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Study-strategy use in learning from text. Does gender make any difference?

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Abstract. Two studies explored the existence of gender differences in spontaneous study-strategies use while learning from texts. In Study I, the Learning-from-text test (LFT), intended to measure deep-level text comprehension skills by high-school graduates, was about philosophy (n = 200) and in Study II about statistics (n = 487).

The results of two sets of data showed significant gender-associated differences in strategy use: female participants used overt study strategies, in particular notetaking more often than male participants. However, no differences between men and women in comprehending either statistical or philosophical texts were found. It was concluded that different study strategies more than gender differentiate the learning outcomes.

Keywords: gender differences, study-strategy use, text comprehension

Recent research in text comprehension has helped us understand what it means to be an effective reader (Lorch & van den Broek, 1997; McNamara, Kintsch, Songer & Kintsch, 1996; Mayer et al., 1996; Greene & Ackerman, 1995). In general, there is a consensus that learning from a text requires the learners to form deep-level mental representations of the text material (e.g., van Dijk & Kintsch 1983; Lonka et al., 1994). Moreover, a parallel set of results have been replicated about the efficacy of using generative study strategies during comprehension (Lahtinen et al., 1997; Lonka et al., 1994, 1996; Slotte & Lonka, 1998, 1999a, b). That is, strategies such as concept mapping and summarising, which increase the active transformation of knowledge, lead to deep-level text comprehension rather than to reproduction.

However, despite many studies on spontaneous study strategies, the issue of gender differences in strategy use has not been addressed previously. Yet, gender is a fundamental component of identity and the primary way of classifying humans into groups (Halpern, 1997). This classification can be seen in all education, not the least when selecting new students to university.

The existing findings concerning gender differences in higher education are far from conclusive. While some differences between men and women

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have been identified, their magnitude has been small, and with little consistency in direction across studies (Richardson & King, 1991). This may in part be due to the fact that most gender-associated studies in student learning are based on students' responses to formal inventories or questionnaires to quantify their approaches to studying (Meyer, 1995; Meyer et al., 1994; Richardson, 1993; Severiens & ten Dam, 1997; Wilson, Smart & Watson, 1996). It is thus not yet clear whether men and women differ in what they *actually do* when engaging a given task in a particular context. According to the previous results (e.g., Kimura, 1992), one would assume that female students spontaneously use more verbal study strategies in comparison to their male counterparts, and that men would rely more than women on spatial strategies. Is this true when studying real material in real learning situations? What is the role of subject domain?

The purpose of this article is, first, to see whether any gender differences in spontaneous strategy use exist and, second, to examine the effect of these strategies on learning outcomes, taking into account the subject domains of philosophy and statistics. Two separate studies were carried out in a highly demanding learning situation, that is, in an examination taken for admission to a Finnish medical school.

Study activities and the quality of learning

Empirical research has consistently identified that different ways to perceive and engage in learning tasks have an effect on the learning outcomes. These ways include various learning activities and approaches, the part of which study strategies are. In general, qualitative analyses roughly divide learning into two categories: surface-level *reproduction* versus deep-level *transformation* of knowledge, the latter involving active constructive processing, elaboration, or efforts to understand (Marton & Säljö, 1976, 1997; Entwistle & Entwistle, 1992; Hamilton, 1997). The notion of generative processing is closely related to the above mentioned transformation, indicating active generation of relations – whether it is to wed background knowledge with new text information or to restructure an idea to accommodate audience and the learning demands (Bereiter & Scardamalia, 1987; Biggs, 1996; Greene & Ackerman, 1995).

