LITERATURE REVIEW: TUTORING

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Introduction

Tutoring research is an expanding field, but the vast majority of studies have been conducted at the elementary and middle school level (Kenny, 2004; Lepper et. al., 1990, 1997; Cohen 1982; Graesser & Person, 1994; Lesh & Kelly, 1997). The research focus of many of the studies is primarily learning issues for intelligent tutoring systems for computers. These researchers are developing computer based "intelligent" tutors. So, despite the claim of these researchers that the findings and characterizations of tutoring from these studies are applicable to any content area, they may not address key issues of adult learners at the college level.

I will give a cursory description of the current research that has taken place at the K–12 level on tutoring and tutoring strategies. Many of these studies focus on the educational psychology aspects of the interactions and discourse that occur during a tutoring session, and the effect of questioning on student achievement.

I will describe what research into tutoring has shown about the cognitive and motivational aspects of tutoring and its structure. Research does reveal that motivation directly influences how often students use learning strategies, how well they do on curriculum-related tests, and how long they persevere and maintain skills after the tutoring sessions are over. Therefore, it is important to know what our students' motivations are. Brophy (1998, p. 3) defines motivation as "a theoretical construct used to explain the initiation, direction, intensity, and persistence of behavior, especially goal-directed behavior." The one-on-one interpersonal interaction and the characteristics of learners seeking tutoring give us the opportunity to explore the assessment of the causal factors of motivational change.

Finally, I will discuss the characteristics of the student seeking tutoring. There were few research studies that addressed this area for the college-level student, so I will review the research done at the K–12 level. (It must be noted that at the K–12 level, many students are recommended or signed up for tutoring by their parents and/or teachers).

Review

What is tutoring?

Teaching on a one-to-one basis is perhaps the most traditional form of instruction, whether in the form of a private tutor for children of the elite, or in the informal education that takes place between apprentice and craftsperson, or even in interaction between parent and child. In fact, tutoring is often considered the most effective method for teaching (e.g., Bloom, 1984; Graesser, Person, & Magliano, 1995; Lepper et al., 1997). Moore (1968) writes, “The tutor is not a teacher in the usual sense: it is not his job to convey information. The student should find for himself the information. The teacher acts as a constructive critic, helping him to sort it out, to try out sometimes, in the sense of exploring a possible avenue, rejecting one approach in favor of another.”

Most tutoring research has focused on the learning benefits for tutees, demonstrating tutoring’s effects in enhancing tutee content knowledge and/or tutee meta-cognition and strategy use (e.g., Bloom, 1984; Cohen et al., 1982). For instance, Bloom (1984) found that individualized instructional tutoring resulted in student mastery of the material at a much greater level than in the conventional classroom, such that “the average tutored student was above 98% of the students in the control class” (p. 4). Cohen et al.’s (1982) meta-analysis of over 50 different studies on tutoring’s effect on exam scores found a smaller, but still substantial, mean effect size of .40 for tutoring. Tutoring has also been shown to enhance student persistence (e.g., Maxwell, 1990). Many tutoring studies have been carried out in mathematics, with respect to the elementary school child, (e.g., Bloom, 1984; Derry & Potts, 1998; Graesser & Person, 1994; Graesser et al., 1997; Lepper & Chabay, 1988; Lepper et al., 1990, 1993; McArthur et al., 1990; Person & Graesser, 1999; Person, Graesser, Person et al., 1995; Putnam, 1987; Lesh and Kelly, 1997). Given the above studies in tutoring, there is a notable lack of research in this area at the college level.

“Traditional” Tutoring

Research into the tutoring process indicates that one of the differences between classroom interactions and tutoring interactions (e.g., Fox, 1993; Graesser et al., 1995, 1997) is the amount of intensive collaboration that occurs on problem solving. Tutoring researchers have also attempted both macro- and micro-analyses of one-on-one tutorial structure. As Fox (1993) has pointed out, “the immediate goal of tutoring… is inextricably tied to the particulars of the situation” (p. 83); it is in these particulars that actions and language, which may enhance student motivation (and, of course, achievement as well), reside.

For Putnam’s (1987) math sessions, he suggested that the overall pattern of tutoring followed a teaching structure he referred to as

“curriculum scripts.” These are a top-down mini-lesson, in which tutors tend to use a standard set of explanations, examples, and problems. Curriculum scripts are very similar to classroom teaching; they comprise “a loosely ordered but well-defined set of skills and concepts students are expected to learn, along with the activities and strategies for teaching this material.” Rather than attempting to determine or “model” faulty tutee knowledge and make instructional decisions from that awareness, then, Putnam’s tutors instead tended simply to re-teach the topics, with some modifications due to student input. However, specific features of Putnam’s experimental design (including selection of classroom teachers as tutors and the task tutors were asked to accomplish) likely were responsible for this instructional pattern.

