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AUTHOR Nelson, Wayne A.; Smith, Randall E.

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ABSTRACT

Multimedia computer technology and modified case methodologies were used to encourage and facilitate the process of reflection by beginning teachers. A computer-based multimedia system was developed and tested that features prespecified cases for analysis, facilities for linking various aspects of one case to other cases, and capabilities for entering and linking new cases by individual students as a product of their classroom observation. Formative testing was conducted to describe student activities and to explore strategies for integrating the system into a teacher-education curriculum. The software developed for the project, "Chronicles of Teaching," allows users to enter descriptions of cases and incidents they have observed and to create hypermedia links to cases and descriptions in the database. Users must reflect on similarities and differences among their cases and other cases or theories in the database. The software has been integrated in foundations, general methodology, and methods courses at Southern Illinois University and in student teaching. Three figures illustrate software screens. (Contains 17 references.) (SLD)

Title:

# Learning How to Teach: A Computer-based System to Enhance Teacher Reflection

Authors:

Wayne A. Nelson
Randall E. Smith

Department of Curriculum and Instruction
Southern Illinois University at Edwardsville
Edwardsville, IL 62026

*Background*

Conceptions of teaching, especially outside the profession, often maintain simplistic and narrow beliefs that teaching is a skill that can be acquired relatively easily by any reasonably intelligent individual. However, learning and development theories suggest that a complex skill like effective teaching is acquired over thousands of hours of practice (Norman, 1978); practice that includes autonomy, collaboration, and time (Wildman & Niles, 1987a). Recent trends in teacher education have stressed reflection as an important component of this learning process (Schön, 1991; Wildman & Niles, 1987b). Helping beginning teachers learn to think about and analyze their pedagogical activities is seen as an important step in developing effective teachers. The research project described in this paper elicits the help of multimedia computer technology and modified case methodologies in an attempt to encourage and facilitate the processes of reflection by beginning teachers.

The theoretical framework for this effort is drawn from two areas of research: the use of case methods in teacher education (Shulman, 1986) and cognitive flexibility theory (Spiro, et al., 1988). Case methodology is a proven instructional strategy in many areas (notably law, medicine, and business) that has become more widespread in teacher education in recent years. Many hold the belief that case-based instruction for teachers can help them to better reason about and reflect on their practice (Christensen, 1987; Schön, 1983). A number of projects developing and using case materials have been undertaken (Greenwood & Parkay, 1989; Kowalski, Weaver & Henson, 1990; Silverman, Welty & Lyon, 1992), while others are advocating the use of student-written cases as a means of encouraging beginning teachers to reflect on pedagogical issues (Kagan & Tippins, 1991; Shulman, 1991).

Coincidentally or not, there is a parallel movement in cognitive psychology that is emphasizing cases, episodes, or "stories" as a model of storage and retrieval in human memory (Neisser, 1981; Schank, 1992; Spiro et al., 1987). In particular, cognitive flexibility theory (Spiro, et al., 1988) proposes that the acquisition of knowledge in domains that are ill-structured (where content is complex and application is irregular -- teaching is certainly such a domain) needs to be decontextualized. That is, rich interconnections among knowledge components need to be developed in order for learners to access knowledge from multiple sources in the construction and adaptation of knowledge to new situations. Spiro and his colleagues assert that case-based instruction is likely to achieve the cognitive flexibility necessary to acquire relevant knowledge and successfully solve problems in ill-structured domains, especially when the cases are not organized into predefined categories, thereby requiring the learners to access the information from many different perspectives.

Cognitive flexibility theory further suggests that an appropriate vehicle for presenting the cases, and for helping learners to "crisscross the landscape" of cases while noting similarities between cases that on the surface may seem dissimilar, is a computer-based hypermedia environment (Spiro & Jehng, 1990). Hypermedia allows users to rapidly and efficiently access a large amount of information in a nonsequential manner by following "links" (cross references) between "nodes" (the actual information in the database). Further, hypermedia systems can be developed to allow learners to create their own links between nodes, actively involving the learner in reflecting on how various aspects of one case may be similar to aspects of other cases. The result is a system that supports random access instruction (Spiro & Jehng, 1990), where learners build a complex knowledge representation of the domain by experiencing cases from a variety of perspectives in order to develop a more complete understanding of the nuances in the domain.