Generative processing has been shown to produce qualitatively better learning outcomes than less generative forms of processing. Examples of generative processing are summarising or creating graphs, tables, and concept maps. A number of studies of concept mapping have shown this strategy to be effective because it facilitates knowledge construction by helping to relate selected ideas to each other in a meaningful way (Heinze-Fry & Novak,

1990; Novak, 1990; Okebukola, 1992; Roth & Roychoudhury, 1993; Slotte & Lonka, 1999b). Correspondingly, matrix notes and summarisation have been found to result in superior performance as opposed to less generative actions, such as verbatim notetaking and copying (Kiewra et al., 1991, 1995; Benton et al., 1993; Slotte & Lonka, 1999a), or simple reading already-generated material (Lahtinen et al., 1997). The results have been interpreted to demonstrate that non-generative strategies follow the organisation of a text without fostering the transformation of knowledge.

While there is support for the advantages of using generative processing, the difference gender might make continues to be a source of controversy and speculation. Research and debate about the origins of gender differences are grounded in the biological mechanisms (e.g., 'sex' hormones), sociocultural practices (e.g., environment), and their interaction. Some variables, however, are both biological and social and therefore cannot be classified into one of these two categories. For example, learning influences brain structure which, in turn, supports certain skills and study activities which may lead people to seek additional similar experiences (Halpern, 1997).

In an extensive meta-analytical review, Hedges and Nowell (1995) suggested that possible gender differences arise mostly because of differences in experience, socialisation and in opportunity to learn. Their data showed that women performed better on verbal tests, such as reading and writing, which are learnable skills. Similarly, Halpern (1997) argued that women tend to have greater verbal fluency than men, whereas men perform better than women on tasks requiring spatial ability. In particular, men have an advantage in tests that require transformations in visual-spatial material. On this basis, male students might be expected to transform linear text information into two-dimensional graphic maps more often than their female counterparts.

On the other hand, being more rapid in accessing verbal information (Halpern, 1997), female students might be expected to outperform men in selecting the most central concepts from the text. This ability is a basic skill needed in constructing concept maps or summaries, and may be especially important in the case of longer texts. When there are many topics and not all of them have the same value, certain parts of the text have to be eliminated from notes and summaries. Yet, as Hidi and Anderson (1986) have concluded, the major concerns of the effective summariser is not only to decide what to include and eliminate from the original text, but also to determine what combinations or transformations of ideas make sense, and whether the original structure needs to be reorganised.

Although some gender differences in subcomponents of cognitive abilities have been found there are no major differences in the overall level of science ability and achievement. In some studies male students tend to outperform

female students in science and mathematics courses, yet in others, women do as well or better than men (e.g., Benbow & Arjmand, 1990; Erwin & Maurutto, 1998). Stumpf & Jackson (1994) reported, however, that women scored higher than men in memory tests. In their review of available gender-sensitive data in student learning, Severiens & ten Dam (1994) stated that consistent gender differences arise only on affective aspects of studying. They found that men tend to obtain higher scores on achievement and extrinsic motivation, whereas women tend to score higher on fear of failure. Further, gender inequality in educational choices and careers appears to be partially due to the way students learn (Severiens & ten Dam, 1997).

For the present, however, we know little about whether female university applicants differ from their male competitors in the manner in which they try to understand context-specific text information. For instance, Erwin & Maurutto (1998) found in their interview study that first year female undergraduates commonly complaint about lack of familiarity with university methods of teaching, notetaking, and methods of evaluation. However, they interviewed only female undergraduates without any appropriate comparisons of whether male students enter the university with similar kind of school-leaving study activities. According to Meyer (1995, p. 201) the gender differences are "of potential strategic value to university departments insofar as they are able to locate difficulties that students bring with them early in their undergraduate studies".

The design principles of the 'Learning-from-text' test

The Helsinki University Faculty of Medicine reformed its selection criteria in 1988 by designing a new Learning-from-text test (LFT) to complement traditional multiple-choice tests in biology, chemistry and physics. The purpose of the LFT is to measure deep-level text comprehension and critical thinking skills of the applicants. The idea is that by broadening the scope of tasks, the Faculty would get students whose approach to studying was not too narrow, and therefore increase the likelihood of successful and meaningful studying.

