Review Of Gender Differences In Learning Styles: Suggestions For STEM Education

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ABSTRACT

Women have made great strides in baccalaureate degree obtainment, out numbering men by over 230,000 conferred baccalaureate degrees in 2008. However, the proportion of earned degrees for women in some of the Science, Technology, Engineering, and Mathematics (STEM) courses continues to lag behind male baccalaureate completions (National Science Foundation, 2010). In addition, according to the National Center for Women and Information Technology (NCWIT), only 21% of information and computer science degrees were awarded to women in 2006 (NCWIT, 2007). In the past decade, higher education has experienced a rapid decline in the number of women involved in the information sciences, particularly computer science (Bank, 2007). A number of social and educational factors have been considered barriers to women entering STEM fields and this area has been well studied in the literature. However, research examining the relationship between gender differences and learning styles in the context of these technical fields is limited. According to Kolb (1976), people decide on a major based on how well the norms of the major fit with their individual learning styles. This paper presents gender differences in learning styles and recommends teaching methodologies most preferred for female learners in STEM courses. Further, a survey was administered to ascertain the extent the results of this study support previous findings.

Keywords: learning styles; Kolb; experiential learning theory; gender; STEM Education

INTRODUCTION

In 2005-2006, 60% of higher education degrees in the US were awarded to women; however, only 11% of computer engineering and 15% of computer science degrees went to women (Nagel, 2007). Without more women in the workforce, the health and growth of information industries will suffer. It is estimated that 1,000,000 computer and information science-related jobs will become available in the US Economy by 2014 (Nagel, 2007; Joseph, 2008). Some feminists suggest that women face many social and educational barriers which hinder advancement in technical and traditionally male-dominated fields, such as information and computer science (Belenky, Clinchy, Goldberger, and Tarule, 1997). Societal factors, such as stereotyping, traditional gender roles, inflexibility toward women with children, alienation and many other factors, are often mentioned as the context for injustice in occupational fields and contribute to why women stay away from majors perceived as male disciplines. Many other factors, such as personal career anchors, lifestyle, geographic and economic circumstances, etc., influence whether or not women will pursue a degree or career in any Science, Technology, Engineering, and Mathematics (STEM) fields (Adya, 2008; Bank, 2007; Fear-Fenn and Kapostasy, 1992; Group of the Advancement of Psychiatry, 1975; Hazzan and Levy, 2006; Madill, Ciccoccioppo, Stewin, Armour, and Montgomerie, 2004; Quesenberry and Trauth, 2007; Tindall and Hamil, 2003; Trauth, Quesenberry, and Morgan, 2004).

The authors of *Women's Ways of Knowing* strongly argue that educational values, like objectivity and rationalism, although important, are not necessarily accommodating to women (Belenky et al., 1997). When pedagogical methods suitable for men are assumed as appropriate for women, gender deficits can be problematic (Philbin, Meier, Huffman, and Boverie, 1995). It is often believed that these traditionally valued characteristics are more valuable in STEM fields than characteristics stereotypically feminine. Research refutes this idea, proposing that interpersonal skills, such as listening, empathy and sensitivity, facilitate success in the workplace (Joshi & Kuhn, 2005).

Little evidence suggests that women are not intelligent enough to learn technical materials. According to the American Association of University Women (AAUW), in 2005, young women were outperforming young men in both reading and math in secondary school (AAUW, 2008). Most studies imply that it is not inability, but disinterest, that keeps women away from pursuing careers in the information and computer science fields (AAUW, 2000). According to Nagel (2007), although girls tend to have more experience in math and some engineering areas than boys in K-12 education, only 1% of females taking SATs in 2006 indicated an interest computer and information sciences majors. Educational institutions tend to focus on female under-representation as either an issue of recruitment or retention. Nonetheless, Kolb (1976), an educational theorist, suggests that individuals often make a decision to pursue a particular major based on how well their preferred styles of learning coincide with the norms of that field.

