THE RELATIONS BETWEEN STUDENTS' ANXIETY AND INTEREST IN PLAYING AN ONLINE GAME

Jon-Chao Hong
Department of Industrial Education
National Taiwan Normal University
tcdahong@gmail.com

Ming-Yueh Hwang
Department of Adult & Continuing Education
National Taiwan Normal University
t06013@ntnu.edu.tw

Tsui-Fang Hsu
Department of Industrial Education
National Taiwan Normal University
tsuifang@hotmail.com

Yu-Ju Chen
Department of Industrial Education
National Taiwan Normal University
luludapipi@gmail.com

ABSTRACT
In this modern and technologically dependent society, people seek to improve human performance, get higher productivity and increase user satisfaction with technologies. In Chinese society, Chinese Idiom learning plays an important role in vocabulary learning which cultural and social functions are involved. Therefore, an online game named 'Chinese Idioms String Up Puzzle' was developed by the Digital Game-Based Learning Laboratory, National Taiwan Normal University in Taiwan to motivate students to learn Chinese Idiom. A survey was conducted to examine participants' anxiety, interest and cognitive load by using this new computer-assisted game. According to the survey, students felt this new program is interesting and would like to play again in the future. For those students who believe anxiety helps their performance, and for those students whose degree of anxiety lowered after completing the test, they tend to have greater interest in playing the game. Findings of the Partial Least Squares (PLS) contribute to an expanded understanding of both psychological anxiety and somatic anxiety influence on their cognitive load, whereas both anxieties was not significantly related to their playing interest. In addition, the study results indicated that the higher degree of psychological and somatic anxiety, the greater cognitive load of the participants.
Keywords: anxiety sensitivity, competitive anxiety, interest, e-learning, Chinese idiom

INTRODUCTION

In this modern society, people, including children and adults, interact with computers in all settings almost every day. Some evidence indicated that computer-assisted educational games could be used for learning and they are more effective than traditional methods (Laffey, Espinosa, Moore, & Lodree, 2003; McGarvey, 1986), in other words, interested students will do faster and learn more in educational settings (Rieber, 1996; Romme, 2003). Additionally, past studies supported that playing games make our brains work efficiently and take in more cognitive materials than we do in traditional settings (Pange, 2003; Perry & Ballou, 1997).

Additionally, in this technologically dependent society, people seek to improve human performance, get higher productivity and increase user satisfaction with technologies. In Chinese society, Chinese Idiom learning plays an important role in vocabulary learning which cultural and social functions are involved. Teachers may have problems to provide each student with an individualized program that has each student's interests in the program (Hidi, 2001). Therefore, we, the Digital Game-Based Learning Laboratory supported by National Taiwan Normal University in Taiwan, developed the 'Chinese Idiom Puzzle' game, to trigger students' interest by visual stimulus, and to motivate students to learn Chinese vocabularies but also Chinese Idioms in either school settings or at home.

The integration of digital game and language learning is not difficult; however, Chinese language-learning programs are still memorization-orientation, and not much fun (Lin et al., 2008). Playfulness and learning can be viewed as two ends of a continuum. At the extreme of playfulness players will not learn; on the other hand, at the extreme of learning there is no fun created by the game design and the players' interaction with the game and its

design (Hong et al., 2009). Thus, the goal of this game design is to engage learners by making learning fun since Chinese is one of the most difficult languages to learn in the world. This computer-assisted educational game was tested in a national-wide competition in Taiwan. It is important to reveal the complex interplay between game and learner, and to understanding the process that occurs within learners' heads. We would like to gain an understanding to what extent participants apply their acquired knowledge and skills in this competition-like problem-solving situation. Therefore, this preliminary study aimed to investigate participants' anxiety sensitivity, cognitive load and participants' interest in playing the game. Moreover, the relationship path between anxiety and interest were examined.

RESEARCH CONTENTS AND HYPOTHESES

Competitive anxiety and game behavior

People with the symptom of anxiety sensitivity, such as racing heart, shortness of breath, or dizziness, tend to fear sensation. Based upon the definition of anxiety sensitivity that Reiss used in 1991, Stewart et al. (2001) stated that anxiety sensitivity is "a fear of anxiety-related sensations, which arises from beliefs that these sensations have harmful physical, social, or psychological consequences" (p. 443). The level of anxiety sensitivity lies on environmental influences (Watt & Stewart, 2000; Stewart et al., 2001; Reiss & McNally, 1985). Furthermore, people with high test-anxiety seemed to have an impact on tasks, achievement tests, and school grades (Cassady & Johnson, 2002; Deffenbacher, 1980; Morris, Davis, & Hutchings, 1981).