The participants are told that they will have to read a demanding and a lengthy text in order to write essay-type answers on the basis of it. The text to be read is different every year and its content varies from philosophy to gene technology. The Faculty of Medicine demands that the content and structure of the LFT is not known beforehand, thus the applicants cannot prepare themselves directly for it (Lindblom-Ylänne et al., 1996). Those students who by chance have familiarised themselves with the subjects in question are free to benefit from their general knowledge. Previous years' experience shows that these are very few.

The LFT tasks are designed on the basis of Van Dijk & Kintsch (1983) cognitive model of strategic discourse processing. Their theory distinguishes between three forms of mental representations that may be constructed during text comprehension: a *surface memory* for actual words and phrases, a *textbase*, in which a coherent representation of the text is formed, and a *situation model*, in which the text content is integrated into the comprehender's knowledge system. The textbase reflects the coherent relations between the propositions in the text and their organisation, whereas the situation model is a mental representation of the situation described by the text. Mannes (1988) sees the dichotomy between the two forms of representation so that remembering or understanding the text depends on the textbase, whereas learning from text depends more on the situation model.

The ability to form coherent syntheses of texts is considered a very important skill for medical students, because they, as all the other university students, have to study extensive texts in a limited time. Further, the development of expertise in medicine requires not only declarative knowing that, but also procedural knowledge, knowing how (Anderson, 1985; Chi et al., 1988; Gilhooly, 1990). Therefore, the LFT includes tasks that are designed to measure the formation of a textbase and situation model. The purpose of the present studies is to determine whether such tasks give any advantages to either gender or to certain strategy users. Based on the above reported research, women were expected to use more verbal study strategies whereas men were expected to use two-dimensional graphic maps more often than women.

Study I

Method

Sample

The participants were 503 applicants to the Helsinki University Faculty of Medicine in 1988. All of them had to participate in an entrance examination in order to apply for admission to a 6-year study program combining medical school and graduate studies. The applicants' ages ranged from 18 to 37, mean age being 22 years. The examination of study strategies in this study was, however, inspected within a random sample of 200 participants (123 women and 77 men). There were no differences in applicants' ages ($F(1,501) = 1.44$, $p < 0.05$) nor in prior school performance ($F(1,501) = 0.35$, $p < 0.05$) between the sample and the rest of the subjects. With regard to gender differences, no statistically significant differences were found in prior school performance nor in traditional multiple-choice tests in biology

nor chemistry. In physics, male applicants scored somewhat higher than their female counterparts ($F(1,198) = 5.84$, $p < 0.05$).

Materials and procedures

The material consisted of 18-paged philosophical text written by the Finnish philosopher G. H. von Wright (the last chapter of his book *Science and Human Reasoning*). As they were reading, the participants were allowed to make notes on the text or an attached blank sheet of paper in any manner they desired. After 90 minutes of reading time, all the materials were collected and the participants were given three essay-type tasks. The cognitive demands of these tasks have been reported in more detail by Lonka et al. (1994). The applicants were told that they would be credited not only for content, but also for clear presentation and concentrating on the essentials. They had another 90 minutes to complete three different tasks.

The Detailed tasks required two concepts from the text (a minor detail and a central idea) to be explained to a reader who had no previous knowledge of philosophy, and was designed to measure how well the applicants could remember and explain individual concepts or themes. The title of the article had to be explained in the Synthesis task, and this called for pulling together the essentials of the text. In the Critique tasks, the participants were given two paragraphs of the text, which they had to review critically on the basis of their general knowledge. These tasks were designed to measure the ability to go 'beyond' the text, that is, the formation of a situation model. The answers to each tasks were to be written within a given space in the answer sheet.

A detailed *a priori* scoring system was applied to the answers by two official raters. At first, the raters scored the first 50 papers independently of each other and then they discussed the scoring criteria. After that they independently scored the remaining 453 papers. A subsequent joint inspection revealed that out of the 503 papers, the raters were unanimous in 95% of the total scores. The scores for each of the three tasks varied from 0 to 10. In each task, six points were given on the basis of the content, and four points on the basis of the quality of the argument, in other words, whether the answer was understandable, logical and coherent. If unessential details were included, two points were deducted.