When taking their first courses in information science, some women find that they fail to thrive because of an invisible barrier disconnecting them from the information that the instructor is trying to convey. That invisible barrier may be due to teaching methods which favor one or two learning styles, ignoring the ones that women tend to prefer. In one study, an educational dialect questionnaire was distributed to 72 participants (female = 45) asking how their learning styles fit with their educational experiences. One of the female participants responded, "I felt like I was talked at; no transfer of knowledge, really, just words without meaning spoken. I never saw much practical application for the words and topics being discussed." (Philbin et al., 1995, p. 491) The male participants in this survey had a more positive reflection of their educational experiences claiming that their learning styles fit educational practices. Men learn well with instructors who assume an expert role or authoritative role. Women may adapt to this type of instruction, but identify more and perform better with an instructor who facilitates learning (Barrett, 2006). The Experiential Learning Theory (ELT) suggests that learning is not necessarily dependent on the "transmission" of knowledge from teacher to student, but that it is also created by the individual learner (Kolb & Kolb, 2005). This idea is also supported in the research conducted by Belenky et al. (1997), which suggests that the "transmission" model used today is inadequate in educating women. Students, who grew up using all sorts of new technology, are often not receptive to traditional lectures. Baker et al. (2007) discuss different ways to better serve this generation (i.e., Millennials), addressing different pedagogical techniques, such as multimedia lectures using different tools.

According to Tindal and Hamil (2003), typical STEM core courses are exceedingly competitive and fail to accommodate all learning styles. There is little research correlating learning style preferences with the gender deficit in STEM majors, particularly information science majors. The intent of this article is to review the research on experiential learning theory, the major gender differences identified within learning styles, and how they relate to educational practices in STEM majors. In addition, a survey was administered to ascertain the extent the results of this study support previous findings.

LEARNING STYLES AND GENDER

Learning Styles

The term "learning styles" began appearing in educational literature in the 1970s. It has been used interchangeably with similar terms, such as cognitive style and thinking style. According to Curry (1983), there are 21 models for learning styles. From a general standpoint, the Oxford American College Dictionary defines *style* as, "A way of behaving or approaching a situation that is characteristic of or favored by a particular person." From a psychological standpoint, style is much more complex, especially in the context of formal education. As a result, a true definition has never been agreed upon.

According to the ELT, learning style is an individual's preferred methods for perceiving and transforming his/her learning experiences (Mainemelis, Boyatzis, and Kolb., 2001, 2002; Lachenmayer, 1997). It is the internal goals and specific needs that shape how an individual approaches learning, resulting in a dominant learning style (Lachenmayer, 1997). The alignment of the dominant learning styles of the individual with the teaching styles of the instructor has strong implications for academic success. In fact, one of the main factors considered when deciding on an academic major is the cohesion and compatibility of the norms of the major and learning styles (Amany, 2001).

Many disciplines have conducted studies using ELT as a framework. The academic discipline with the most published research on learning styles is education, followed by business management and computer science. Educational research on learning styles is typically focused on matching student learning styles with curriculum and teaching styles (Mainemelis et al., 2001). Business Management examines learning styles in the context of organizational learning, correlating learning styles to management styles, decision making, and problem solving. Provitera and Esendal (2008) review different teaching approaches in management education. It is clear that the use of a variety of teaching techniques will provide the most success in appealing to the broadest range of student learning styles. They pointed out that instruction currently being more student-centered and focusing on more hands-on learning experiences. However, as mentioned previously, little research examines the relationship between female learning styles and participation in STEM fields, particularly information science and technology.

Kolb and Learning Styles

The foundation for Kolb Learning Style Inventory (KLSI) originated from the experiential ideas proposed by early researchers like John Dewey, Kurt Lewin, Jean Piaget, William James, Carl Jung, Paulo Freire, Carl Rogers and other human learning and development theorists (Kolb & Kolb, 2005). Essentially, the ELT indicates that people have modes, or styles, by which they take an approach to the world. This theory describes how experience contributes to learning and guides our behaviors and decisions (Kolb, 1976).

According to Heffler (2001), there are four learning style classifications that are determined by where an individual's score falls on two continuums: the active experimentation-reflective observation and concrete experience-abstract conceptualization dimensions. The active experimentation-reflective observation dimension focuses on what an individual does with information he/she is learning or being taught. Those who approach learning with active experimentation can be described as "doers"; they prefer to practice what is being taught. Reflective observers can be described as "watchers"; they prefer to learn from observing and reflecting on what they see. The concrete experience–abstract conceptualization dimension focuses on how an individual perceives information. This dimension asks how the learner grasps information. Concrete experience learners are the "feelers"; they base their perceptions of information on intuition and feeling. Abstract conceptualization learners are the "thinkers"; they take an objective approach to new information they learn. From these two continuums, Kolb (1976) developed four learning modes which through different combinations produce the four learning styles:

