

3.7 What are the Roles of Individual Interest, Task Difficulty, and Gender in Student Comprehension?¹

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Although educators, parents, in fact probably everyone who works with another person takes it for granted that interest influences comprehension, findings overviewed in this paper suggest that interest does not always assist student comprehension. In fact, together with task difficulty and gender, interest appears to alter the extent to which students are able to access, process, and complete the passages and problems they are assigned. For example:

- Girls may be more likely than boys to complete accurately problems that have their *noninterests* as a context, whereas boys appear to be more likely to complete accurately problems that have their *interests* as a context.
- Students with a specific interest in reading are likely to recall passages about their *interests* just as well as they recall passages about their *noninterests*.
- Students with a specific interest in mathematics are only minimally influenced by the task difficulty of the problems they are assigned.

Thus it seems logical to ask: *What are the roles of individual interest, task difficulty, and gender in student comprehension?*

Introduction

Early theoretical work certainly suggested the importance of interest as an influence on student attention and the effort students put forth to learn (cf. Baldwin, 1911; Dewey, 1913; James, 1890), where interest was conceptualized as including both the stored knowledge and the stored value for a class of object, or what since has been labeled individual interest. It described interest as schooling student attention and therefore influencing the kind of learning that students were ready to accomplish. In fact, interest was understood to be universal. Later research then

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corroborated the strong influence of interest on both the attention and memory even young children have for tasks (Renninger & Wozniak, 1985).

Despite evidence of the effect of interest on attention and memory, however, it is still not clear to what extent student interest in a task actually influences comprehension, where comprehension is understood to refer to consolidated understanding, not memorization of facts. Some evidence suggests that for adults, deeper processing occurs in reading about topics of interest to them (cf. Schiefele & Krapp, 1996), but we do not really know what aspects of the process of reading a text, for example, are facilitated by the presence of interest and whether these aspects are different for school-age students. Is it generally the case that interest captures attention and thus helps students engage in a task, or are there more specific task elements, difficulties, or strategies that are influenced? Does interest in a task by definition presume more procedural knowledge, or more easily developed levels of procedural knowledge? Does interest lead development in terms of students' attention to the elements of a task or abilities to develop strategies to work with it? To what extent do students use interest to assist themselves as they work on tasks?

To date, research on interest has tended to focus more on the content of tasks to be assigned to students than on the way they will process information or how their instruction might be adjusted accordingly. The work overviewed in this paper represents basic research necessary for a shift in emphasis. It addresses the question: What is the role of interest, task difficulty, and gender in student comprehension?

Individual Interest: Some Background

Building most specifically on the work of Baldwin (1911), Dewey (1913), and Vygotsky (1967), individual interest is used here to refer to an individual's stored knowledge and stored value for a class of objects (subjects), events, or ideas. This is not a static knowledge/value system but rather a system that is dynamic, a process of consolidating and revising what is understood as a function of interactions with the environment – others, objects, and events. It is conceptualized as one system since what is valued can only be derived from what is known. Thus, interest becomes a lens through which the individual understands and engages the social and physical world, affecting the nature of questions people pose and the resources on which they draw in problem solving.²

2 Here problem solving is used in the broad sense to refer to playful, if not specifically reflective, behavior.

I assume that individual interest is universal, although I expect that the actual contents of interest will vary by individual. Furthermore, I consider interest to be a psychological state that derives from a particular subject-object interaction. Interests are expected to evolve over time as a person's knowledge and experience are consolidated and new opportunities and challenges are encountered (see discussions in Renninger, 1989, 1990).

Methodologically, individual interest is operationalized as those classes of objects, events, or ideas for which students have both more knowledge and more value (stronger positive feelings) than they have about other such classes. In contrast to interest, noninterest refers to those classes of objects, events, or ideas for which the individual has knowledge but low value relative to other such classes.

Several aspects of this approach to operationalizing interest and noninterest differ from the approach others have taken. First, interests and noninterests are always assessed relative to the other engagements of the student. This permits the identification of clear interests for the student, and a consideration of differences among students in the way in which they consider their engagements (some students rate everything in extremes; others are more likely to have neutral responses). It also means that the identification of students' interests and noninterests is conducted relative to each student and his or her activity. Second, students are not asked to identify their own interests or noninterests, since pilot work indicates that students are not usually reliable sources of information about their own interest, when interest is to be distinguished from preference and attraction. In fact, from a theoretical perspective, neither preferences nor attractions necessarily involve much stored knowledge (see Renninger & Leckrone, 1991). Third, interest is studied as an independent variable in order to permit a preliminary mapping of the role of interest in the process of students' work. Finally, interest is studied as a context for reading passages and for mathematical word problems, in order to evaluate its effect across subject areas.

