

**ENHANCING TRANSFORMATIONAL LEARNING THROUGH MULTIMEDIA  
CASE-BASED INSTRUCTION \*\***

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# ENHANCING TRANSFORMATIONAL LEARNING THROUGH MULTIMEDIA CASE-BASED INSTRUCTION

## ABSTRACT

In re-designing teacher preparation programs to bridge the gap between what is experienced as a student and the reality of classroom teaching, teacher educators are searching for new instructional methods and materials that provide students more authentic learning experiences to enable them to ‘think like a teacher’ about problems of practice. Instruction using multimedia cases is one method to engage students in a realistic environment by embedding problem-solving activities into authentic contexts. Case developers in education have described case methods, designs for cases, and best practices. To date, there have been no empirical studies that evaluated the effectiveness of multimedia case-based instruction (M-CBI) under different instructional models to facilitate conceptual development of pre-service teachers.

In this two-year multi-site study, M-CBI was implemented in 20 different higher education courses with varying instructional andragogies. Multi-method naturalistic research was conducted with 251 pre-service and practicing teacher education students from 5 different universities. Learning outcomes were measured using quantitative and qualitative methods. Quantitative measures of conceptual change were derived from scores of teacher pre/post concept maps. Qualitative data included semi-structured interviews with participants, reflective narratives, researcher assessment of participant conceptual development, and instructor field notes and de-briefing sessions. A grounded theory qualitative research approach was used to identify essential ingredients in M-CBI that affect transformational learning of pre-service teachers.

The findings from this study support the conclusion that overall, M-CBI *is* an effective instructional medium for all learners, but how multimedia cases are integrated into courses makes a difference in learning outcomes. The most effective instructional method for M-CBI is a combination of learning within cases along with guided application of case knowledge and skills to simulated and real situations. This finding contrasts to common use of cases to simply contextualize class activities through authentic “stories” or “problems.” Case usage in and of itself does not ensure learning without effective implementation and opportunities for applying knowledge and skills without instructor guidance. Further, it was found that case-based learning is enhanced by the use of online discussion formats (in whole or in part) in contrast to limiting case-based discussions to face-to-face formats. It appears the online environment allows pre-service teachers opportunities to become more deeply engaged over time in knowledge sharing and construction.

## **ENHANCING TRANSFORMATIONAL LEARNING THROUGH MULTIMEDIA CASE-BASED INSTRUCTION**

An ongoing question in teacher education is how best to teach students to apply conceptual knowledge to real-world problems (Greenwood & Maheady, 2001). The challenge is to deliver effective preparation to teachers-in-training to expand their knowledge and skill repertoires and enable them to ‘think like a teacher’ about problems of teaching (Cochran-Smith & Lytle, 1999). Case-based instruction (CBI) has been recommended as an approach that engages students in a more authentic environment to bridge the gap between theory and practice (Elksnin, 2001). The incorporation of newer technologies with case-based instruction—multimedia, electronic performance support tools, online discussion groups—provide promising methods for supporting teaching and learning.

This study used the interactive, multimedia cases in the Teacher Problem Solving Skills (TPSS) series developed by Fitzgerald and Semrau (1993-1997; 1998-2000). The cases are unique because the interactive materials embed authentic casework activities and electronic performance support tools into the cases, providing information for knowledge and skill development, contextual problems for solving, and guidance from scaffolds and expert commentary. These multimedia cases are designed as practice fields—a term introduced by Senge (1994). Practice fields focus mainly on situating content in authentic learner activities. In practice fields, learners define and solve ill-structured problems, utilize domain-related information, receive coaching and modeling of thinking skills, and have opportunities for reflection (Barab & Duffy, 2000).

There are three titles in the series that facilitate use of the cases across a variety of general and special education courses. The four cases in Program 1 focus on understanding children’s behavioral disorders from multiple perspectives, thus lending the cases to use in introductory and characteristics courses. The two cases in Program 2 focus on learning and practicing assessment and planning procedures and are most aligned with assessment courses. The four cases in Program 3 focus on developing instruction and management plans as interventions, thus relevant to a wide variety of methods and interventions course across disability areas. Previous users of the programs have successfully implemented the cases across a range of courses in disability areas and severity levels (Hollingsead, Koury, Mitchem, Miller, & Fitzgerald, 2005). The materials are appropriate for special educators, general educators, school psychologists, and other helping professionals involved in serving these children. Descriptions of the programs are available at <http://vrcbd.org>.