1. Concrete Experience (CE) and Active Experimentation (AE) combine to form the Accommodator learning style. Those who have this style of learning usually prefer *doing* things, planning, or experimenting and learning through trial and error. Individuals with this learning style tend to go into fields like business.
2. Reflective Observational (RO) and Abstract Conceptual (AC) combine to form the Assimilator learning style. Those who have this style of learning usually prefer using inductive reasoning, theory and concepts, logic, and research. Individuals with this learning style tend to go into science and mathematics.
3. Active Experimental (AE) and AC combine to form the Converger learning style. Those who have this style of learning usually prefer to use hypothetical-deductive reasoning, focus on specific problems, and deal with things rather than people. Convergers tend to go into fields like engineering.
4. Divergers (i.e., combination of CE and RO learning modes) prefer to use brainstorming and their imaginations and they are interested in people and organizing information to procure meaningful relationships. Usually, divergers go into the humanities or liberal arts.

Nostanski and Slick (2008) studied the learning style preferences (as measured by the KLSI) of online business students. A significant difference in terms of mean grade point averages was found between Divergers and the other three learning styles, i.e., Assimilators, Accomodators, and Convergers. However, their survey results revealed that there is no significant difference in course completion among different learning styles.

Learning Styles and Gender Differences

Men tend to embrace the Assimilator learning style which accurately reflects traditional pedagogy, whereas the learning styles that women match least is the Assimilator (Philbin et al., 1995). Most research suggests that preferred learning styles of males and females can generally be distributed equally among the four learning modes; however, there is considerable evidence suggesting a discrepancy between male and female scores in the abstract-concrete dimension of learning (Heffler, 2001; Tindall and Hamil, 2003). Studies suggest that females score higher in the concrete learning mode whereas males score higher on the abstract conceptualization side of the continuum. Women with a concrete experience learning approach usually prefer hands-on experiences to learn, they make intuitive or feeling based judgments, they are people oriented, and they typically feel comfortable with ambiguity (Heffler, 2001). They excel at understanding people, identifying problems, brainstorming, imagining, taking risks, leading, and getting work done (Lachenmayer, 1997). Conversely, men who prefer abstract conceptualization take an analytic approach to learning, they think logically and rationally, they enjoy working with symbols and like structure (Heffler, 2001).

Implications of Gender Differences

The research shows that there is a difference between the way men and women learn. The question to explore is whether or not traditional education supports how both men and women learn. There is evidence to suggest that traditional education does not support all learning styles. According to Philbin et al. (1995), traditional education supports and appeals to men more than to women. Subjective responses by female participants in the survey conveyed disconnect between student experiences and learning styles. One female respondent said, “I never saw much practical application for the words/topics being discussed.” Compare this to a male respondent who said, “I believe my learning style of using logical steps to break down things and analyze them helped me in my studies of computer science and systems analysis” (Philbin et al., 1995, p. 491). This supports the idea that institutions develop a culture that puts emphasis on one mode of learning and dismisses other learning modes (Kolb and Kolb, 2005).

RESEARCH QUESTIONS

The purpose of the survey was to address the differences in learning between genders suggested in previous research outlined above. Therefore, the following four research questions were posed for this study:

1. Do males and females differ with respect to the preference to how content is delivered?
2. Do STEM majors differ with respect to their preference to how content is delivered compared to non-STEM majors?
3. Are there discernable differences between male and females in the approach(s) to learning new content?
4. Similarly, do STEM majors approach learning new content differently than non-STEM majors?

SURVEY

An online Learning Styles Survey was administered twice. Specifically, students enrolled at Penn State Berks in Spring 2010 were asked to participate in a Learning Styles Survey. The survey was administered again to students enrolled in Fall 2010. Students enrolled in both Spring 2010 and Fall 2010 were asked not to complete the survey again in the second administration. Students were made aware of the survey by a posting on the student listserv. For the Spring 2010 administration, one reminder was posted on the student listserv two weeks after the initial email. Over three hundred (n= 313) students completed the survey.