Task Difficulty and Gender: Some Background

Task difficulty and gender are two variables that have been linked to interest but have not been studied in ways that permit a clear understanding of their particular relation to it.

Task Difficulty

Research and teaching practices have typically conflated interest and achievement. It has been assumed that interest affects and results in

achievement, even though the tasks presented to students typically are not evaluated with respect to the individual ability of students to perform them. In order to control for differences between students as a function of task difficulty in the present project, tasks (expository texts and mathematical word problems) were individualized for students.

Building on the work of socio-cultural psychologists who have suggested a window, or zone of proximal development, for learning (cf. Newman, Griffin, & Cole, 1989; Vygotsky, 1978), as well as the findings of Berlyne (1969), Hebb (1949), and White (1959), who described the roles of optimal challenge, complexity, and the necessity of competence for students' attention to tasks, it was further decided to evaluate two levels of task difficulty for each student. Thus, students were assigned two levels of tasks (passages or word problems). Each student received passages and problems that could be accomplished independently (mastery level, or low-difficulty tasks), and passages and problems for which he or she would need assistance (instructional level, or high-difficulty tasks). In fact, for this project, each student received interest low-difficulty, noninterest low-difficulty, interest high-difficulty, and noninterest high-difficulty passages/problems.

Gender

Just as interest and achievement have been conflated, so have research and practice regarding interest and gender. In fact, there are at least three different reasons to study gender and its particular relation to interest. First, early research into students' work with text suggested that both content and performance differences were a function of gender (cf. Asher, 1979). Given that these studies presented students with tasks that varied in levels of difficulty, it seems useful to reconsider the relation between interest and gender in the present project.

Second, it is a prevailing (although often an unreflective) practice of teachers and schools to organize curriculum in the early grades to meet the "interests" of boys (cf. Spache & Spache, 1977; Spender, 1982). Why does it work to organize curriculum to meet the interest of boys and not girls? Presumably this practice builds on teachers' implicit knowledge about the way in which many boys and girls go about learning. It also may be linked to the neurological development of boys and girls at this age (cf. Davis & Emory, 1995). Regardless of the source of this information, it appears necessary to evaluate the assumed connection between interest and gender. Finally, discussions of gender as a system of values or a process of enculturation (Belenky, Clinchy, Goldberger,

& Tarule, 1986; Gilligan, 1982; Golombok & Fivush, 1994) suggest the need for a clearer articulation of the specific influences of interest, task difficulty and gender in students' work with the tasks they are assigned—the kinds of assumptions that exist, and their legitimacy. Such information would permit consideration of the particular effects of interest, task difficulty, and gender, and their implications for working effectively with all students (and their teachers) to understand their power and possibilities.

Task Difficulty, Gender, and Performance: An Overview

What are the roles of individual interest, task difficulty, and gender in students' comprehension? In this section I review findings from three parts of a larger project focused on this question. The first part consists of findings from the qualitative analysis of the types and strength of students' individual interests and an assessment of the role of interest, task difficulty, and gender in student performance in reading and mathematics. The second part of the project is an experimental evaluation of the roles of individual interest, task difficulty, and gender in students' comprehension of expository text, as well as a re-analysis of the performance of students whose identified interests or noninterests included reading. The third part is an experimental evaluation of the roles of interest, task difficulty, and gender in students' comprehension of mathematical word problems, as well as a re-analysis of the performance of those students whose identified interests or noninterests included mathematics.

General Method

The study was conducted with 259 suburban fifth and sixth grade public school students (128 Boys, 130 Girls) as part of their ongoing classroom work with expository text and mathematical word problems. The subsample of students identified as having specific interest in reading included 63 students (26 B, 37 G). The subsample of students identified as having a specific noninterest in reading included 39 students (21B, 18G). The subsample of students identified as having a specific interest in math included 20 students (11 B, 9 G). Finally, the subsample of students identified as having a specific noninterest in math included 79 students (37 B, 42 G).

