the PIs state that a lasting legacy of project are the Research Group products.*

Due to the demands placed on the MCTP project by the NSF to collect and report data for accountability purposes, from our perspective the Evaluation Group has shaped more of the project leadership's daily decisions than have the Research Group. On the other hand, the Project Investigators have oftentimes expressed appreciation for the Research Group's products as leaving a lasting legacy of the project. In a project characterized by lasting and widespread impacts difficult to measure and touch, such as faculty transformation, as opposed to more tangible products such as new curricula, the reports by the Research Group offer hope that over time a record will be available documenting the energies devoted to the MCTP. This type of appreciation of the Research Group's efforts has been supportive since the time required to collect data, analyze them, and report back to the project has limited the immediate impact of the Research Group's finding on the project.

Conclusion

We began our experiences viewing evaluation and research as two distinct, often incompatible, activities. However, our view of evaluation has broadened. We are now in agreement with the view that there are multiple purposes and perspectives of evaluation. Evaluation for accountability, which is often thought to be the primary purpose of evaluation, is important and necessary. However, evaluation for development can be of extreme value to the participants in a CEPT project, or any large scale teacher preparation project. Moreover, evaluation for knowledge will inform a much wider audience, resulting in long lasting benefits to the educators beyond the specific project. Thus, it appears reasonable that future programs address these multiple perspectives in their evaluation activities. Therefore, we believe that the traditional conception of a dichotomy of evaluation and research should be recast. We concur with Chelimsky (1997) (with acknowledgement to Guba and Lincoln (1989) for initially challenging our thinking) that a more fruitful conceptualization for future evaluation activities is one based on multiple purposes: accountability, development, and knowledge generation.

Finally, in considering the best of all worlds, our experience leads us to strongly advocate for two separate groups working on different purposes of evaluation, such as we have enjoyed in the MCTP. The reason we hold this belief for two separate inquiry groups termed "Evaluation" and "Research" is the concern we hold for the quality of data. We believe that if one evaluation handled all three purposes of evaluation as presented by Chelimsky (1997), it would be difficult to obtain the rich valid data we have obtained from our project participants. It is our experience as members of a separate Research Group, that the participants have been open and honest with us; a refreshing difference from the guarded responses participants oftentimes offer those whom they see as evaluating them for the purpose of accountability.

References

American Association for the Advancement of Science (1993). Benchmarks for Science Literacy. New York: Oxford University Press.

Brause, R., & Mayher, J. (Eds.). (1991). Search and re-search: What the inquiring teacher needs to know. London: Falmer Press.

Chelimsky, L. (1997). The coming transformations in evaluation. In Eleanor Chelimsky and William R. Shadish (Eds), Evaluation for the 21st century. Thousand Oaks, California: Sage Publishers

Chelimsky, E. & Shadish, W. R. (Eds.) (1997). Evaluation for the 21st century. Thousand Oaks, California: Sage Publishers.

Cobb, P. (1988). The tension between theories of learning and instruction in mathematics education. *Educational Psychologist*, 23(2), 87-103.

Driver (1989). The construction of scientific knowledge in school classrooms. In R. Miller (Ed.) Doing science: Images of science in science education. London: Falmer Press.

Directorate for Education and Human Resources/National Science Foundation (1997). User-friendly handbook for mixed method evaluations (No. NSF 97-153). Arlington, Virginia: Author.

Directorate for Education and Human Resources/National Science Foundation (1996). Teacher preparation and NSF Collaboratives for Excellence in Teacher Preparation (No. NSF 96-146). Arlington, Virginia: Author.

Directorate for Education and Human Resources/National Science Foundation (1993). User-friendly handbook for project evaluation: Science, Mathematics, Engineering and Technology Education (No. NSF 93-152). Arlington, Virginia: Author.

Glaser, B. G., & Strauss, A. L. (1967). The discovery of grounded theory: strategies for qualitative research. Chicago, IL: Aldine.

National Research Council (1996). National Science Education Standards. Washington, DC: National Academy Press.

National Council of Teachers of Mathematics (1991). Professional standards for teaching mathematics. Reston, VA: Author.

Smith, M. L., & Glass, G. V. (1987). Research and evaluation in education and the social sciences. Englewood Cliffs: Prentice-Hall, Inc.

The University of Maryland System (1993). Special teachers for elementary and middle school science and mathematics. A proposal submitted to the National Science Foundation Teacher Preparation and Enhancement Program.