Research by McArthur et al. (1990) on three tutors working with remedial high school algebra learners found that the tutors varied in their routines of tutoring. While some tutors followed a policy of “modeling-scaffolding-fading” in their presentation of materials, others provided less upfront presentation of information, “deliberately supply[ing] little information when introducing a task, instead preferring to deal with student difficulties when errors arise” (p. 226). Frequently, these tutors tended to have a set series of appropriate actions to carry out in response to student errors. McArthur et al. (1990) termed these action sequences “microplans”; Merrill et al. (1995) also found evidence of tutors using microplans to respond to tutee errors.

Based on an analysis of math and statistics tutoring, Graesser and Person and their colleagues (e.g., Graesser & Person, 1994; Graesser et al., 1997; Person & Graesser, 1999; Person et al., 1995) created a “dialogue frame,” which they used in analyzing other concerns (such as question-asking and conversational strategies). A modified version of the standard “initiate-respond-evaluate” (I-R-E) pattern (e.g., Cazden, 1988). Graesser’s frame included five steps: “1. Tutor asks a question. 2. Student answers the question. 3. Tutor gives feedback on the answer. 4. Tutor and student collaboratively improve the quality of (or embellish) the answer. 5. Tutor assesses student’s understanding of the answer” (Person et al., 1995, p. 167). Proponents of this model suggest that the final two steps are the crucial ones for distinguishing tutoring from regular classroom teaching.

MacDonald (1991) also investigated interactional patterns in four one-on-one college peer tutorials in different disciplines, finding additional elements beyond the I-R-E routine. MacDonald’s model began with the same initiation, reply, and evaluation aspects, but also included "additions," un-requested clarifications or elaborations of the topic; and "markers," short utterances indicating attention and topic boundaries. MacDonald’s research suggested that tutors were the primary providers of explanations and additions, and that this took place when an error was discovered.

Based on their study of computer programming instructional tutoring, Merrill et al. (1995) described a more complex discourse categorization

system in which every tutor or tutee utterance was classified into one of 36 categories. These researchers found that the primary activity was tutee problem solving, frequently of several problems in a row. This problem-solving activity was often framed by tutor guidance, error feedback, and confirmations of steps. Less frequently, tutors also assessed tutee understanding, modeled problem solving themselves, and checked tutee answers. Lepper et al. (1997) found that "effective [math] tutoring sessions seem[ed] to share a fairly predictable 'helical' structure," characterized by "a progression of increasingly difficult problems for solution by the tutee, with the tutor providing both cognitive and motivational scaffolding of the student's work when needed" (p. 120). This cycle of problem selection, presentation, solution, and reflection was generally repeated, and was occasionally interspersed with a "pure instruction phase" (p. 125).

Questions in Tutoring

Graesser and his colleagues (e.g., Graesser et al., 1995, 1997) have suggested that the frequency and depth of questioning by tutors and tutees is one of the reasons for tutoring's effectiveness in enhancing student achievement relative to classroom teaching. Graesser and other researchers have looked at aspects of questioning to determine how they relate to student achievement. Graesser and Person (1994) and Person et al. (1994) tallied and categorized student questions and answers in math and statistics tutorials. Their categorization was comprised of 17 question categories, four triggering mechanisms for questions, and four "quality categories" for answers; these discourse features were correlated with course achievement outcomes. Among other results, the study found that tutors asked most (80%) of the questions; that "deep-reasoning" questions (e.g., "why," "how," etc.) were useful in gauging student comprehension and in leading to collaborative discourse; and that students frequently gave misleading positive responses to tutor comprehension-gauging questions (e.g., "do you understand?"). Graesser and Person (1994) found that tutee "deep-reasoning" questions correlated with exam scores.

The Importance of Motivational Factors

The effectiveness of tutoring is frequently linked to motivational factors. Tutoring theory and research suggest that successful tutoring—like successful teaching—should support both students' academic achievement and their motivation toward the subject matter. Tutoring research suggests that effective tutors are aware of the importance of both cognitive and motivational factors in their work with tutees. For example, tutors' selection of topics and problems to work on and the ways in which they provide feedback are frequently guided by motivational considerations (e.g., Lepper et al., 1997). Motivational factors seem especially important in the context

of remedial tutoring, in which the student may have a history of failure, difficulty, and low self-confidence (see, for example, Lepper et al., 1993).