Nicaise (1995) defined competitive anxiety as an individual's physiological, cognitive and behavioral responses that stimulate negative feelings about an evaluation. When an individual becomes anxious, the physiological system becomes aroused such as the heart beating faster. At the same time, the individual may experience apprehension and a higher sense of inadequacy. When an individual experiences competitive anxiety, these physical and cognitive responses may lead to negative feelings and cognitions about competitive situations. In addition, competitive anxiety was defined as a feeling of tension that a person experiences before and during an examination (Akca, 2011). Approximately 40% of children suffer from competitive anxiety (Beidel, Turner, & Trager, 1994). According to Galassi, Frierson, and Sharer (1981) found that competitive anxiety levels are affected by positive thoughts, negative thoughts, somatic excitement, subjective discomfort and prediction of marks.

Competitive anxiety and interest in games

Interest has been divided into two types: individual interest and situational interest (Hidi, 2001; Hidi & Renninger, 2006; Krapp, 2000). Individual interest develops slowly, and lasts long; it refers to person's enduring predisposition to re-engage in certain activities. Whereas situational interest is a psychological state of interest that is triggered by specific environmental stimuli, it may or may not have long-term effect on person's knowledge or value (Ainlye, Hidi, & Berndorff, 2002; Hidi, 2001; Hidi & Renninger, 2006). Interest has been conceptualized as an individual predisposition and a psychological state.

In addition, interest has been classified as an affective variable, or an emotion (Dai & Sternberg, 2004; Iran-Nejad, 1987; Meyer & Turner, 2002). Previous studies indicated that interest has a powerful influence and positive role in learning (Hidi & Renninger, 2006; Lawless, Brown, Mills, & Mayall, 2003; Renninger, 1998, 2000; Oblinger, 2004). When children are interested in activities which offer suitable challenges that correspond to their competences, focus their attention, or enjoy their engagements, their interest in the activity will increase, and they tend to learn better than those individuals who do not have such interests (Schiefele, 1998; Kiili, 2005). Educators were suggested to help students to sustain attention for tasks, even though those tasks are challenging; and to provide opportunities for students to ask questions; and to create resources that promote problem solving (Hidi & Renninger, 2006).

Cognitive load theory

Cognitive load theory is a learning theory grounded in the learner's cognitive architecture, it is used to show the load related to the control of working memory (Paas, Renkl, & Sweller, 2004; Sweller, 2010; Van Merrienboer & Sweller, 2005; Baddeley, 1986; Miller, 1956). And it focuses on the used cognitive resources during learning and problem solving. It is more difficult to process the information in working memory when people have to learn in a shorter amount of time. Moreover, it suggested that people learn best under environments that are aligned with cognitive architecture.

Cognitive load theory distinguishes between three types of cognitive load: intrinsic, extraneous, and germane (Paas, Tuovinen, Tabbers, & Van Gerven, 2003). These three cognitive load types are not asymmetric. Intrinsic cognitive load depends on the complexity level of the information, and is determined by the interaction between the material being learned and the expertise of the learners. It measures the amount of working memory at the

given time. Extraneous cognitive load is the extra load, and results from activities or information that does not contribute to the schema construction, such as, the poorly designed instruction. Unlike intrinsic cognitive load, and like extraneous cognitive load, germane cognitive relates to the process that contributes to the schema construction, and is influenced by how information is presented to learners and the learning activities required.

RESEARCH HYPOTHESES

Out of the literature review, a couple of questions emerged that would expand the knowledge base regarding anxiety and interest in playing an online game. Therefore, hypotheses have been distilled in the following major research hypotheses:

H1: Somatic anxiety is positively associated with students' interest in playing 'Chinese Idioms String Up Puzzle'.

H2: Somatic anxiety is positively associated with students' cognitive load in playing 'Chinese Idioms String Up Puzzle'

H3: Psychological anxiety is positively associated with students' interest in playing 'Chinese Idioms String Up Puzzle'.