Most survey items were based on learner preferences. However, the focus of one item was the presentation of course content. Before the survey was administered it was reviewed by several faculty including both male and female faculty that instruct courses in STEM fields. In addition, the survey was critiqued by the Office of Planning, Research, and Assessment using the guidelines outlined by Kline (2005). Several demographic items, such as gender, age, class level, were also included.

RESULTS

Demographics

Approximately forty five percent (45.2%) of the respondents were male. Fifty-eight percent (57.9%) of the respondents indicated that he/she was 18-19 years old while eighteen percent (18.3%) indicated he/she was 24 or older. Correspondingly, most of the respondents were either freshman (46.0%) or sophomores (27.0%). Over half of the survey respondents indicated that he/she were enrolled in STEM majors. Over two-thirds (66.9%) of the male survey respondents but less than half (44.2%) of the female survey respondents were enrolled in STEM majors. A phi-coefficient revealed that the relationship between gender and STEM major enrollment was statistically significant (ϕ= -.227, *n*= 304, $p < .001$). A phi-coefficient is most appropriate when the variables are both dichotomous (Crocker and Algina, 1986). Accordingly, the proportion of male and female survey respondents enrolled in STEM majors is dissimilar to the proportion of male and female survey respondents enrolled in non-STEM majors.

Different Learning Modes

Survey respondents were asked to indicate the type of course material he/she prefer. About thirty-one percent (30.6%) of the female survey respondents and about thirty-four percent (34.3%) of the male survey respondents indicated that he/she favor concrete materials. The most disparate preferred course material type between male and female survey respondents was materials pertaining to creative thinking (23.6% and 39.4%, respectively). As such, a chi square for goodness of fit was statistically significant ($\chi^2(3, n = 305) = 10.35, p \leq .05$). Therefore, the answer to the first research question is yes. There appears to be a gender difference in the preference of how content should be delivered. The proportion of males and females, by indicated course material preference, is shown in Table 1.

Likewise, males and females differed on what type of information was most easily remembered. Female survey respondents (44.1%) were more likely to choose materials that related to other subjects while male survey respondents (60.0%) were more likely to remember logical material or material that they had done before.

STEM major survey respondents (38.0%) were more likely to prefer hands-on materials than non-STEM major survey respondents (15.8%). Non-STEM major survey respondents (45.3%) were more likely to choose creative thinking materials than those survey respondents enrolled in STEM majors (20.5%). A chi square for goodness of fit for STEM major compared to non-STEM major survey respondents was statistically significant ($\chi^2(3, n = 305) = 28.11, p \leq .001$). The proportion of STEM and non-STEM major survey respondents, by indicated course material preference, is also listed in Table 1. The answer to the second research question is a resounding yes. There is a statistically significant difference in the preference of how content is delivered between STEM and non-STEM majors. This is supported by the chi square statistic and the frequencies in Table 1.

Table 1: Course Material Preference for Males and Females

	Gender				**Major**			
	Male		**Female**		**STEM**		**Non-STEM**	
Preference	***n***	**%**	***n***	**%**	***n***	**%**	***n***	**%**
Concrete Material (i.e., facts, data)	48	34.3	52	30.6	55	33.1	43	30.9
Creative Thinking Materials (i.e., brainstorming)	33	23.6	67	39.4	34	20.5	63	45.3
Abstract Materials (i.e., concepts, theories)	16	11.4	10	5.9	14	8.4	11	7.9
Hands-on Materials (i.e., experiments)	43	24.1	41	27.1	63	38.0	22	15.8

Non-STEM major survey respondents (47.5%) were most likely to remember content that related to other subjects than STEM major survey respondents (27.1%). Almost one-third of the STEM major survey respondents (30.7%) indicated that if done before, it would be remembered (30.7%) while only one-fifth of the non-STEM major survey respondents (20.7%) indicated this as a preference.

Learning New Subjects

When asked about the best method to learn new content, male survey respondents (31.0%) were more likely to indicate doing research. The second most popular response for male survey respondents was learning content by testing out implications (30.6%). On the other hand, female survey respondents chose testing out implications as the most preferred method to learn new material (45.5%) and doing research (41.3%) as the second most preferred method. The methods to learn new material, response counts, and percents for male and female survey respondents are listed in Table 2. Note that a chi square for goodness of fit was statistically significant ($\chi^2(1, n = 10007) = 24.71$, $p \leq .001$). These results address the third research question. There are discernable differences between males and females in the approach(s) to learning new content.