### **THEORETICAL FRAMEWORK**

#### *Multimedia Case-based Instruction (CBI)*

CBI is a fairly recent, popular alternative to traditional, teacher-directed instruction in special education teacher preparation (Anderson & Baker, 1999; Goor & Santos, 2002; Lundeberg, Levin & Harrington, 1999; McNaughton, Hall, & Maccini, 2001). A recent summary of current practice in the use of case methods in special education teacher preparation programs stated that the greatest advantages to case methods of instruction are bridging the gap between theory and practice and developing students’ problem-solving skills (Elksnin, 2001). Although CBI has

been proclaimed as a problem-centered pedagogy that engages novices in thinking like professionals (Merseth & Lacey, 1993), a review of the evidence for case-based instruction caused Merseth (1996) to note that “The collective voice of its proponents far outweighs the power of the existing empirical work” (p.722). More recently, researchers have begun to explore the effects of traditional narrative forms of CBI on learners (Cutter, Palincsar, & Magnusson, 2002; Lundeberg et al., 1999). Cutter et al. (2002), for example, found that conversations around case-based vignettes appeared to provide a context in which teachers were able to develop common understandings of diverse learner needs and identify approaches to enhance the participation and achievement of those students.

Multimedia cases provide the means to bring dilemma-laden, complex situations of teaching into training programs. Within these cases, the addition of electronic performance support tools and online discussions with practicing professionals provide supports for novices to apply, adapt, and evaluate effective instructional processes. These features result in a unique and potentially valuable context within which pre-service teachers can share their experiences and ideas with their peers and, at the same time, have access to feedback from experienced inservice teachers and other educators (Makinster, Barab, Harwood, & Andersen, 2006) allowing novices to develop ‘case’ knowledge for use in ill-defined situations in the real world (Fitzgerald, Wilson, & Semrau, 1997; Fitzgerald, Semrau, & Deasy, 1997).

Interactive linking of multiple media such as images, videos, and sound within a case environment permits the creation of a realistic practice field for teachers to solve problems of teaching (Ayersman, 1996). Practice fields focus mainly on situating content in authentic learner activities so that students may engage in the kinds of problems and practices that they will encounter outside of school. Preparing practice fields involves creating realistic activities or experiences for the learner. These activities must be authentic; they must present most of the cognitive demands the learner would encounter in the real world, that is, authentic problem solving and critical thinking in the domain (Barab & Duffy, 2000).

Previous evaluation studies with the TPSS cases have demonstrated that users significantly increase content and procedural knowledge, develop an understanding of multiple treatment perspectives, and engage in more complex problem solving on the case activities (Fitzgerald & Semrau, 1998; Johnson, Semrau, & Fitzgerald, 2000; Kraus, Reed, & Fitzgerald, 2000). Overall, the empirical studies conducted with these multimedia cases demonstrated that well-designed learning systems, particularly those built from practice field design principles, provided equally effective learning environments for pre-professional students regardless of learner differences.

### *Implementation and Facilitation of CBI*

To date, case developers in special education have described case methods, design strategies for producing cases, descriptions of usage, and evidence of learner satisfaction with case-based instruction. In terms of how best to implement CBI, surveys of educators have identified the need for guidance on case facilitation as well as learner evaluation (Elksnin, 1998; McNaughton et al., 2001). Snyder and McWilliam (2003) described some general strategies for CBI that had been validated with 128 early intervention instructors who participated in intensive training designed to increase their knowledge about and use of CBI. In terms of learner evaluation,

Snyder and McWilliam reiterated the need for research to clarify what learners learn and do not learn from CBI and which facilitation methods best support learning.