H4: Psychological anxiety is positively associated with student cognitive load in playing 'Chinese Idioms String Up Puzzle'.

METHOD

'Chinese Idioms String Up Puzzle' game

To achieve the benefits of interest we developed an online game named 'Chinese Idioms String Up Puzzle' that draw on the form of interest motivation and address the challenge of language learning. It was designed on the belief that this game is highly motivating and engaging.

'Chinese Idioms String Up Puzzle' game, like crossword puzzles, is a text reconstruction online program developed by the Digital Game-Based Learning Laboratory, National Taiwan Normal University in Taiwan. This tool used the power of computer and competition or collaboration toward the fun factor to motivate Chinese idiom learning. Students are timed to key in the missing words. The great amount of learner control influence students' motivation and performance in computer-based instruction (Becker & Dwyer, 1994; Schnackenberg & Sullivan, 2000). This game encouraged students to use their organizing schemes to explore language, thus, students are active participants rather than passive recipients in learning. In addition, students have more confidence and great satisfaction when they work together to find the missing words.

Figure 1 shows the illustration for practice. Students are timed to key in the missing words of the Chinese idiom in each side of the square clockwise. They are expected to type and learn Chinese idioms by searching their memory scheme and associating Chinese idioms for finding out the correct characters. In addition, this game could pair students to challenge each other (Figure 2). This game encouraged students to use their organizing schemes to explore language, thus, students are active participants rather than passive recipients in learning.

Fig. 1. Key in the missing characters to make words in each side of square becoming a four-character idiom.

Fig. 2. Paired students to challenge each other.

The designs of this game help student to sustain attention to answer questions. Furthermore, this game seek to establish relevance between Chinese Idiom learning and learners' interests.

Research Design

This study was conducted using a survey research design. The first step of the study design procedure was to develop a set of survey questions regarding anxiety and interest based on the review of documents and literature. Second, the initial version of the instrument was given to an expert panel to evaluate. Third, the final version of the survey instrument was administered to the participants. Finally, a combination of descriptive, comparative and correlative approaches was used to analyze the data.

With the time restrictions entailed in the implementation of this study, a cross-sectional sampling approach was employed in this study: this allows the study to be conducted at a single point in time, and requires that the respondents answer the survey just once (Leedy & Ormrod, 2001). Participants in this study were elementary and junior high school students involving in the final match of the 'Chinese Idioms String Up Puzzle' Competition.

Participants

The Digital Game-Based Learning Lab and Hinet EduCities hold a competition to motivate students to learn Chinese Idiom through the game-based program named 'Chinese Idioms String Up Puzzle'. To qualify themselves in the final match, each individual who was primary or junior high school student and each primary or junior high school group had to attend the kick-off regional competitions.

Therefore, those students in the final match were invited to participate in this study. Of the 122 returned questionnaires, a total of 63 participants were males and 59 participants were females. According to survey responses the minimum age of the participants was 10 years old; the maximum age was 16 years old. The mean age was 13.09 years old. Their grades ranged from grade 4 to grade 9.

Data collection

Prior to collecting data, permission to distribute the survey was obtained from the Hinet EduCities. The data collection initiated after approval by the Hinet EduCities. The Hinet EduCities was asked to pass out the survey package to each participant involved in the final match of the 'Chinese Idioms String Up Puzzle' Competition. After the competition, each participant was given a survey package which contained a cover letter including the purpose of the study, the importance of their involvement and appreciation for returning the survey. A total of 200 participants received questionnaires and 122 questionnaires were returned. Of the 122 questionnaires returned, only one was invalidated, 121 were available to analyze the data because participants who did not complete the one of the three sections of the questionnaires had to be excluded.

Instrumentation

The instrumentation was developed by the researcher based upon the literature review and previous studies regarding the objectives of the study. The survey questionnaire was a self-reporting design starting with an introduction, which consisted of the purpose of the study and the instruction to participants.

Text Anxiety Scale. The first section of the survey, Section A, was adapted from the study done by Ree, MacLeod, French and Locke (2000), and encompassed four item clusters. The first part of Section A contained 9

items asking participants to rate the degree of somatic anxiety on a 5-point Likert scale where very low =1, low=2, normal=3, high=4, and very high=5. The second part of Section A contained 11 items sought responses to identify participants' psychological text anxiety on a 5-point scale where very low=1, and very high =5.The third section of Section A contained two items asking participants whether their somatic and psychological anxiety helped their game competition performance on a 5-point scale where 'not helpful at all=1, not helpful=2, neutral=3, helps=4, and helps a lot=5'. And the fourth section of Section A contained 2 items asking participants whether their degree of somatic and psychological anxiety lower once the competition get started on a 5-point scale where not helpful at all=1, and helps a lot=5. Data collected in Section A was ordinal in scale.