The text materials and note papers of 200 participants were analysed in terms of underlining, notetaking, or concept mapping. Different kinds of notes were recorded (from 1 to 4) as (1) no physical records or notes, (2) underlining, (3) note-taking, and (4) concept mapping. Concept map was defined as students' naturally made maps containing all kinds of graphic representations consisting of a minimum of three links or relationships

Table 1. Percentages of study strategies used in LFT (Philosophy) according to gender

Study strategy	Gender					
	Men		Women		Total	
	Frequency	(%)	Frequency	(%)	Frequency	(%)
No notes	9	(11.7%)	2	(1.6%)	11	(5.5%)
Underlining only	15	(19.5%)	23	(18.7%)	38	(19.0%)
Written notes	35	(45.5%)	71	(57.7%)	106	(53.9%)
Concept maps	18	(23.4%)	27	(22.0%)	45	(22.5%)
Total	77	(100%)	123	(100%)	200	(100%)

between the concepts (Lonka et al., 1994). These categories were mutually exclusive, so that only the most dominating strategy was taken into account.

Also, to determine whether the participants have used covert information processing they were asked to complete a one-page questionnaire about what study activities they had used while trying to learn from the text. The participants were asked to score “no” or “yes” on whether they had done something else than underlined, took notes or made concept maps (and if “yes”, describe that strategy).

Results and discussion

The typicality of different study strategies

Table 1 shows that men and women differed in their use of different study strategies while trying to learn from philosophical text ($\chi^2(3) = 10.12$, $p < 0.05$). That is, of male participants, almost 12% did not produce any physical records, whereas the correspondence proportion among female participants was only 2%. Female applicants, on the average, also took notes more eagerly than did their male competitors, but the proportions of those who drew concept maps or underlined the text were almost the same among both genders.

According to the questionnaire ($n = 200$), about one quarter of the participants described using covert study strategies, for example “reading with careful thought”, “reflecting” or “searching for the main point to get the whole picture”. Although slightly more men (29.9%) than women (23.6%) reported having processed information mentally, the difference was not statistically significant ($z = 0.15$, $p > 0.5$). The descriptions of the strategy use were similar among both genders.

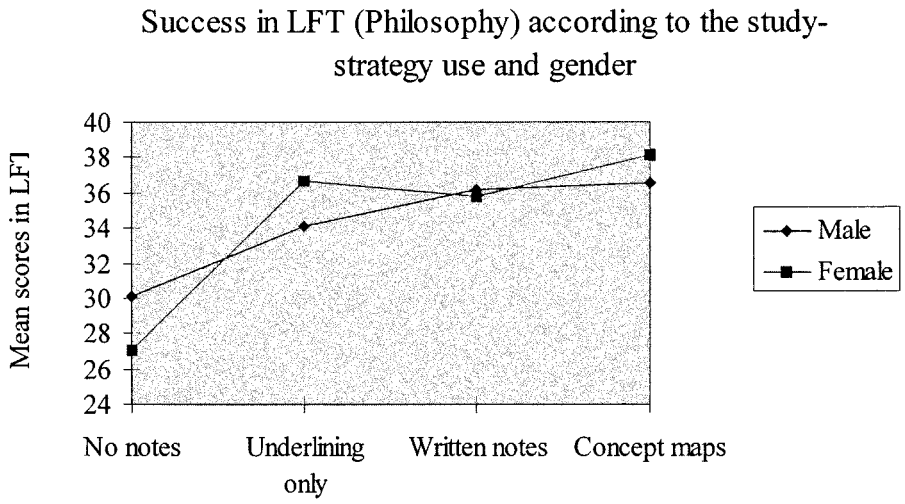

Figure 1. Learning from philosophical text.