Interactive, multimedia cases are far more complex and richer than paper-based or simple video-based cases making elucidation of the types of scaffolding and support that best facilitate learning for different individuals even more critical. Increasing use of these technologies has prompted additional questions for teacher educators related to how to structure learning environments, facilitate discussion, and evaluate learner outcomes. Recently, researchers have begun to explore some of these issues including the use of synchronous and asynchronous online discussion to support CBI with pre-service and inservice teachers (Levin, He, Robbins, 2006; McLinden, McCall, Hinton, Weston & Douglas, 2006; Mitchem, Fitzgerald, Hollingsead, Koury, & Miller, in press), the role of effective preparation and tutor support (McLinden et al., 2006), and the kinds of scaffolding that support learning through hypermedia video-based activities (Boling, 2007). Largely unstudied, however, is how teacher educators should most effectively implement multimedia CBI to ensure that their students learn and transfer knowledge and skills into the field. The purpose of this study was to investigate how and what participants learn from cases under differing instructional conditions.

## **RESEARCH APPROACH**

This study investigated the integration the TPSS multimedia cases and provision of electronic supports and case-based discussion groups related to the cases into undergraduate and graduate coursework. The study used a naturalistic, design-based research model in which learning was observed in contexts through systematic study of instructional strategies (Brown, 1992). This is a successive, iterative process by which theories, artifacts, and processes are systematically studied in contexts leading to successive refinements and new theories that provide implications for practitioners (The Design-Based Research Collective, 2003). This approach is particularly appropriate for addressing innovations that are implemented in complex, real-world contexts that explore usability and seek to advance their continued viability across settings (Brown, 1992; The Design-Based Research Collective, 2003). As research-based designs are carried out in multiple cycles of design, implementation and study, researchers respond to new features of contexts and emergent findings to help refine the interventions as well as to expand the impact (Barab, Dodge, Thomas, Jackson, & Tuzun, 2007; The Design-Based Research Collective, 2003).

Multiple forms of quantitative and qualitative inquiry were conducted within and across class contexts to examine and interrelate learning from the cases (Bonk, Malikowski, Angeli, & East, 1998). Learning was measured by pre and post changes in individually-constructed concept maps that were scored for breadth, complexity, and quality of knowledge construction. The quantitative data were compiled across contexts and time using repeated measures to study the impact of multimedia CBI on conceptual change.

Qualitative data were gathered from interviews, student reflective narratives, and researcher field notes; these were used to clarify and extend the empirical results and examine recommendations for case-based instructional methodologies. A grounded theory qualitative approach was used to allow findings to emerge from the qualitative data (Creswell, 1998). Grounded theory approaches focus on process and develop meaning as insights grow from data, records, hunches,

discussion, and hypotheses. The grounded theory approaches include open coding, categorizing, and the integration of data (Morse & Richards, 2002; Richards, 1999). This combination of quantitative and qualitative data accumulation provided the means to triangulate findings within and across data types in the study.

The following research questions guided this research:

How does instructional implementation affect learning outcomes from multimedia CBI?

What do participants learn from multimedia CBI?

What do participants perceive they learn from multimedia CBI?

## **METHODS**

The technology-enhanced case-based instruction was implemented in 20 undergraduate and graduate higher education courses from four different universities with varying instructional delivery modes. Each instructor implemented a minimum of two multimedia cases into one course per semester for four semesters. Multiple methods of quantitative and qualitative inquiry and analysis were conducted within and across the implementation groups to examine how the use of multimedia cases implemented as practice fields with technology supports affected learning outcomes and transfer of knowledge and skills to professional practice in applied settings.

### *Participants*

Data were collected on 251 research participants who represented a full range of students enrolled in teacher preparation programs both as pre-service students and inservice teachers working on advanced degrees or certification/endorsement areas. The research pool demonstrated a balance of students with and without teaching experience while enrolled in the courses: 42.8% had no teaching experience; 15.5% were novices with up to 3 years experience; and 41.6% had 3 or more years of prior teaching experience. In terms of access to classrooms for application of knowledge and skills during training, 58.5% were not teaching while enrolled and 41.5% were simultaneously teaching while enrolled in their courses. From this group, a representative sample of 105 students were selected for follow-up interviewing.