Somatic anxiety questions listed in the first section of Section A, such as, Item 2 (heart beating), Item 5 (thirsty), and Item 9 (short of breath). Psychological anxiety questions listed in the second section of Section A, such as, Item 2 (worry about their performance), Item 4 (cannot concentrate), and Item 5 (afraid of losing the competition). The third section questions asking participants whether somatic anxiety help their performances (Item 1) and whether psychological anxiety helps their performances (Item 2). And the fourth section questions asking participants whether the degree of somatic anxiety lowers once the competition get started (Item 1) and whether the degree of psychological anxiety lowers once the competition get started (Item 2).

Interest toward Playing 'Chinese Idioms String Up Puzzle' Game Scale. The instrument was adapted from the studies done by Paas, and van Merriënboer (1994), and Lusk (2008). The objectives of Section B of the survey were to measure participants' interests toward playing the game named 'Chinese Idiom Puzzle'. This section included 9 items on a 5-point scale, where the responses were strongly disagree=1, disagree=2, neutral=3, agree=4 and strongly agree=5. Data collected in Section B of the survey was ordinal in scale.

Interest toward playing 'Chinese Idioms String Up Puzzle' Game questions listed in the survey, such as, Item 1 (I believe learning Chinese Idiom is interesting by playing 'Chinese Idioms String Up Puzzle' Game), Item 2 (I would like to join classmates to play 'Chinese Idioms String Up Puzzle' Game), Item 5 (I would like to recommend 'Chinese Idiom Puzzle' Game to people I know), and Item 8 (I would like to play other games similar to 'Chinese Idiom Puzzle' Game in the future) .

Cognitive load toward Playing 'Chinese Idiom Puzzle' Game Scale. The third content area of the survey was titled 'Cognitive Load Scale', and it was adapted from the studies done by Paas, and van Merriënboer (1994). It asked participants to rate 13 statements regarding cognitive load toward playing 'Chinese Idioms String Up Puzzle' Game. Data was collected ordinally in a 5-point scale where, 'strongly disagree=1, disagree=2, neutral=3, agree=4 and strongly agree=5'..

Cognitive load questions listed in the questionnaire, such as, Item 2 (I believe it is very difficult to handle the way of interaction), Item 4 (I believe it is very difficult to answer the questions regarding the game contents) and Item 7 (I feel frustrated to answer the questions in the game), Item 9 (The limited time to finish the game makes me feel disappointed), and Item 13 (I need to pay full attention to answer the questions in the game).

Reliability and validity

The issues of reliability and validity were considered to be important factors in this researcher's developed questionnaire. To ensure the questionnaire would yield trustworthy data, the initial questionnaire were sent to an expert panel to review the questions. The expert panel in this study considered university faculties, and elementary teachers who were experts in this field. They were asked to review the initial instrument and to identify (1) the words expressed, and the format used in the questionnaire; (2) the content validity of the questionnaire; and (3) the reliability of the question. After the review of the instrument, some minor changes were made according to the expert panel's feedback and suggestions. The final version of the survey was approved by the expert panel. The other issues related to reliability and validity of the survey was addressed in the data analysis sections.

Data Analysis

Analysis of Measurement Model

Partial Least Squares (PLS), a structural modeling technique, was used to test the research hypotheses in this study. PLS was appropriate for this study because it has the ability to handle missing values, small sample size, formative constructs and it presumes no distributional form for measured variables (Chin, 1998; Chin et al., 1996; Chin et al., 2003). The sample size of 122 in this study was passing the recommended minimum of 40 for model testing (Wixom & Watson, 2001).