Worthen, B. R., & Sanders, J. R. (19987). Educational evaluation: alternative approaches and practical guidelines. New York, NY: Longman.

Table 1

MCTP Research Citations

Publications

McGinnis, J. R., Watanabe, T., Roth-McDuffie, A, Kramer, S., &Shama, G. (1997). The Maryland Collaborative for Teacher Preparation: Making sense of the enactment of reform in the preparation of specialist teachers of mathematics and science. In P. Rubba, P. Keig, & J. Rye (Eds.), *Proceedings of the 1997 Association for the Education of Teachers of Science, (pp. 326-347).* Pensacola, FL: Association for the Education of Teachers of Science. (ERIC Document Reproduction Service No. ED 405 220)

Watanabe T. & Huntley, M. A. (1998, January). Connecting mathematics and science in undergraduate teacher education programs: Faculty voices from the Maryland Collaborative for Teacher Preparation. School Science and Mathematics, 98(1), 19-25.

In review

McGinnis, J. R., Kramer, S., Shama, G., Watanabe, T., & Graeber, A. (*in review*). The assessment of teacher candidates' attitudes and beliefs about the nature of and the teaching of mathematics and science in college-level reform-based classes. *Journal of Research in Science Teaching* (48 pp.).

Roth-McDuffie, A.,& McGinnis, J. R. (*in review*). Perceptions of reform-style teaching and learning in a college mathematics class. *American Educational Research Journal* (40 pp.).

Watanabe, T., McGinnis, J.R., & Roth-McDuffie, A. (*in review*). Modelling effective instruction in undergraduate mathematics and science content courses: Perceptions of university faculty and teacher candidates. *American Educational Research Journal* (47 pp.).

National

McGinnis, J. R., Kramer, S., Watanabe, T., & McDuffie, A. (1998, April). Charting the attitude and belief journeys of teacher candidates in a reform-based mathematics and science teacher preparation program. A paper accepted for presentation at the American Educational Research Association, San Diego, California.

McGinnis, J.R., Kramer, S., & Tad Watanabe (1998, April). A longitudinal assessment of teacher candidates' attitudes and beliefs in a reform-based mathematics and science teacher preparation program. A paper accepted for presentation at the National Association for Research in Science Teaching, San Diego, California.

McGinnis, J. R., Shama, G., Graeber, A., & Watanabe, T. (1997, March). The assessment of elementary/middle level candidates' attitudes and beliefs about the nature of and the teaching of mathematics and science. A paper presented at the American Educational Research Association, Chicago, Illinois. (ERIC Document Reproduction Service No. ED 407235).

Watanabe, T., McGinnis, J. R., & Roth-McDuffie, A. (1997, March). University faculty "modeling" good instruction in mathematics and science courses for prospective middle grades teachers: Voices from the MCTP. A paper presented at the AmericanEducational Research Association, Chicago, Illinois. (ERIC Document Reproduction Service No.ED406896).

Table 1

MCTP Research Citations (Continued)

McGinnis, J. R., Watanabe, T., Shama, G., & Graeber, A. (1997, March). Development of an instrument to measure teacher candidates' attitudes and beliefs about mathematics and science. A paper presented at the National Association for Research in Science Teaching, Oak Brook, Illinois. (ERIC Document Reproduction Service No.ED406201).

Shama, G., Watanabe, T., & McGinnis, J. R. (1997, February). Teacher candidates' attitudes and beliefs toward the nature of and the teaching of mathematics and science. A paper presented at the Research Council on Diagnostic and Prescriptive Mathematics, Oklahoma City, Oklahoma.

McGinnis, J. R., Watanabe, T, McDuffie A. R., Kramer, S., & Shama, G. (1997, January). The Maryland Collaborative for Teacher Preparation: Making sense of the enactment of reform in the preparation of specialist teachers of mathematics and science. A contributed paper presented at the annual meeting of the Association of Educators of Teachers of Science, Cincinnati, Ohio. (ERIC Document Reproduction Service No.ED402208).

McGinnis, J. R., & Watanabe, T. (1996, April). University scientists and mathematicians talk about the others' discipline: An examination of the role of discourse among professors involved in a collaborative mathematics/science teacher preparation. A contributed paper presented at the annual meeting of the American Educational Research Association, New York City, New York. (ERIC Document Reproduction Service No.ED395785).