### *Instructional Implementations*

The instructional procedures for teaching with the cases were allowed to vary naturalistically across course instructors. Ten different instructors ranging in rank from instructor to professor taught the courses across four universities. All instructors had teaching experience using this series of cases, or were mentored by case-experienced instructors. Each instructor selected cases to use that best fit their course objectives. Because each instructor implemented at least two cases within each course, seven combinations of implementation types resulted and these types were used as independent variables in data analyses. These seven combinations were placed into a levels hierarchy and numbers of students participating in each level are provided in Table 1.

Table 1.

*Implementation Levels for Case-based Instruction*

Level	Types	Implementation Combination	N
1	A & A	Learning Within & Learning Within	65
2	B & B	As Context & As Context (No Within)	17
3	C & C	Guided Application & Guided Application	27
4	A & B	Learning Within & As Context	57
5	A & D	Learning Within & Learning Within/As Context	40
6	A & C	Learning Within & Guided Application	36
7	C & D	Learning Within/As Context & Guided Application (all combinations)	9

*Independent Variable: TPSS Cases*

The TPSS multimedia case programs provide interactive learning environments that embed problem-solving activities into authentic cases. There are three titles in the series: Program 1—understanding children’s behavioral disorders from multiple perspectives; Program 2—learning and practicing assessment and planning procedures; and Program 3—developing instruction and management plans as interventions. The ten cases in the series include videos of children in a variety of school settings; interviews with teachers, principals and parents; computerized case records; information databases; prompted embedded activities; and performance support tools. The over-arching theme of TPSS is to provide flexible learning materials to enhance problem solving of teachers preparing to serve children with social, emotional, and behavioral disorders.

Figures 1 and 2 display sample screens from the case program of “Chelsea”, a four-year old child in an early intervention classroom program for assistance with social and behavioral problems.



Figure 1. Video Observation of Chelsea



Figure 2. Planning Activities for Chelsea

*Dependent Measures—Concept Map Scores.*

Students constructed concept maps at the beginning and end of their courses to measure conceptual change. The maps displayed how participants conceptualized approaches for understanding children with EBD. The map construction procedure was standardized across

courses for directions, size of paper, length of time allowed, and text in the center node. No advance notice of the proctored concept map activity was provided and no resources were allowed during map construction. Pre and post concept maps for the 251 research participants were scored for (a) number of unique nodes representing the breadth or amount of knowledge and (b) number of links between nodes representing the interconnectedness of knowledge. To evaluate the quality of the content in the maps, expert maps were developed by the research team and used to create a scoring rubric. After the research team established reliability using the scoring rubric, a sample of 96 pre and post concept maps were scored; the sample included representatives of all the courses over the two-year duration of the study.

Figure 3 shows an example of a participant-constructed concept map with a nodes score = 43 and a links score = 96. The quality map score is 2. The score of “2” represents a moderate or emerging level of conceptual development. The score is based on three major components being identified in three conceptual areas in the map (curriculum and teaching, identify needs, theoretical perspectives) with minimal development of the concepts