Beside the evaluation of an expert panel, the reliability and validity of the survey were assessed in several ways

by the implementation of PLS. The measurement model of PLS included the estimation of convergent validity, discriminant validity and internal consistency. Convergent validity was confirmed by examining the Average Variance Extracted (AVE) value and the factors loadings of each item (excluding demographic section). To assess discriminant validity, the square root of AVE of each construct was computed and compared with the correlation between constructs. The results of PLS indicated that all AVE values passed the suggested value of 0.5 (Fornell & Larcker, 1981; Gefen et al., 2000; Wixom & Watson, 2001), ranged from 0.50 to 0.93 (see Table 1); the factors loadings of the all items are significant and higher than the suggested value of 0.5 (Nuunally, 1978), ranged from 0.54 to 0.97. All square roots of the AVE were larger than the correlation coefficient between constructs, indicating that each construct was closely related to its corresponding measurement items. This supports the discriminant validity of the measures.

Moreover, internal consistency was assured by examining the composite reliability of each construct, except for the demographic section. Cronbach Alpha value was measured as well for each construct except for the demographic section. Table 1 shows the results of composite reliability and Cronbach Alpha values. All composite reliability values ranged from 0.90 to 0.97, exceeding the suggested values of 0.7 (Nunnally, 1978; Hair et al., 1998). Cronbach Alpha values ranged from 0.83 to 0.93 indicating good reliability.

Table 1: *Results of composite reliability, Cronbach alpha values and AVE*

Construct	Composite Reliability	Cronbach Alpha	AVE
Somatic anxiety	0.90	0.87	0.50
Psychological anxiety	0.92	0.90	0.51
Whether anxiety helps on the test	0.92	0.83	0.85
Whether degree of anxiety lower	0.97	0.93	0.93
Interest	0.93	0.92	0.61
Cognitive load	0.93	0.92	0.52

Results of research model

In PLS, the structural model tests provided the information to assess the research hypotheses in a research model. The test of structural model included the estimation of path coefficients and R^2 values which indicate how well the model in performing. Path coefficients represent the strength of the relationships between two variables. The R^2 values indicate the amount of variance explained by the independent variables. When R^2 values get greater, the model's predictive quality is better (Chin & Newsted, 1999; Wixom & Watson, 2001).

The structural model was used to test the path coefficient which indicated the strength of the relationship between variables. Thus, the relationship between two constructs included in the model was examined. Results for hypotheses 1 through 4 were determined by using the bootstrap resampling procedure to examine the stability of the PLS estimates (Chin, 1998). Figure 1 shows the results of structural model testing.

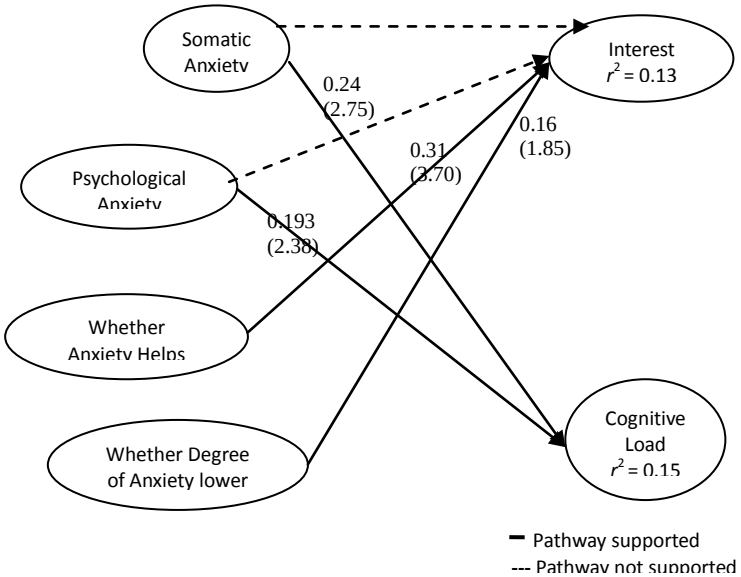

Fig. 3. Research model testing.

RESULTS

The present study was designed to use PLS to further investigate the relationships of somatic anxiety, psychological anxiety, interest in playing an online game and the cognitive load. We had hypothesized that: (1) somatic anxiety is positively associated with students' interest in playing 'Chinese Idioms String Up Puzzle', (2) somatic anxiety is positively associated with students' cognitive load in playing 'Chinese Idioms String Up Puzzle', (3) psychological anxiety is positively associated with students' interest in playing 'Chinese Idioms String Up Puzzle', and (4) psychological anxiety is positively associated with student cognitive load in playing 'Chinese Idioms String Up Puzzle'.