The effect of different strategy use in learning from philosophical text

To analyse the relationship between spontaneous study-strategy use and the success in Learning-from-text test, a 4 (study strategies) × 2 (gender) two-way analysis of variance (ANOVA) was conducted. Dependent variable was the scores on the LFT. The results revealed a main effect for study-strategy use ($F(3,199) = 4.13$, $p < 0.01$, $\eta^2 = 0.06$) but not for gender, nor their interaction. Post hoc comparisons (Scheffe's test, $\alpha = 0.05$) showed that both female and male applicants who made concept maps or took notes from the philosophical text received, on the average, higher scores in LFT than those who did not use any overt strategies. As Figure 1 shows, the performance of the male participants, who did not spontaneously produce any physical records during text reading, was somewhat higher than that of female non-notetakers. However, because there were no more than two women who did not use any overt study strategies, this difference was not even meaningful.

Taken as a whole, female applicants to a medical school did not receive higher test scores than their male counterparts when learning from a philosophical text. This finding is in line with previous research, which indicates no differences between men and women in their overall achievement levels in higher education (e.g., Erwin & Maurutto, 1998). Instead, it appeared that both genders performed the better in text comprehension the more generative study strategies they used. According to expectations, it was also found that women more often used overt study strategies, in particular, notetaking, in comparison to the male participants.

It is possible that women wrote down more notes because they could verbalise the philosophical thoughts more fluently than their male counterparts. The specific domain of philosophy might thus have steered the readers to use special study activities or approaches. The interpretation of these results is problematic because the nature of students' notes could not be taken into account here. It may be, for example, that those males who took notes or underlined philosophical text papers did it in a greater quantity by reproducing the text information as such, or that women made qualitatively better notes in a way to form meaningful grouping and connections of text information.

Apart from not finding any gender differences in learning from philosophical text, such differences might arise in a different context and subject domain. Van Meter et al. (1994) presented data supporting the idea that notetaking varied with course content and perceived course demands. They found that in such courses as humanities and social sciences, paraphrased notetaking was often reported as enhancing the capturing of main ideas and themes. In contrast, both facts and examples in mathematics and engineering were frequently reported to be copied (i.e., using verbatim notetaking). Thus, it is possible that students' general study strategies interact with the domain-specific knowledge.

The results of Study I indicate that there were gender differences in spontaneous strategy use. The design of this study, however, leaves open the possibility that these differences may not be generalized across different subject areas. Therefore, we decided to replicate and extend the results of Study I to a new knowledge domain of statistics concerning risk and probability theories. Second, to improve the generalizability of the previous results, the analysis of spontaneous strategy use was extended from a sample to concern all applicants. Finally, to overcome the problem that the quality of written notes was not looked at in Study I, it was distinguished between verbatim notes and summary notes written in students' own words in Study II.

Study II

Method

Participants

The participants were 502 applicants the Helsinki University Faculty of Medicine in 1991. Their ages ranged from 18 to 48, mean age being 21 years. No differences between genders were found in either of the multiple-choice tasks in biology, chemistry or physics. In prior school performance, women

appeared to score somewhat higher than men ($F(1,501) = 6.48$, $p < 0.05$). The data of fifteen applicants who did not complete the LFT tasks, or were obviously not serious in their applications, were excluded. Of these 'tourists' who participated for the entrance examination without being really motivated to gain the admission, 12 were men. After the exclusion, the material and notes of 487 subjects (298 women and 189 men) remained for analysis.

Materials and procedures

The design and procedure were identical to those used in Study I, except that the reading time and the time to complete three essay-type tasks were each reduced to one hour. The material of the two-hour LFT consisted of two texts called "Risk theories of a single case" and "Finnish health risks" containing 5 and 12 pages, respectively. The former was a university-level text including theoretical information about the interpretation of probability and risk theories, whereas the latter was clearly easier, containing descriptive data on health hazards.