McDuffie, A., & McGinnis, J. R. (1996, April). Modeling reform-style teaching in a college mathematics class from the perspectives of professor and students. A contributed paper presented at the annual meeting of the American Educational Research Association, New York City, New York. (ERIC Document Reproduction Service No.ED394432).

McGinnis, J. R., Graeber, A., Roth-McDuffie, A., Huntley, M., & King, K (1996, March). Researching the preparation of specialist mathematics and science upper elementary/middle level teachers: The second year MCTP report. A contributed paper presented at the annual meeting of the National Science Teachers Association, St. Louis, Missouri. (ERIC Document Reproduction Service No.ED395792).

McGinnis, J. R., & Watanabe, T. (1996, March). Higher education science teaching faculty talk about science and mathematics: An examination of the role of discourse in a middle-level teacher preparation program. A contributed paper presented at the annual meeting of the National Association for Research in Science Teaching, St. Louis, Missouri.

Watanabe, T, McGinnis, J. R., & Graeber, A. (1996, February). Maryland Collaborative for Teacher Preparation: Integrating mathematics and science in pre-service education programs. A paper presented at the annual meeting of the Research Council on Diagnostic and Prescriptive Mathematics, Melbourne, Florida.

McGinnis, J. R., Roth-McDuffie, A., Graeber, A, & Watanabe, T. (1995, April). The Maryland collaborative for teacher preparation year-one report: Collaborating with mathematics and science professors to construct specialized upper elementary/middle level teacher preparation programs. A contributed paper presented at the annual meeting of the National Association for Research in Science Teaching, San Francisco, California.

Table 1

MCTP Research Citations (Continued)

Regional

McGinnis, J. R., Layman, J., O'Haver, T., Hoffman, J., & Denniston, K. (1995, November). The Maryland Collaborative for Teacher Preparation. Presented at the regional meeting of the National Science Teachers Association, Baltimore, Maryland.

Molitor, L., & McGinnis, J. R. (1995, November). Integrating mathematics and the sciences in preservice methods courses. Paper presented at the regional meeting of the National Science Teachers Association, Baltimore, Maryland.

State

McGinnis, J. R., & Roth-McDuffie, A. (1998, January). A case study from an action research perspective of an MCTP science methods class. A paper presented at the Maryland Collaborative for Teacher Preparation conference, College Park, Maryland.

McGinnis, J. R., & Watanabe, T. (1996, January). Research activities in the MCTP. A presentation at the Maryland Collaboration for Teacher Preparation instructor conference, Towson, Maryland.

McGinnis, J. R., Tobin, K., & Watanabe, T. (1995, November). Collaboration in teacher preparation. A presentation at the Mathematics Education Seminar Series, College Park, Maryland.

McGinnis, J. R., (1995, July). Research activities in the MCTP. A presentation at the Maryland Collaboration for Teacher Preparation instructor conference, Salisbury, Maryland.

McGinnis, J. R., & Watanabe, T. (1995, June). Research activities in the MCTP. A presentation at the Maryland Collaboration for Teacher Preparation instructor conference, Frostburg, Maryland.

McGinnis, J. R., Roth-McDuffie, A., & King, K. (1995, January). Research in the MCTP. A presentation at the Maryland Collaboration for Teacher Preparation instructor conference, Baltimore, Maryland.

McGinnis, J. R., Watanabe, T., Roth-McDuffie, A., & King, K (1994, November). Research in the Maryland Collaborative for Teacher Preparation. A presentation for the National Science Foundation visiting committee, College Park, Maryland.

Molitor, L., & McGinnis, J. R. (1994, October). An update on the Maryland Collaborative for Teacher Preparation (MCTP). A paper presented at the annual meeting of the Maryland Association for Science Teaching, Westminister, Maryland.

Figure Caption

Figure 1. Program overview of the Maryland Collaboration for Teacher Preparation.

Maryland Collaborative for Teacher Preparation

Program Overview

New Content Courses

- integrated science and mathematics content
- smaller classes taught by experienced faculty
- teachers model instruction where students form concepts by actively engaging in experimentation and analysis of data

New Methods Courses

- integrated science and mathematics pedagogy
- use technology in science and mathematics teaching

Internships

- science and mathematics in informal setttings, such as museums and zoos
- real world experience using mathematics and science
- exposure to rich ideas about science and mathematics for use in their own classrooms.