With this theoretical framework in mind, a computer-based multimedia system that features prespecified cases for analysis, facilities for linking various aspects of one case to other cases, and capabilities for entering and linking new cases by individual students as a product of their classroom observations was developed and tested. The software seeks to effectively support the kind of knowledge acquisition and reflection necessary to develop sufficient pedagogical knowledge in preservice teachers. The formative testing of the software was conducted to both describe the kinds of activities undertaken by the students when using the system to reflect on classroom observations, and to explore various strategies for integrating the system into a teacher education curriculum.

*Description of the Software*

The software developed for the project, *Chronicles of Teaching*, features a design that encourages users to read and react to descriptions of "critical incidents" or mini-cases that typically occur in classrooms. In addition, users can enter descriptions of incidents that they have observed during their field-based activities. Besides entering descriptions of cases and solutions, users may create hypermedia links between their case and other cases or theoretical descriptions that are in the database. In this way, users must reflect on the similarities or differences between their case and other cases in the database (or descriptions of theories and methods of teaching), and establish links so that subsequent users may follow the links while examining the cases and theories in the database. Another feature that encourages reflection is a "notes" facility that can be used to create and print personal notes, or to leave comments or suggested alternative solutions for other users to view. The software also includes extensive search and indexing features so that these cases and theoretical descriptions can be easily accessed.

As shown in Figure 1, the structure of the *Chronicles of Teaching* system centers around two database modules, cases and theories, that provide search and indexing facilities to aid the user in navigation. The "Cases" module provides facilities for entering descriptions of critical incidents that the user has observed in classrooms during field observations (See Figure 2). Students enter descriptions of both the incident and the solution to the problem, and may also leave comments or suggested alternatives to cases entered by others. A user can also view cases entered by other users by following hypermedia links in the database, searching for keywords, or selecting from an index, as described below. Descriptions of the learning and/or instructional theories underlying the events depicted in the cases are also available. These descriptions were drawn from the research literature on learning and effective teaching, including behavioral and cognitive theories of learning, motivation strategies, questioning techniques, classroom management, and assessment strategies. Users are encouraged to engage in debates/analyses of the cases by accessing the notes facilities or by posing questions or leaving comments for other users. Notes can be printed for later examination and study purposes. Multimedia capabilities to display video clips of actual teaching episodes are also available to users. These video segments illustrate various features of some of the cases and theoretical descriptions in the database. Facilities to allow users to add video clips of student teaching activities are currently under development.

**Figure 1.**

Structure of the *Chronicles of Teaching* software.