In the first essay-type task, the participants had to define the essential points of frequency theory and propensity theory, and then compare the accident risks of persons A and B, described in text 2, according to these two theories. In the second task, Theory Explanation, the participants had to explain in their own words to a 50-year-old, poorly educated person what Bayes' theorem means. These tasks were designed to measure both comprehension and clear presentation of the statistical theories described in the text. The Application task required the applicants to analyse the risk theories or interpretations that may lie behind a physician's inferences when he or she makes conclusions about a disease or its prognosis. This task was meant to measure the ability to form a situation model by making own inferences as how the different statistical theories could be related to a physician work.

Similar to Study I, two official raters from the Faculty of Medicine developed a detailed a priori scoring system for analysing and evaluating the answers (N = 502). All essay-type tasks were assessed by the first rater who was the same as in Study I. Tasks were assessed both for the content and quality of argument. The scores for the first task varied from 0 to 11 (8 points on the basis of the content and 3 points on the basis of quality of argument), and for second and third tasks from 0 to 9 (6 points on the basis of the content and 3 points on the basis of quality of argument). No points were deducted if inessential details were included. The cognitive demands of these tasks have been reported in more detail by Lahtinen et al. (1997).

The text materials and note papers of 487 participants were analysed as in Study I. However, those who took verbatim notes were distinguished from those participants who wrote summary notes in their own words. 'Verbatim

Table 2. Percentages of study strategies used in LFT (Statistics) according to gender

Study strategy	Gender					
	Men		Women		Total	
	Frequency	(%)	Frequency	(%)	Frequency	(%)
No notes	36	(19.0%)	23	(7.7%)	59	(12.1%)
Underlining only	53	(28.0%)	80	(26.8%)	133	(27.3%)
Verbatim notes	64	(33.9%)	100	(33.6%)	164	(33.7%)
Summarising	23	(12.2%)	72	(24.2%)	95	(19.5%)
Concept maps	13	(6.9%)	23	(7.7%)	36	(7.4%)
Total	189	(100%)	298	(100%)	487	(100%)

notes' means notes in which key words, phrases, or sentences are copied directly from the text without relating them to each other by one's own words (Slotte & Lonka, 1998).

Results and discussion

Different strategy use in learning from statistical text

Table 2 shows that the gender groups differed significantly in their strategy use also when reading statistical text ($\chi^2(4) = 20.95$, $p < 0.001$). As in Study I, the percentage of male applicants who did not use any overt study strategies was considerably higher than that of female applicants. In this data, the female applicants took summary notes on the average more often than male applicants, whereas every third participant in both gender groups took verbatim notes. The proportion of the participants who drew concept maps was slightly higher among women than among men.

The results of 5 (study strategies) $\times$ 2 (gender) two-way analysis of variance (ANOVA) on LFT showed significant main effects for study-strategy use ($F(4,477) = 6.72$, $p < 0.001$, $\eta^2 = 0.05$) and for the interaction between gender and strategy use ($F(4,477) = 2.43$, $p < 0.05$, $\eta^2 = 0.02$) but not for gender. Although female applicants generally scored somewhat higher (Mean = 17.1) than their male counterparts in understanding a statistical text (Mean = 15.9), the difference was not statistically significant ($F(1,477) = 2.89$, $p = 0.09$). The results of the two-way ANOVA are illustrated in Figure 2.

With regard to text comprehension, the success of female and male participants depended upon the different ways in which they tried to learn from a text. That is, for the male participants, the best performance was found among those summarising the text content, whereas of the female participants those who constructed concept maps received the highest scores. Although