Correspondingly, survey respondents were asked to identify what teaching methods his/her instructors used. Both male and female survey respondents, 41.9% and 46.8% respectively, were most likely to respond that the faculty lecture. Role play was the method chosen least by male and female respondents, 3.5% and 9.7% respectively.

There was some overlap in the preferred method for learning new content between STEM major and non-STEM major survey respondents. STEM major survey respondents indicated that doing research (37.4%) and focusing on specific problems (35.4%) were the best methods to learn. For non-STEM major survey respondents the most preferred methods for learning new material were testing out implications (38.0%) and doing research (34.8%). Although more STEM major survey respondents (20.7%) indicated a preference for making connections than non-STEM major survey respondents (12.1%), it was the least preferred method for both groups. The methods to learn new material and the response counts and percent of responses for STEM major and non-STEM major survey respondents are also listed in Table 2. A chi square for goodness of fit was statistically significant ($\chi^2(1, n = 999) = 53.07$, $p \leq .001$). Answering question four, there appears to be a difference in the preference on how to learn new content between STEM and non-STEM majors.

Lectures were the most frequently indicated teaching method used by the faculty for both STEM (49.5%) and non-STEM major (39.3%) survey respondents. As seen, the STEM major survey respondents were more likely to indicate lecture was the method used by faculty than the non-STEM major survey respondents. Expectedly, role play was the method chosen least by both STEM major survey respondents and non-STEM major survey respondents, 5.2% and 7.5%, respectively.

Table 2: Methods of Learning New Content Preferences for Males and Females
(Note that respondents could choose more than one method.)

	Gender				**Major**			
	Male		**Female**		**STEM**		**Non-STEM**	
	n	**%**	***n***	**%**	***n***	**%**	***n***	**%**
Preference Facts	60	25.8	92	29.7	74	24.3	61	20.9
Connections with Related Subjects	55	23.6	122	39.4	63	20.7	37	12.1
Observe and Reflect	78	11.4	79	25.5	96	31.5	71	23.3
Test Implications	95	24.1	29	9.4	114	37.4	116	38.0
Focus on Specific Problems	85	24.1	44	14.2	108	35.4	99	32.5
Work with Others	86	24.1	66	21.3	104	34.1	81	26.6
Do Research	96	24.1	42	13.5	114	37.4	106	34.8
Use Experiments	89	24.1	57	18.4	92	30.2	015	34.4

Gender as an Indicator of Success

At the end of the survey, respondents were asked if he/she thought success was difficult because of gender. Ironically, a larger proportion of male respondents (99.3%) indicated yes than female survey respondents (95.3%). STEM (97.8%) and non-STEM (96.4%) major respondents were similar with respect to the percent who thought it was difficult to succeed because of gender. This is not surprising given the large proportion of male STEM major survey respondents.

LIMITATIONS

Although most students at Penn State Berks are traditional age students enrolled full-time, the survey was only administered at one campus. Results may have been different if distributed at another college or across several institutions. The survey gleaned more female than male respondents. However, at Penn State Berks over half (55.2% in fall 2009) of the enrollment was male. Less than two percent (1.6%) of the survey respondents indicated that he/she had not declared a major. Typically, ten percent of the students enrolled at the College have not declared a major (Penn State Berks, 2009). If more students who had not declared a major at the time of the survey had completed the survey, results may have been dissimilar to the current findings. For both administrations, the survey was administered online. Survey responses gleaned from a paper survey may have also been different. Online surveys traditionally result in different response rates than paper surveys (Greenlaw and Brown-Welty, 2009).

CONCLUSIONS

The purpose of this study is to discern differences in learning styles between males and females, as well as those enrolled in STEM majors compared to those in non-STEM majors. The survey attempts to put a finer point on these differences by examining learner preferences for learning and remembering course content. It also asks students to identify modes of instruction. Further, the survey ascertains discrepancies between learning preferences and modes of instruction.

As mentioned, male and female have different learning preferences (Heffler, 2001; Tindall and Hamil, 2003). The results of this study suggest that doing research and testing out implications is preferred for both males and females, but females are more apt than males to favor abstract materials. The survey findings contradict previous research that suggests women prefer concrete experiences, while men are attracted to the abstract (Heffler, 2001). However, a marked difference between males and female survey respondents, with regard to preferring creative thinking materials to other types, was observed supporting previous studies (Lachenmayer, 1997).