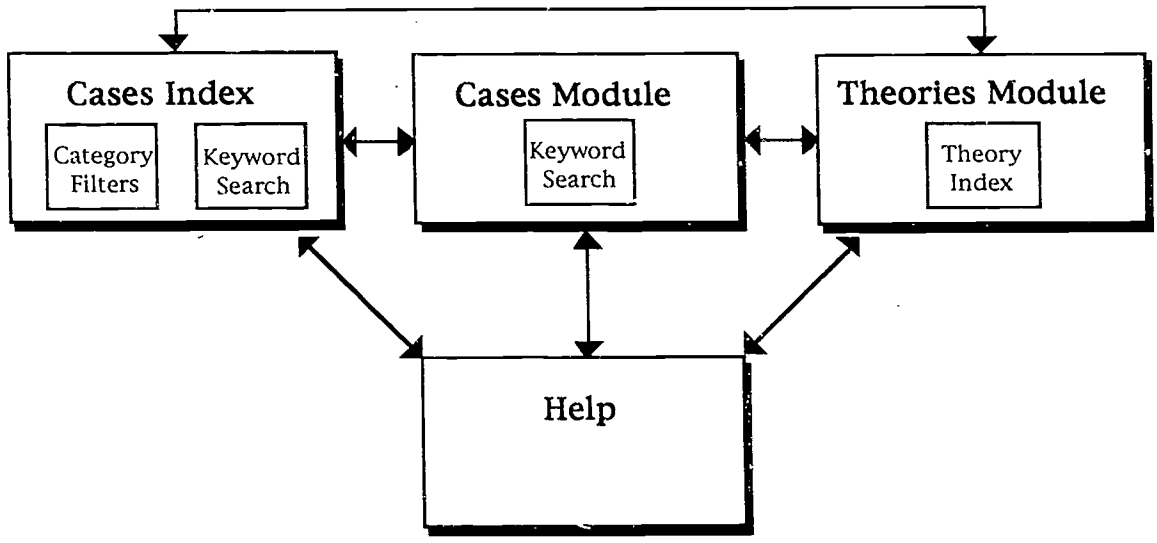
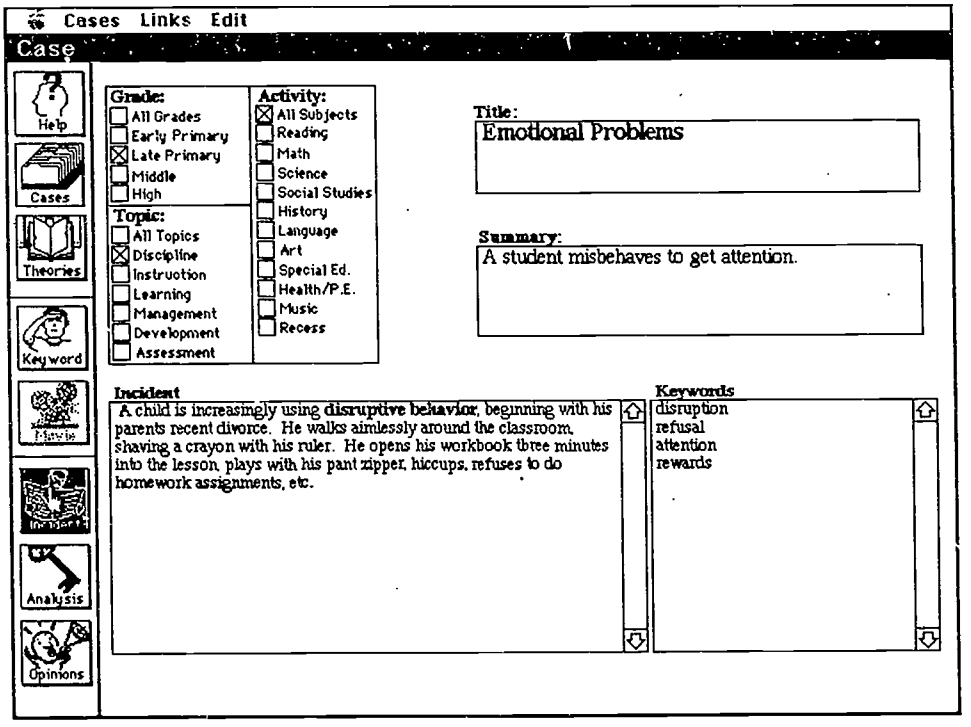


Figure 2.