Early work on tutor "roles" by Harris (1980) also pointed out that tutors could not neglect the motivational and affective side of tutoring. Rather than simply teaching the subject material, tutors were directed to fulfill a "coach" role, involving teaching strategies; a "commentator" role of providing evaluation and context for the learning; and a "counselor" role, providing affective support. In 1998, Derry and Potts investigated the personal constructs five tutors used to classify their tutees; their cluster analysis revealed that the tutors tended to classify their students in terms of two factors: ability and motivation. This "modeling" of students influenced the tutors to adjust both the content and presentation of the tutorial based on what they expected to be most successful for a given tutee.

Lepper and Chabay (1988) explicitly noted the importance of motivational concerns in tutoring: "motivational factors may often prove as critical as cognitive factors in determining the results of a tutorial interaction" (p. 254). Likewise, Lepper et al. (1993) found that tutors attempted to use two diagnostic models—one cognitive, one affective—to characterize their students' problems and progress, and endeavored to balance the demands of these two areas in their practice. A survey of tutees conducted by Krabbe and Krabbe (1995) suggested that students expected their tutors to give them the assistance they needed academically, as well as to provide affective support. In fact, in describing what tutees liked best about their tutors, tutor personality was listed more often than was their skill in teaching the material (Krabbe & Krabbe, 1995, p. 22).

Lepper et al. (1997) created the acronym "INSPIRE" to describe the techniques and characteristics of the most expert tutors from their studies. These tutors were Intelligent, knowledgeable both in the subject and in pedagogy; they were Nurturant, giving tutees attention and empathy; they were Socratic, preferring to give indirect feedback through questions; they used consistent and Progressive routines to introduce material and to point out areas of difficulty; they provided Indirect and polite feedback; they were Reflective, encouraging students to consider the underlying reasoning and the relationship to real world problems; and they were Encouraging, interested in enhancing tutees' motivation and confidence. Thus, these tutors were aware of both motivational and cognitive domains in their work with tutees. As tutors—especially expert tutors—appear to give weight to motivational factors in addition to cognitive ones, tutoring seems an appropriate venue for addressing how these motivational factors may be modified.

Students needing remedial tutoring due to difficulty or inability to comprehend the topic as presented in class should ideally be tutored "in a manner that will not further discourage or distress" them (Lepper et al., 1993, p. 78), and indeed that will enhance their current and future

motivation to learn. Students struggling in an instructional setting, with a history of failure or (at the very least) dissatisfaction with their classroom performance, may be impelled to seek tutoring. Such students would likely have low feelings of self-confidence (both for current performance and for future learning), based on their lack of success in the classroom context. Understanding these motivational factors should help teachers and tutors plan effective instruction for struggling math students. However, little is known about the actual profile of achievement motivation among the population of college students seeking math tutoring.

Expert Tutors and Motivation

To what extent does research into tutoring suggest that tutees' achievement motivation beliefs might be alterable? Expert tutors are typically quite concerned with providing opportunities for student success, reducing anxiety, and increasing tutee affect and competence (e.g., Lepper et al., 1997). "Expert tutors also help make assignments supportive of mastery goal orientation and model the belief that any student can be helped to learn" (Lepper et al., 1997, p. 132). For instance, four major motivational or affective goals to which tutors attend (at least when working with remedial learners) have been identified (Lepper et al., 1993, p. 80). These goals are (1) producing an appropriate level of challenge for the learner, (2) creating in the learner a sense of personal control, (3) enhancing learner confidence (especially important for self-efficacy), and (4) fostering a high level of curiosity (Lepper et al., 1993, p. 80). In a series of studies by Mark Lepper and his colleagues (e.g., Lepper & Chabay, 1988; Lepper et al., 1990, 1993, 1997) expert tutors used a variety of strategies to achieve these goals with their struggling elementary math tutees. To evoke curiosity, tutors in Lepper et al. (1993) used "Socratic" questioning techniques and contextualized problems in either real-world or fantasy settings (pp. 93–96). To challenge tutees, Lepper et al. (1993) found that expert tutors selected problems of appropriate difficulty levels, scaffolded these problems, and influenced the subjective perceptions of task difficulty by directly challenging the student, emphasizing task difficulty, and by engaging in playful competition with the student. Selecting tasks of the right level for the students, such that they were challenging but solvable, should also lead to feelings of competence.