The survey findings reinforce the possible lapse in the accounting for different learning styles (Tindal and Hamil, 2003). Both male and female survey respondents prefer that faculty lecture and use PowerPoint slides. Similarly, both STEM and non-STEM majors reported lecture and use of PowerPoint slides as the primary mode of instruction. On the other hand, case studies and role playing was the least utilized method for all groups. That being said, the research indicates that students employ different learning styles, regardless of gender, and would benefit from different modes of material dissemination. Unfortunately, the results of this study were unable to demonstrate the instructor's use of a variety of content dissemination methods. In addition, the survey results have shown that even among the instructors, similar modes were being used. Therefore, the instructors are not accommodating the spectrum of learning styles (Kolb & Kolb, 2005). This is regardless of the course content, STEM or non-STEM. As mentioned, these unilateral approaches are a barrier to all learners, regardless of gender (Tindal and Hamil, 2003).

IMPLICATIONS

Predominantly, in today's education system, women have successfully integrated. However, in STEM, women still are under-represented (National Science Foundation, 2010). Research has examined many factors which may contribute to the female deficit in these fields but few have considered gender differences in learning styles to be an influential factor. Men and women have been found to differ in their learning and instructional preferences (Heffler, 2001). Women tend to prefer hands-on learning experiences, they make intuitive or feeling based judgments, they are people oriented, and they are comfortable with ambiguity. Men tend to take an analytic approach to their learning, they think logically and rationally, and they enjoy working with symbols and like structure. STEM courses tend to reflect the analytical approach that men tend to embrace. This may create a barrier for women in these fields. Some recommendations for educators to enhance the learning experiences of women and men alike are to create internship opportunities, use real-life examples and applications, allow students to construct knowledge and encourage a collaborative classroom culture.

RECOMMENDATIONS

Institutions of higher education should take gender differences in learning styles into consideration, especially in classrooms which still use traditional teaching methods. There are many ways to consider the learning needs of women and other non-traditional learners in teaching. It is not the intent of this paper to discredit current methods being used in colleges and universities but to encourage growth in pedagogical methods, expanding teaching styles that would enhance the learning experience for all students and not just those whose learning styles fit limited methods. To accomplish this growth in pedagogical methods, the research offers some suggestions to make appropriate curricular changes. A major initiative which would enhance not just learning experiences of women but also men would be internships. Research shows that internships increase proficiency and self-efficacy. Opportunities for a work/study role allow students to have some hands-on experiences in their fields, which help them gain confidence and an early understanding of how learning applies to real life (Madill et al., 2004; Joseph, 2008). In addition, hands-on experiences give students opportunities to immediately practice what they have learned. Moreover, the survey results reinforce the need for practical experiences such as internships and field experiences.

Another recommendation would be to take a multidisciplinary approach to teaching, using real-life applications and practical examples that draw on student interest and hold relevance to the topics being discussed in class (Faulkner and Lie, 2006; Fear-Fenn and Kapostasy, 1992; Madill et al., 2004). Women have more success when they can see the purpose of what they are learning and how it influences the external world (Madill et al., 2004). Furthermore, instead of developing a "transmission" relationship between teachers and students, allowing students to take charge of their own learning, by encouraging experiential learning or self-authorship, will help students construct knowledge, not just receive knowledge (Kolb and Kolb, 2005).

In order to appeal to the social strengths of women, more collaborative learning in the classroom should be encouraged over competition, which tends to isolate students. Competition is commonly encouraged in STEM classrooms to ignite productivity, but that strategy may do little to enhance productivity or performance for women who are people oriented and prefer to be a part of a team. Research suggests that men value competitive environments and women tend to value collaboration; however, as a whole, collaborative and cooperative environments are more attractive to students regardless of gender (Barrett, 2006; Joseph, 2008; Kirk and Zander, 2002). During problem-solving activities, putting students in teams, avoiding all-male/all-female groups, and asking that each person have a specific job which can be rotated among team members during the next group activity, will promote communication and teamwork, as well as ensuring that everyone participates and no one person dominates the group's activities (Fear-Fenn and Kapostasy, 1992). Another benefit to this model is that each student's learning strengths mitigate the learning weaknesses among group members.

AUTHOR INFORMATION

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