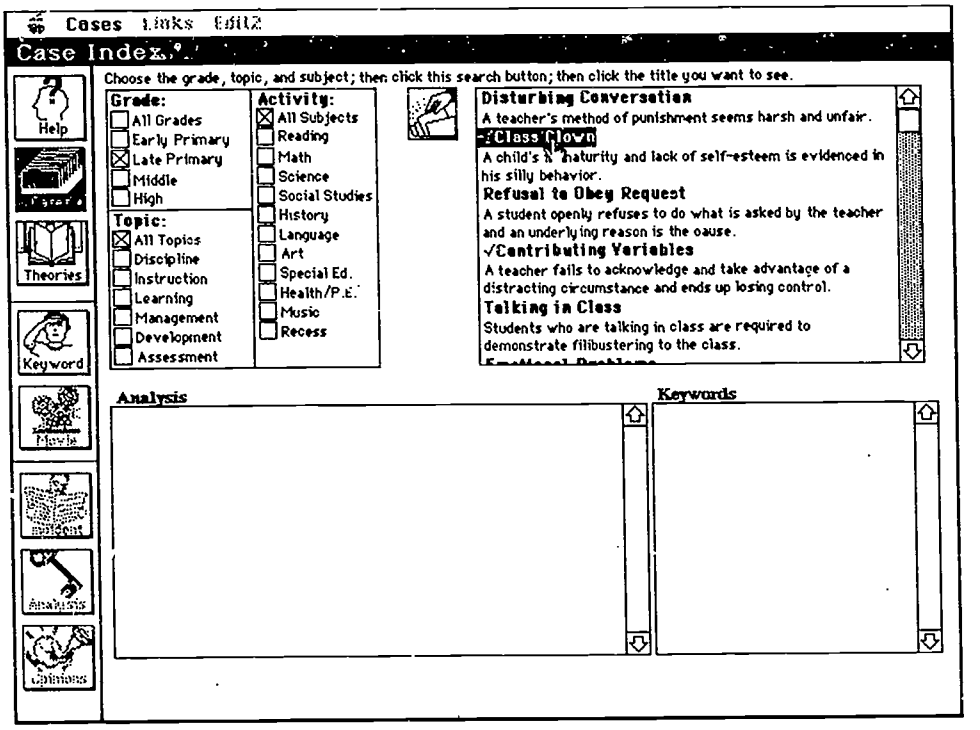
A case from the database.




The search facilities provided in the software are designed to allow easy access to both cases and theoretical descriptions. Searching for particular cases can be accomplished in several ways. First, the user can access a search facility that filters the available cases based on category selections made by the user (See Figure 3). The filters include grade level, subject, and type of teaching activity. By selecting various combinations of these parameters, the system searches the database of cases and displays the titles of cases that match the selected parameters. Users may then view a particular case by selecting its title from the list. The hypermedia links embedded in the text of the case descriptions and solutions, as described below, also provide an important facility for accessing cases. Each case in the database also includes keywords describing various characteristics of the case that are entered by the author of the case. A user may access a search facility that will sequentially display all cases where a match to the current keyword is found. At any time, users may view descriptions of various theoretical principles drawn from the literature on learning, instruction, and effective teaching. The user simply selects the desired theoretical description from a list of descriptive titles.

**Figure 3.**

The case index screen.




The software also provides capabilities for case authors to create hypertext links from various words or phrases in their case to other similar cases or theoretical descriptions, thereby helping them to actively reflect on how the events they have observed in classrooms are similar to, or different from, other situations described in the database. Users can easily create links by highlighting a word or phrase in the case narrative, navigating to the target case, and making a selection from the menubar to create the link. Links can also be deleted by the author of the case, but once the author is satisfied with the case and links, the text is "locked" so that other users cannot alter the author's case description or links.

*Field Testing*

Development of the *Chronicles of Teaching* software has proceeded using a rapid prototyping model. That is, more than 45 teacher education students from the target population have participated in several cycles of testing and revision of the software. Initially, randomly selected students from sections of the teacher education program who had completed 16 hours of course work in education (Introduction to Education, Educational Psychology, etc.), and who were entering a "block" of methods courses in elementary education that requires extensive observation in public school classrooms (20 hours per week), helped with testing of the various prototypes. Participants were introduced to the system, and to case writing and analysis procedures, during a training session prior to their scheduled observations in the schools. The students then used the system individually to

enter and link cases and solutions based on their classroom observations during the remainder of the period of classroom observations.