Active Learning

NEW TEACHER
... who understands the connections between science and mathematics and creates an exciting interactive learning environment for all students

Field Experiences

- collaboration with experienced upper elementary and middle school science and mathematics teachers, who are committed to the interdisciplinary approach
- special student teaching experiences

Sustained Professional Support

- placement assistance
- access to a support network of experienced professionals

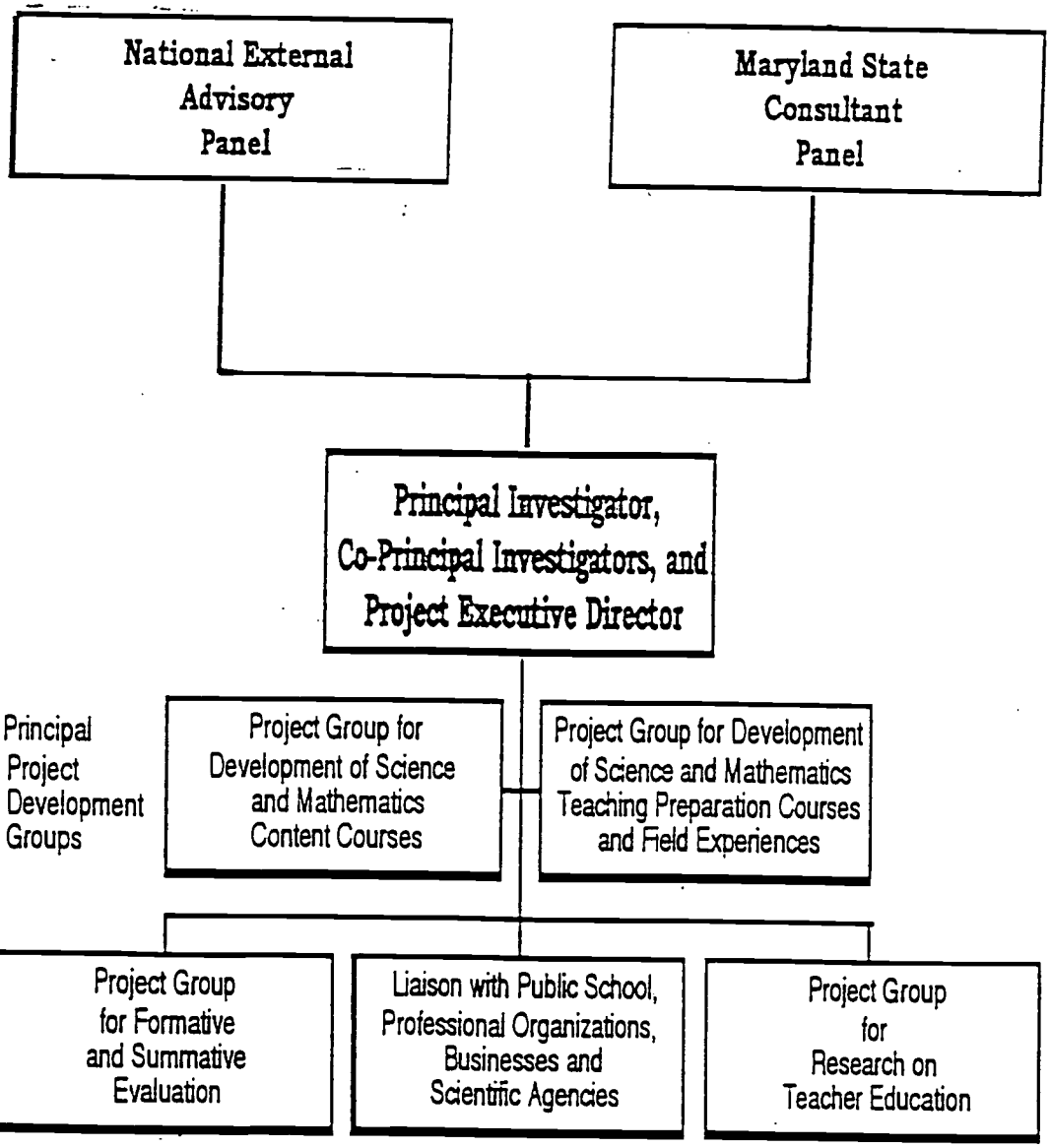
This program is funded by a grant from the National Science Foundation
DUE # 9255745

Figure Caption

Figure 2. Program structure of the Maryland Collaboration for Teacher Preparation.

Maryland Collaborative for Teacher Preparation

Program Structure



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