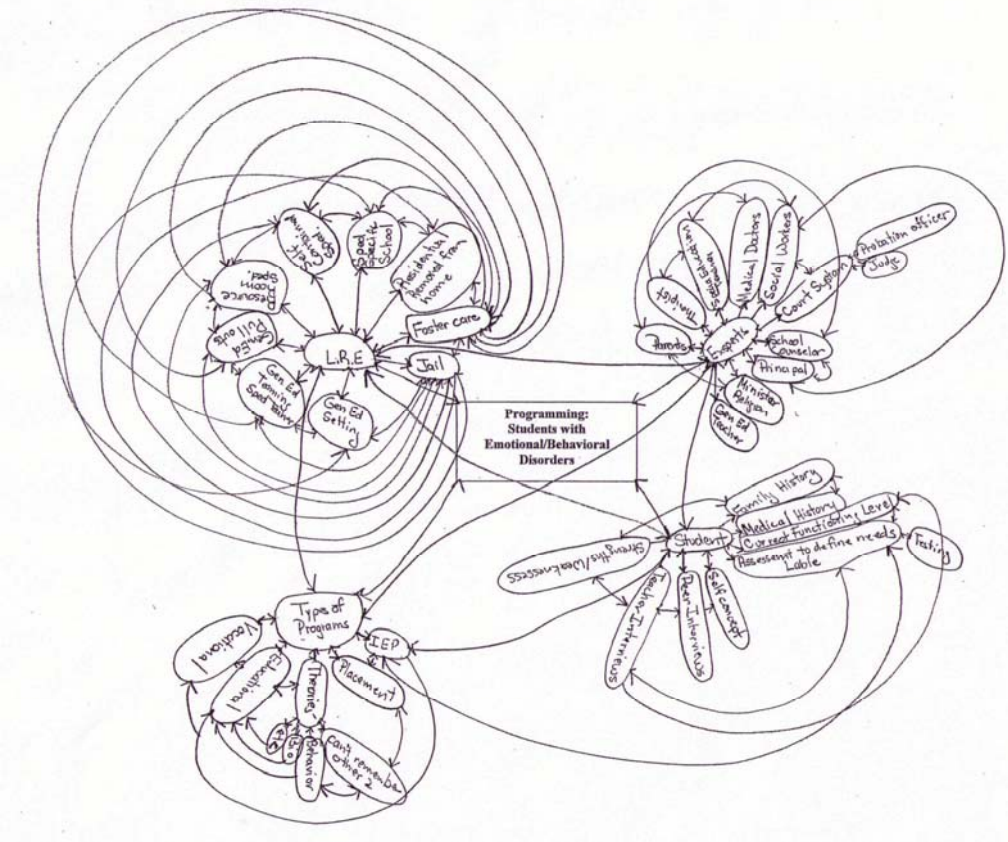


Figure 3. Concept Map Constructed by a Pre-service Teacher

*Qualitative Data.*

Multiple forms of qualitative inquiry and analysis were conducted within and across groups to examine the process of learning from the cases and discussion groups. Qualitative data included semi-structured interviews compiled from 105 interviews conducted the semester following case

usage; student narrative comparisons of their growth on concept maps for the research pool of 251 participants; researcher comparisons of student concept maps for a representative sample from the research pool; instructor field notes created while teaching the courses; and research team summaries and de-briefing sessions. Interview topics included perceptions of benefits and limitations of multimedia CBI, problems with the materials or technologies, perceptions of learning (knowledge and skills) and transfer to real settings, satisfaction with case teaching methodologies, and recommendations for instructors and implementation into other courses and fields. Audio interviews were transcribed and triangulated with participant written reflections and researcher electronic field note files for analyses.

## FINDINGS

### *Conceptual Change Related to Type of Instructional Implementation*

Although significant pre-post learning occurred overall, students using the cases only as context for related course assignments (level 2) demonstrated lower levels of learning as measured by the nodes, links and the quality scores. An interaction seen with the nodes score demonstrated that the within-case instruction combined with guided application (levels 3, 4, and 5,) was superior to the within-case instruction format (level 2) using cases only for context as shown in Figure 4.

An interaction found with the quality rating score indicated that the within-case instruction combined with guided application (levels 6 and 7) as shown in Figure 5 was superior to all other combinations.