The major activities completed by each student involved composing and entering their own case(s) derived from their classroom observations, and linking various aspects of their case(s) to other cases and to the theoretical descriptions included in the system so that subsequent users could access the student's case(s) from a variety of other points in the hypermedia database. The students also responded to other cases by viewing and commenting on analyses made by other users. The system was instrumented to collect data regarding the specific activities each user completed during interaction with the system.

Feedback from the students who tested the system was used to guide modifications and enhancements of the prototype. Specifically, users asked for a more sophisticated search system that would allow them to search for cases based on various categories of teacher activities (i. e., discipline, instruction, classroom management, etc.) as well as student level (i. e., early elementary, middle school, high school, etc.) and context (i. e., math, reading, science, recess, etc.). This search feature was added to the system, along with navigation capabilities that allow users to "backtrack" along the path they had followed while browsing with hypertext links.

Besides specific suggestions regarding modifications of the system, students also volunteered their subjective impressions, noting that the tasks involved with using the system were very appropriate for reflecting on various aspects of teaching. The activities involved in entering, linking, analyzing and commenting on cases in the database seemed to engage the students at a high level. One student even jokingly suggested that field observations be replaced with use of the system because the same outcomes could be achieved with a significant reduction in mileage on his car!

A more extensive analysis of the cases entered during testing of the prototype reveals that the students are noticing and discussing a wide variety of classroom situations in both early and late primary classrooms. An examination of the topics for the 32 cases entered in the database reveals that discipline (47%) and instructional methods (31%) dominate the concerns of the preservice teachers who have tested the prototype, while the context of the incidents is more diverse, covering reading, math, science, history, language arts, health/physical education, and even recess. It is also apparent that the system encourages the kind of reflective thinking necessary to develop teaching expertise, as exemplified by the following excerpt from an opinion entered by someone in response to a case description:

> I think proximity would be the best in this situation. By moving closer to the students and standing next to them, they will know that they were heard. Some teachers may separate them, but this causes disturbance to the lesson flow. I would continue the lesson while moving towards the student.

*Integration into the Teacher Education Curriculum*

The *Chronicles of Teaching* software has been integrated in several courses of the Elementary Education Program at Southern Illinois University at Edwardsville, thereby involving all elementary education majors in four stages of utilization of the software. In the first stage, students enrolled in the Foundations of American Education course (the initial course for all education majors) are introduced to the software through discussions of the

cases already in the databases. The software is demonstrated by the instructor, and students are then encouraged to browse through the databases and enter opinions and alternative ideas for solutions of the problems described in the cases. In this way, the students are encouraged to reflect on the situations, and to compare what is described in the cases to what they see during the 20 hours of field observations that are required in the course.

After the introductory course, elementary education majors enroll in a general methodology course where they are required to write a description of a critical incident ("mini-case") they observed during their field work in the public schools. The students enter their case description into the database and continue to examine the other incidents that are already entered in the database. Part of the process involved in creating a new case requires the students to link aspects of their description to other cases in the database, supporting a reflective process whereby they identify similarities and differences between what they observed and what others have observed. Particularly important in this reflective process is the consideration of how the situation was resolved, and the alternative solutions that might be considered. Students also continue to respond to other cases in the database by viewing and commenting on analyses made by other participants.

The third stage of integration of the *Chronicles of Teaching* software into the teacher education curriculum occurs in several of the five methods courses that students must complete. For example, in the Social Studies Methods class, students are required to write two critical incidents they have observed during their 100 hours of classroom experiences completed during this block of the program. The critical incidents at this phase might describe incidents they have observed or that occurred while they were actually teaching. Again, participants are encouraged to respond to other cases by viewing and commenting on analyses of the other cases in the database.

The last stage of curriculum integration takes place during student teaching. All elementary student teachers are required to produce a description of a critical incident that occurred during their student teaching and place it in their final senior student teaching portfolio as well as enter the case in the database. As time permits, these students are also encouraged to continue responding to other cases. Hopefully, student teachers and even alumni will continue to take advantage of the case descriptions collected in the database to reflect on their teaching and learn from the analyses and alternatives suggested by users of the *Chronicles of Teaching* software.

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