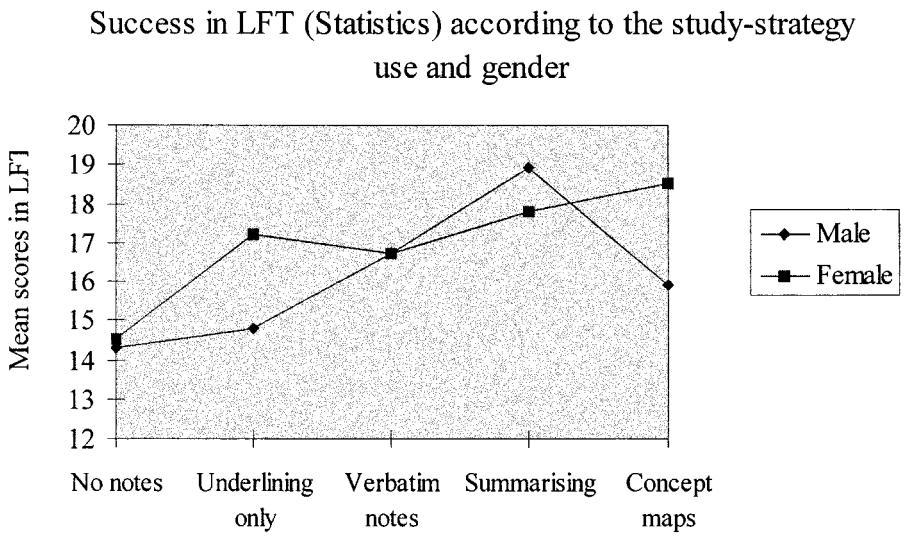

Figure 2. Learning from statistical text.

the women who spontaneously made concept maps scored, on the average, higher (M = 18.5) than their male counterparts (M = 15.9) this difference did not receive statistical significance ($F(1,35) = 2.84$, $p = 0.10$). Yet, those women who underlined the statistical text benefited from using this strategy significantly more (M = 17.2) than the men who underlined the text (M = 14.8), $F(1,132) = 8.28$, $p < 0.01$.

Post hoc comparisons in strategy use (Scheffe's test, $\alpha = 0.05$) revealed that of the male participants, those who made summary notes performed better than both those males who underlined the text information and those who did not spontaneously use any overt study strategies. Instead, of the women both those who made concept maps and those who summarised the text content received higher scores than those women who did not produce any physical records during studying.

In sum, although the female students took summary notes more often than their male counterparts, the latter might be superior in summarising as a way to promote the understanding of statistical text. Otherwise, the women benefited rather evenly from using either verbatim study strategies, which reflect more a linear text, or generative strategies that require summarising the text content, or by relating different concepts to each other graphically.

General discussion

In two studies, clear gender differences in spontaneous strategy use were found. However, despite of using different ways in learning from text, female

and male applicants did not differ in text comprehension. These results were similar across two different subject domains. That is, in the domain of philosophy and in the domain of statistics concerning risk and probability theories, no differences between genders were observed. The present findings are thus in line with previous research (Halpern, 1997; Wilson et al., 1996), indicating that major gender differences seem to lie in patterns of study activity rather than in overall level of performance.

First, the data of both studies gave support to the expectation that female applicants more than men relied on verbal study strategies. Moreover, the results of Study II added to the previous findings in that this difference derived mostly from summarising the text content. This raises the possibility that women might be more aware of the generally recommended ways of studying, that is, strategies that promote paying attention to the text as a whole which leads to comprehension of the phenomenon described in the text (Marton & Säljö, 1997; Entwistle, 1997; van Dijk & Kintsch, 1983). This interpretation is also supported by the result that those women who constructed concept maps, also succeeded well in deep-level text comprehension.

Second, the findings provided no supporting evidence to indicate that men used spatial study strategies more often than women. Okebukola (1992) has also reported mix effects of concept mapping on the problem-solving abilities according to gender. In analysing university students' ability to solve problems in biology, he found that in some tasks female concept mappers did better than their male counterparts, and in others, men outperformed women. However, in all problem-solving tasks, in both gender groups, those who drew more extensive concept maps outperformed those who did simpler ones or did not use this strategy at all (see also Slotte & Lonka, 1999b). Together with previous studies it can thus be concluded that different study strategies differentiate the learning outcomes more than does gender.