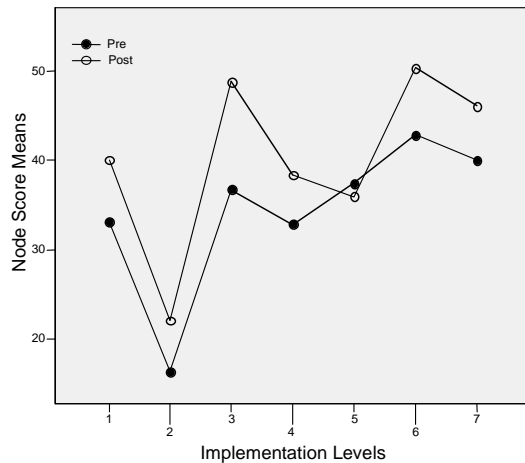


Figure 4. Concept Map Number of Nodes across Implementation Levels

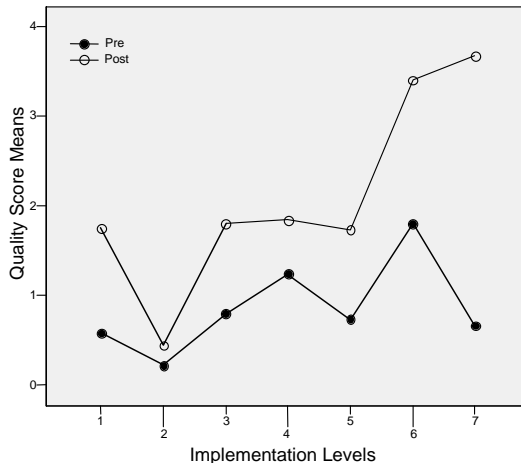


Figure 5. Concept Map Quality Scores across Implementation Levels

The most learning occurred in the three implementation levels that included guided application and combined within-case learning with guided application (levels 3, 6 and 7 on nodes; levels 6 and 7 on quality score). It follows that what works best for learning from cases fits the hierarchy shown in Table 2.

Table 2.

### *Implementation Effectiveness*

Learning	Implementation of CBI
Least	Cases used for limited purpose of contextualizing class activities and assignments—limited case usage. (Level 2 )
Some	Cases used for within-case learning with or without use as contextualizing class activities or assignments. (Levels 1, 4, and 5)
Most	Cases used for within-case learning along with guided application of case knowledge and skills to simulated or real situations—extensive case usage. (Levels 3, 6, and 7)

Consistent themes emerged in the qualitative data from participants across the seven implementation types. It was clear they valued the use of cases for gaining perspectives, thought they had better understanding of children and teaching because the material was anchored in real cases, and appreciated the need for teamwork in meeting multiple needs. Further there was general agreement that they valued the opportunity to gain experience through problem-solving with the cases and felt the access to resources and tools for the future would be useful in their work in schools.

Participants in all groups suggested that more cases be used in courses, and that additional time and discussions be held on the cases because “the more cases we do and learn from, the more we will be able to use the materials in the real setting.” [Level 4 Participant] There was substantial support for expanding the use of cases to real situations.

One frustration expressed by students regarded the use of case material for out-of-case assignments explained the need for integrating case use into course content. Some students felt that they did not have sufficient prior knowledge to carry out the applied assignments embedded in the cases and offered pre-teaching suggestions.

#### *Conceptual Change Related to Type of Discussion*

A comparison was made of pre-to-post change between participants engaging only in face-to-face discussions and those engaging in some online discussions. Higher levels of change in number of nodes and links were found for learners in the online discussion group format (see Figure 6), although there were no differences in their concept map quality scores based on type of discussion. Both groups demonstrated significant levels of growth in quality.

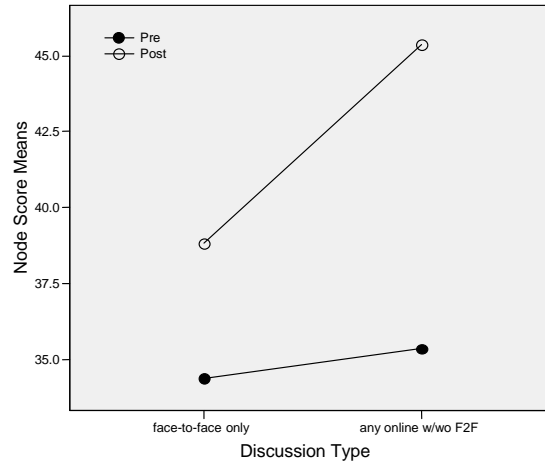


Figure 6. Concept Map Number of Nodes across Discussion Group Types

Perceptions of the value of case-based discussions were similar across the two discussion formats. Most respondents valued others' perspectives, engaged in sharing and comparing their points of view, appreciated input from others, used the discussions to clarify their own ideas, and appreciated being in mixed groups with those with different experiences. Specific comments from the two groups provided insight into differences between these two discussion formats that may have led to the finding of greater growth in breadth (nodes) and interconnectedness of concept (links) for the online group participants.