Briefly, the design of the experiment included a questionnaire and two preliminary worksheets that together were used to inform the development of an individualized target worksheet for each student in reading and in mathematics. First, a Likert-type questionnaire that

assessed students' knowledge of, feelings about, and actual level of activity with each of 40 items (i.e., football, math, music) was presented to all of the students. Data from this questionnaire were used to identify interests and noninterests for each of them. Next, neutral-context pretests were presented in order to identify low and high levels of task difficulty in the two subject areas for each student. Information about each student's individual interests and noninterests and levels of task difficulty were then used to develop individualized target worksheets in reading and mathematics. Each target worksheet consisted of four types of passages or word problems: interest and low difficulty, interest and high difficulty, noninterest and low difficulty, and noninterest and high difficulty.³

Results

Types and strength of interest and noninterest

All of the students' identified interests and noninterests were strong, although overall girls' interests were more likely to be strong than were boys'. The most frequently occurring interests were: swimming, biking, listening to the radio, dogs, and soccer. The most frequently occurring noninterests identified were: homework, setting the table, jumping rope, washing dishes, and mathematics. Only ballet was identified as being of interest to girls but not to any of the boys. Only movies and videos were identified as being noninterests for girls but not for any boys. These findings suggest that students' individual interests and noninterests vary widely and that one student's interest was not as a rule the interest of other students. In fact, one student's interest was often the noninterest of another student.

Roles of interest, task difficulty, and gender in comprehension

The effects of students' interest in the context of the passage or problem, level of task difficulty, and gender on their comprehension of expository text and mathematical word problems were studied using a series of 2 (value: interest or noninterest) x 2 (task: low difficulty or high difficulty) x 2 (sex) MANOVAs in which both value and task were repeated measures. Where three-way interactions emerged, the Least-Significant Differences Test (LSD) was employed to compare means.

In this portion of the project, then, each student's work with the target worksheets in reading and in mathematics (passages in reading and word problems in mathematics) was studied relative to his or her own

3 It should be pointed out that the passages were expository texts specifically designed to extend rather than restate information that students had about their identified interests and noninterests.

work in each task condition (i.e., interest, low difficulty; noninterest, low difficulty; interest, high difficulty; noninterest, high difficulty).

Reading. The study of the effects of students' interest, task difficulty, and gender on their reconstructive recall involved an evaluation of their work with a modification of Anderson, Mason, and Shirey's (1984) reconstructive recall task. Students were asked to read an assigned passage, answer two unrelated buffer questions, and then write down as much as they can remember of the passage. This procedure was repeated for each of the four passage types.

Dependent variables included: points remembered, gists recalled, sentences written, paragraphs included, type of overall gist, number of paragraphs represented in recall, order of points in recall, accuracy of recall, and distortions in recall (misreading, misunderstanding, misremembering, miscombined information, mislabeled information, extraneous information included, added information, elaboration on text, and comments).

Interest was found to influence student performance on all of the variables evaluated, with the exception of order of recall. Based on these findings, it appears that interest influences how accessible students find tasks, as well as their ability to work with different passages. In general, students were not likely to be influenced by task difficulty in reading, although they were likely to recall fewer paragraphs on high difficulty than on low difficulty passages.

There were few gender differences. Those that did emerge suggested that when students had difficulty recalling factual information from the passages, girls were more likely than boys to recall the concepts presented in a passage accurately but to make factual mistakes in their recall.

Reanalysis of the performance of the subsample of students who could be identified as having a specific interest in reading indicates a very different pattern of effects. These students did not perform differently as a function of the embedding of an identified interest in the passages they were assigned. It appears that their interest for reading was so strong that it outweighed the influence of variations in the embedded context. They were more likely to remember more points, recall more gists, write more sentences, include more paragraphs, and recall the gist if the passage had a context of interest rather than noninterest.

Students with a specific interest in reading were more likely to make mistakes in their recall because of having misunderstood passages with contexts of noninterest and having misremembered passages of low

difficulty. The findings also suggest both that the students did distinguish between the task conditions and that they may have presumed that they understood noninterest or low difficulty passages better than they really did. This would indicate that students are distinguishing between the task conditions of interest and difficulty even if they are unaware that they are doing so. Girls in the specific interest sample were also more likely than boys to recall more gists and to add more relevant information to their recall of high difficulty passages, whereas boys were more likely than girls to recall more gists and to add more relevant information to their recall of low difficulty passages.