Avoiding explicit negative feedback seems to be another way in which tutors foster feelings of student competence. Positive feedback "enhances perceived competence" (Deci, Vallerand, Pelletier, & Ryan, 1991, p. 333), whereas negative feedback tends to decrease motivation. Researchers have found that expert tutors typically do not correct student errors or even label them as such (e.g., Lepper et al., 1990, 1993, 1997; Person, Kreuz, Zwaan, & Graesser, 1995). Instead, the tutors use hints and ask guided questions focusing tutees on the problem area. The effectiveness of this approach in

enhancing student competence was demonstrated in an experimental study with non-remedial fourth-graders, in which students tutored with an indirect style of error correction "selected significantly more difficult problems to attempt" than did students tutored under a direct error correction style (Lepper et al., 1990, p. 231). Lepper et al. (1990) found that expert tutors minimized failures by describing wrong answers as "a good first step, a close approximation, or an excellent guess" (p. 90); similarly, Graesser, Bowers, Hacker, and Person (1997, p. 155) noted that tutors in their studies provided positive-sounding feedback more frequently than negative feedback, even when student contributions were incorrect. Apparently, then, providing indirect and/or positive feedback is beneficial for fostering both feelings of learner competence and a sense of appropriate challenge. This sort of feedback should promote self-confidence as well as providing the impetus toward mastery and intrinsic valuing of the task.

Successful tutors also expend considerable effort promoting students' feelings of control and autonomy. Lepper et al. (1990) found that tutors both objectively and subjectively transferred control to the tutees; objectively, by offering real choices about content and procedure and by soliciting student input; subjectively, by indirect feedback, emphasizing student agency, and offering the appearance of choice to the student (i.e., asking if they wanted a harder or easier problem, but providing the same problem in either event) (pp. 93–99). Merrill and colleagues (1992) also observed that "experienced human tutors maintain[ed] a delicate balance, allowing students to do as much of the work as possible and to maintain a feeling of control, while providing students with enough guidance to keep them from becoming frustrated or confused" (p. 280). Expert tutors' actions seem in keeping with recommendations for creating an autonomy-enhancing environment for students by "offering choice, minimizing controls, acknowledging feelings, and making available information that is needed for decision making and for performing the task" (Deci et al., 1991, p. 342). The extensive scaffolding tutors provide, coupled with direct instruction when necessary (e.g., Lepper et al., 1997; Merrill et al., 1995), also ensures that students have the necessary information for task completion.

Lepper et al. (1990) reported on a series of descriptive and experimental studies investigating how expert tutors attributed student achievement in the context of elementary-school level mathematics tutoring. Rather than attribute student performance to internal, unstable, controllable causes like effort, as these authors hypothesized, expert tutors in Lepper et al.'s (1990) study consistently "focus[ed] primarily on highlighting the high difficulty of the task, and secondarily on noting the considerable ability of the student" (p. 223).

Characteristics of Students Seeking Tutoring

In the research studies mentioned above (e.g., Bloom, 1984; Derry & Potts, 1998; Graesser & Person, 1994; Graesser et al., 1997; Lepper & Chabay, 1988; Lepper et al., 1990, 1993; McArthur et al., 1990; Person & Graesser, 1999; Person, Graesser, Person et al., 1995; Putnam, 1987; Lesh and Kelly, 1997) the age group studied was the K–12 group. This group has no autonomy in seeking out tutoring. For example, in Lesh and Kelly's study (1997), the students were recommended for tutoring and had to participate for the duration of the study. Participation of many of the students in the studies discussed above was dependent on failing grades.

Characteristics of college-level students who seek tutoring have been largely unexplored. However, the difficulties that college students face in learning mathematics have been explored in recent research. This research focus is related to the construction of knowledge drawing on the work of Piaget (Jaworski, 2002). Jaworski (2002) was aware of how mathematics learning at the grade school level was characterized, but was interested in how learning and teaching develops at the college level. Her work built on the theoretical perspectives of cognition; aspects of pedagogy and other aspects of learning were clearly developed in order to help the researchers look at "particular moments" of interactional discourse. Clearly missing were references to the attributes of the students seeking tutoring.

Other studies have shown that unsuccessful students cannot correctly interpret their level of understanding of algebra concepts, nor can they evaluate their need for assistance (Greenberg, 1991). Given the above studies in tutoring, there is a notable lack of research in this area at the college level.

Summary

The research indicates that many students enter higher education with a deficit in mathematics for various reasons. For example, frequent problems include a poorly implemented high school curriculum, nontraditional students whose content knowledge is lacking, and those for whom lack of motivation is a key factor in their failure at the college level (Waits, 1988). Despite their need for assistance many students remain reluctant in seeking out tutoring. Unclear in the research is the descriptors of students utilizing tutoring at the college level. Unclear also is the number of tutoring sessions that are required to obtain mastery and goal attainment in the mathematics area.

In summary, the research has indicated that there are strategies that provide structure to tutor interactions. While the majority of the research has been in the K–12 arena, it remains to be seen if those strategies can be implemented successfully at the college level.

Also, the context of tutoring enables us to research the motivational characteristics of the student who seeks help. Little work has been done in

identifying characteristics of students that seek tutoring and in whether their motivations can be modified.

It is clear that the amount of interaction that is involved in a tutoring session differs substantially from classroom interactions and may play a part in the motivational characteristics of the successful student.

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