In the online group, people described the value of interacting with participants from other geographical locations because things were done differently. It is possible that the comparisons of these differences expanded knowledge and understanding of perspectives. There may have been some advantages in online groups in that the discussions took place over a longer time frame and allowed opportunities for participants to engage in critical thinking and interact over time to stimulate further conceptual development.

## DISCUSSION AND IMPLICATIONS

### *Instructional Implementation: Provide Embedded Case Activities and Guided Transfer*

How multimedia cases are integrated into courses appears to make a difference in case-based learning outcomes. Overall, significant learning occurred for all learners on a pre/post basis except those who used the cases in a limited way only to contextualize additional course learning activities and assignments (Implementation Level 2). In this limited usage format, there was no emphasis on doing practice or problem-solving activities as casework prior to other instructional activities. Learners explored the case for embedded information and then used the information to contextualize other assignments outside of the case that were the focus of the course.

Limiting case usage to contexts for course learning was not as effective as other implementation methods that required in-depth casework, guided application of material mastered in casework, or a combination of these two approaches. Partial use of these multimedia cases is not recommended. The highest post node and post link scores occurred in all implementation levels

that required completion of embedded activities within the case plus offered guided application of the knowledge and skills represented in the cases to simulated or real situations (Levels 3, 6, and 7). Providing bridges to help students transfer and apply their knowledge and skills to similar and real situations will enhance overall learning outcomes.

### *Instructional Design: Embed Learning Activities within Cases*

These multimedia cases are uniquely different from other forms of cases in the fact that learning activities are embedded, scaffolded, retained, reviewed and revised within the case. Consistent with the above finding on limited versus full use of cases, engaging learners within cases prior to transfer activities supports conceptual development because learners are gaining and using information in a scaffolded environment. Going back to the theoretical work by Barab and Duffy (2000) on the design of practice fields, well-designed environments do more than provide authentic content—they provide realistic activities or experiences for learners to be engaged in authentic problem solving and critical thinking in the domain. Instructional designers and instructors can enhance learning from cases by embedding learning activities into the authentic case environments and providing appropriate scaffolds for learners to solve, review, and reflect on real problems.

### *Instructional Implementation: Conduct Case-based Discussions in an Online Format*

Important differences emerged when comparing learning outcomes related to types of case-based discussions. While all learners demonstrated change on their quality of map scores, those who had opportunities to discuss and apply the case information in online environments demonstrated greater change in their breadth and interconnectedness of knowledge than those limited to face-to-face class discussions. Overall, conducting case-based discussions with at least part of them being online, chats, or web-assisted formats was superior to conducting case-based discussions in face-to-face formats alone. The addition of online discussion opportunities where students can share information, compare perspectives, and discuss relevant problems of practice over time is recommended. These results support the finding by Ziegler, Paulus, and Woodside (2006) that face-to-face discussion groups focused on instructor-defined tasks rarely demonstrate the depth of engagement observed in online groups involved in a process of knowledge creation.

## **Summary**

In summary, these robust multimedia cases were effectively integrated into appropriate instructional programs in teacher education over a sufficiently long treatment period to stabilize outcomes. Significant learning resulted for all types of learners from casework, and completion of embedded learning and problem-solving activities within the cases enhanced conceptual outcomes. However, case usage in and of itself did not ensure learning without effective implementation and opportunities for applying knowledge and skills with instructor guidance.

The results support the conclusion that M-CBI case usage containing extensive, embedded casework activities is a necessary foundation for students to transfer case knowledge and skills to similar situations. To support transfer of learning, instructors need to go beyond using the materials to contextualize learning activities and assignments. Better learning outcomes occur

when students fully engage in cases and complete embedded problem-solving activities first, thus mastering knowledge and skills prior to applying that content to simulated and real situations.

Once the conceptual foundation is in place, students are better able to transfer the knowledge and skills to similar situations and apply their learning to professional practice. M-CBI can best be viewed as both foundations and bridges to learning. In addition, opportunities to discuss the cases in online venues with time to develop ideas and engage in reflection with others support better outcomes for M-CBI.

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