It is unclear why girls and boys with a specific interest for reading respond differently to the presence of interest and levels of task difficulty in the passages. Nor is it clear why when students were accurate and incomplete in their recall, this was more likely to characterize the boys' work than the girls'. The question of their orientation to learning might be raised in explanation, but the direction of such an explanation would differ from current discussions such as those of Pintrich, Ryan, and Patrick (1996), who report that a mastery orientation is only adaptive for females—unless mastery is understood by these students as linked to challenge/difficulty. It is the case that a mastery orientation has been linked to the readiness to assume challenges (cf. Ames, 1992). It also is the case that the relation between interest, problem solving/comprehension behaviors as studied here and goal orientation have not been detailed. Clearly, such study needs to carefully consider the apparent distinction between individual interest as embedded context and individual interest for the subject matter under study, specific interest (see related discussions in Hoffmann & Häussler, Todt & Schreiber, Gräber, all this volume).

In contrast to the findings regarding the subsample of students with a specific interest for reading, the sample of students with a specific noninterest for reading was influenced by interest in much the same way as the overall sample of students. Furthermore, interactions of interest, task difficulty, and gender indicate that task difficulty becomes more salient for students identified as having specific noninterest for reading.⁴ Thus for the contexts in which interest was embedded, it appears that, like interest, noninterest affects the way in which the student perceives a passage and the demands involved in its recall. In particular, girls were more likely than boys to include more points and more gists, and to be more accurate and complete in their written recall of high difficulty

4 The reader is here reminded that levels of task difficulty were individualized so that no student's task was more or less difficult for him or her than the next student's.

interest passages. Boys, however, were more likely than girls to include more points and more gists, and to be more accurate and complete in written recall on low difficulty interest passages.

Math. The study of the effect of student interest, task difficulty, and gender on their work with individualized mathematical word problems included an evaluation of accuracy and error type (copying, computation, partial set-up, set-up, unfinished problem, unattempted problem). In contrast to the findings reported for reading, the main effects for mathematics seem to be limited to task difficulty, where it appears that in general all students are less accurate and make more errors on high difficulty problems. Interactions, on the other hand, suggest a picture of girls and boys differentiating between interest for the problem and its level of task difficulty.

Girls, for example, were more likely than boys to make fewer set-up difficulties on problems with contexts of noninterest, whereas boys were more likely than girls to make fewer set-up errors on problems of interest to them and when they could only set part of the problem up, they did so on interest rather than noninterest problems.

For the purposes of the present discussion, students' set-up errors are considered to be indicators of their lack of comprehension of the question posed in the word problem. Findings such as these suggest that intentionally embedding context in word problems assists all students, but that embedding interest as problem contexts is most likely to assist boys' comprehension, while embedding noninterests as problem contexts is most likely to assist girls' comprehension.

Like the subsample of students with a specific interest in reading, the subsample of students with a specific interest in mathematics was not influenced by the embedding of interests or noninterests in the context of the problem. These students were also only marginally influenced by the level of task difficulty. When they made computation errors, for example, girls were more likely than boys to make such errors on low-difficulty problems and boys were more likely than girls to make computation errors on high-difficulty problems. Such findings suggest that interest in mathematics may not only influence the likelihood that students can work with varying contexts, but also the likelihood that the difficulty of the task generally does not make a difference to students—even when it is, for them, a more difficult task.

As in the case of the subsample of students with specific noninterest in reading, the comprehension of students with a specific noninterest for mathematics was affected by the presence of contexts of interest and noninterest in the word problems. Girls in the specific noninterest

sample, for example, were more likely than boys to make set-up errors on problems of interest, whereas the boys were more likely than girls to make set-up errors on noninterest problems.

Discussion

It appears that the respective roles of interest, task difficulty, and gender vary as a function of the subject area under investigation, and according to whether interest is embedded in the task of comprehension or is the subject area in which contexts are being embedded. Findings from this portion of this project suggest that there are content differences in what is of interest (and noninterest) to students. They confirm findings that suggest that interest can influence student comprehension. They also extend these findings by providing evidence that interest does not always assist comprehension, and that together with task difficulty and gender, interest can alter the way in which students work with the passages and the problems they are assigned. Furthermore, they suggest that while interest, task difficulty, and gender all influence students' comprehension, these variables are both independent and joint influences, depending on the aspect of task completion being evaluated.

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