The structural model testing indicated that (1) hypothesis 1 was not confirmed. The path direction indicated that somatic anxiety was not significantly related to students' interest in playing the game; (2) hypothesis 2 was confirmed (p=.24, t=2.75). Somatic anxiety is positively associated with students' cognitive load; (3) hypothesis 3 was not confirmed. The path direction indicated that psychological anxiety was not significantly related to students' interest in playing the game, and (4) hypothesis 4 was confirmed (p=.19, t=2.38). Psychological anxiety was positively associated with students' cognitive load. Moreover, the results showed that students' interest in playing the game was influenced by whether somatic and psychological anxiety helps on the test (p=.31, t=3.70), and whether the degree of somatic and psychological anxiety lower when the competition begins as compare to the degree of anxiety before the competition (p=.16, t=1.85).

The structural model testing indicated that hypothesis 1 was not confirmed. The path direction indicated that somatic anxiety was not significantly related to students' interest in playing 'Chinese Idioms String Up Puzzle'. While the hypothesis 2 was confirmed, the path direction indicated that interest was significantly influenced by psychological anxiety. Briefly, the result did not mirror the results of previous studies (Deffenbacher, 1980; Cassady & Johnson, 2002; Morris, Davis, & Hutchings, 1981; Zatz & Chassin, 1983) indicating students with high degree of test anxiety or anxiety sensitivity had poorer test performance.

Descriptive analyses revealed that many participants tend to have a higher degree of somatic anxiety only on racing heart item, as compare to other somatic anxiety items. Many of participants, including people who won the first prize in elementary and junior high school group competitions, reported that they have a higher degree of psychological anxiety, such as, worry about their performances, and afraid of losing the contest. It is exciting to find that majority of all students rated this game was interesting and would like to play it again.

As predicted, anxiety levels increased over the duration of competition, dropping significantly after completing the test. This is consistent with the notion that participants experience an increasing cognitive backlog of items requiring conceptual processing. In addition, the results indicated that the higher degree of psychological and somatic anxiety, the greater cognitive load participants had. The experience of anxiety could be considered a natural result of this developing backlog. After completion of the test, a release of anxiety is observed with the completion of the memory task.

One of the interesting results of this study was no significant difference was detected between anxiety and performance. It is possible that participants had a great backlog of experience with 'Chinese Idioms String Up Puzzle' to fall back on either students worked in groups or individually. At other times the anxiety measure may have been capturing something more like a general predisposition about having tests, it only provides insight into differences in observed performance when they are administered during the performance.

CONCLUSION

The results of this study indicated that this 'Chinese Idioms String Up Puzzle' game is attractive to the learners while it implied that it is practical for the teachers, and that somatic and psychological anxiety do not seem to influence their interests in playing this game in the future. The games for educational learning grow fast, we seek to contribute to this field by showing the positive learning outcome of 'Chinese Idioms String Up Puzzle' that has attracted the attention of participants, and we hope to deploy this learning strategy in both educational settings and at home. The results of the anxiety measure this study provided initiative us to start researching different domains of learning in the future.

The major implication of the study is directed toward identifying ways to improve outcomes of computer-assisted game learning or digital learning for students in Taiwan. For example, (1) school administrators, or teachers may put more emphasis on computer-assisted games to vitalize the instruction, (2) other professionals who cares about education, such as, e-learning web site designer, could construct a variety of e-learning platforms to attract students.

Many unresolved questions in this research that need to be dealt with. For example, the power of this 'Chinese Idioms String Up Puzzle' game acts as a medium for supporting Chinese idiom learning; it creates an environment for interesting language activity while data could be collected to understand how the learner makes use of that learning environment. Obviously, a great deal of research is needed, not only on this unique game, but also on developing new instruments to explore the details of the learning experience and the nature of students' working memory, and language processing. Additionally, the length of engagement in playing the game or in tying Chinese vocabularies in the computer was needed to clarify when replicating the study.

The online game itself is unique and may be useful to future researchers interested in a deeper understanding regarding Chinese Idiom learning issues. For example, future research is needed to examine the shape of the relationships between learning, and interest, especially when comparing across different levels of knowledge. Previous studies indicated that interest increased as learning increased (Schraw et al., 1995). We feel that it is adequate to test whether interest is related to high-knowledge participants and low-knowledge participants.

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