With respect to the absence of gender differences in learning performance, it might be that these differences are not as important as the considerable variation arising within the population of men or the population of women. This conclusion is largely supported by the results of this investigation, specifically by the variation in how male and female applicants go about studying in the first place. These findings are important because even a small difference can have a substantial real-world effect that might correspond to a level needed for entry into a training program.

Methodological reflections of the studies

Entrance examination to a Finnish Medical School provided a worthy chance to look at gender-related differences in study-strategy use when trying

to learn from complex texts. While offering two ecologically valid and well-standardised learning settings, the situation also posed restrictions to research: the number of male applicants and a number of female applicants could not be controlled. Therefore, the samples in the present studies might not represent the population at large. The fact that in two independent samples women outperformed men by a ratio of 5:3, however, indicates that somewhat more female students than male students are interested in educating themselves as physicians. This findings resembles to that obtained among nearly 187 000 students applying for admission to German medical schools (Stumpf & Jackson, 1994).

All applicants to a medical school were in average very good students, most of them achieving top grades in the Finnish matriculation examination (see Lahtinen et al., 1997; Lindblom-Ylänne et al., 1996). Could women have had higher prior knowledge or could they have been more highly motivated than men or vice versa? As was shown here, women scored slightly better in prior school knowledge only in Study II indicating the lack of systematic gender differences across different sets of data. No systematic variances were either found in traditional science tests measuring how well the applicants had prepared themselves to the entrance examination. Further, such interpretations would require one to explain how different experiences or divergent motivation would result in male and female applicants scoring similarly on learning test.

Additional methodological reflections concern the off-line analysis of study strategies. Although the questionnaire in Study I showed that about third of the participants described doing strategies other than those producing physical records, the proportion of covert study strategy users may actually be higher. It is possible that some participants have not been capable or interested enough to answer this question. Unconscious or habitualised processes that often are involved in the monitoring and self-regulating (Boekaerts, 1997) remain hidden. The self-regulated learner is obviously not only aware of a variety of goal-specific study strategies but can also adjust their usage according to the context and learning tasks.

A more qualitative approach might have revealed something about the nature of the thinking processes that mediate between study strategies and learning outcomes (Entwistle & Entwistle, 1992). For the present, we can only say that there appeared to be differences in women's and men's strategy use. So far, this is the only study which has analysed spontaneous study strategies and gender differences in a real-life learning situation.

Educational implications

The area of spontaneously used study strategies for identifying ways of studying that promote deep-level text comprehension is without a doubt an important topic in higher education. Further, the similarities and differences in how males and female students actually study are clearly important, since they give valuable information when planning more successful study strategy training. Teachers, for example, should be aware that generative study strategies, such as concept mapping and summarising have a great potential for improving the learning of both genders.

Another practical implication of these results in the present context is the increased confidence with using the Learning-from-text test in different subject domains. Showing no evidence of entry-level gender differences among the high-school graduates who are more or less oriented towards to mathematics and sciences, the current results demonstrated that it is possible to design a learning test that does not favour either gender. This is especially important when developing a new kind of selection criteria for admission to the university. Further, there has been much interest in the possibility that gender differences in human cognition are decreasing in Western countries, a fact that might reflect the diminished effect of gender role stereotypes and other sex-differentiated environmental norms (Halpern, 1997). The present data suggested no indication of different results between the two samples over the 3-year time. Other researchers have provided stronger evidence showing that the average gender differences remain relatively stable across the 32-year period (Hedges & Nowell, 1995) and across the 9-year period (Stumpf & Jackson, 1994). Because of numerous changes in the nature of tests and the population taking these tests more research on this area is certainly needed.

Finally, the fact that male and female participants succeeded equally well by using different study strategies, points to the importance of supporting and encouraging each gender's confidence in their own ways to study. This means that educators should not necessarily recommend that all students use the same strategies. It would also imply taking gender into account so that all individuals can use their intellectual potential in its fullest.

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