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The Influence of Pre-Exam Activities on Test Performance: Studying the Gender Differences

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บทคัดย่อ

การวิจัยครั้งนี้มีวัตถุประสงค์เพื่อศึกษาอิทธิพลของกิจกรรมก่อนการสอบที่ส่งผลต่อผลการสอบและนัยสำคัญของเพศในแต่ละกรณี เครื่องมือที่ใช้ในการทำวิจัยประกอบด้วย แบบสอบถามและคะแนนสอบอย่างเป็นทางการในรายวิชาสังคมศึกษา ผู้ตอบแบบสอบถาม (n = 358, เพศหญิง 224, เพศชาย 134) ถูกจัดให้อยู่ในกลุ่มหนึ่งในห้ากลุ่มตามกิจกรรมก่อนการสอบที่ได้เลือกไว้คือ การฝึกจดจำเนื้อหา (PRSM), การเขียนหรือการทบทวนเนื้อหาที่จดไว้ (WRCN), การกระตุ้นสมอง (BCS), อารมณ์และการมีปฏิสัมพันธ์ทางสังคม (SI) วิเคราะห์ข้อมูลโดยใช้ค่าเฉลี่ยค่าพิสัยควอร์ไทล์ของคะแนนสอบ โดยการวิเคราะห์ความแปรปรวน (ANOVA) และการทดสอบค่าที (t-test) ด้วยนัยสำคัญทางสถิติที่ระดับ 0.5 ผลการวิจัยพบว่า 1) โดยรวมคะแนนสอบมีความแตกต่างกันอย่างมีนัยสำคัระหว่างกลุ่ม 2) ความแตกต่างอย่างมีนัยสำคัญของคะแนนสอบเมื่อเปรียบเทียบระหว่างเพศพบเฉพาะในสามกลุ่มจากห้ากลุ่ม 3) ความแตกต่างระหว่างเพศมีค่ามากที่สุดในกลุ่ม SI การวิจัยในอนาคตควรพิจารณาความแตกต่างระหว่างเพศในแต่ละกลุ่ม โดยการทดสอบความรู้ความเข้าใจในรูปแบบต่าง ๆ และผลของการปฏิสัมพันธ์ในรูปแบบต่าง ๆ ภายในกลุ่ม SI

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Abstract

The aim of this study was to investigate the influence of pre-exam activities on exam performance, and the significance of gender in each case. The research instruments comprised of a behavioural trait questionnaire and the scores which were taken from a Social Studies formal examination. Respondents (*n* = 358, female = 224, male = 134) were assigned to one of five groups based on their chosen pre-exam activity; Practising Recall of Subject Material (PRSM), Writing/ Reviewing Course Notes (WRCN), Brain Chemical Stimuli (BCS), Mood, and Social Interaction (SI). Data were analysed in terms of mean quartile range exam scores using analysis of variance (ANOVA) and t-test at the .05 significance level. The study found that: 1) Overall, a significant difference in test scores was observed between groups; 2) A significant difference in test scores was only observed in three of the five groups when compared by gender; 3) The gender difference was greatest in the SI group. Future research should look at the gender differences in each group across different styles of cognitive test, and the effects of the different forms of interaction within the SI group.

KEYWORDS: BEHAVIOURAL TRAIT / EXAM PERFORMANCE / GENDER DIFFERENCE / PRE-EXAM

Introduction

Throughout education, there has always been a requirement to evaluate student performance to ascertain their understanding and ability to apply their knowledge. While formal methods of testing, such as national tests, are viewed as a reliable measuring instrument, anxiety, fatigue, lack of self-confidence, or perceived ability can often have a significant impact on the true performance of the student and, hence, produce an inaccurate evaluation of their true potential. It is commonplace for teachers to expect students to prepare for an exam by reviewing course notes and practising exam style questions; however, prior to the exam, students are often observed participating in various activities. This has often led to debate among teaching staff regarding the effects of pre-exam activities on students' exam performance.

Aims of this study are to investigate the influence of pre-exam activities on exam performance, and to determine whether gender has a significant influence in each case. It is hoped that the findings from this study would assist educators in better understanding the study needs of their students.

Literature Review

While there has been significant research into the effects of specific activities on cognitive performance, test anxiety, and test performance, it was not possible to source any research that drew a more general comparison between the effects of different pre-exam activities on test performance. The search for literature focused on six topics in relation to cognitive performance and test performance: practising recall of subject material, reviewing course notes, anxiety, social interaction, mood, and chemical stimulation in the brain.

Students are often expected to prepare for exams by reviewing course notes or practising exam style questions. Practising questions that are similar to the exam has been shown to improve exam performance and the overall confidence of the student (Hackathorn et al., 2012). The retrieval of subject information during this process requires the student to actively recall the information, which strengthens their knowledge and increases the likelihood that they will recall it again in the future (Karpicke, 2017; Karpicke, Blunt, & Smith, 2016); however, excessive revision in this way can lead to fatigue, self-doubt, and heightened anxiety (Kumari & Jain, 2014).

In terms of recall and exam performance, research has shown that students are capable of learning while reviewing or taking notes. During note taking, memorisation occurs most when students engage in a deep comprehension of the source material (Williams & Eggert, 2002); however, this method of making notes requires significant cognitive effort, which may,

in turn, lead to cognitive overload (Piolat, Olive, & Kellogg, 2005).

In an exam situation, it is normal for students to feel a level of anxiety and display physiological symptoms such as an increased heart rate, sweating, or the urge to urinate. Such symptoms are a natural, automatic reaction to a perceived threat or danger, which often stems from poor exam preparation or a poor performance in a previous exam (Trifoni & Shahini, 2011). The brain's reaction is usually to release adrenaline, which increases the arousal state and can lead to sharper reactions and improved performance; however, for students who possess heightened levels of anxiety sensitivity, the effects can be debilitating (Reiss & McNally, 1985). In their research, Osa-Edoh and Jolly (2013) looked at the relationship between students' test anxiety and test performance. They used a modified test anxiety inventory to measure the test anxiety and test performance of 50 secondary school students. They concluded that a significant relationship exists between test anxiety and test performance.

Exam-related stress can also cause ego depletion (Valentin & Mihaela, 2015), leading to a loss of self-control and willpower, and a negative effect on motivation, recall, and concentration (Trifoni & Shahini, 2011), all of which can lead to increased errors during the exam. According to Burns (2004), poor exam preparation and previous exam scores are factors that greatly influence anxiety in students. In his research on 378 junior and senior students, he used questionnaires to measure the students' reported anxiety, their performance expectations, and their level of preparation for the final exam. He then compared these results with the students' performance in two midterm exams and the final exam. Burns found that the students' grade expectations at the beginning of an academic term had little or no effect on

their reported level of anxiety at the final exam. He found that students who had scored higher on the first two exams reported higher anxiety at the final exam than those who scored lower on the first two exams. In addition, students who reported poorer preparation for the final exam also reported higher levels of test anxiety.

It is worth noting here that the research of Trifoni and Shahini (2011) and Walsh, Stewart, McLaughlin, and Comeau (2004) found that anxiety sensitivity was greater in girls than boys when evaluated using a childhood anxiety sensitivity index (CASI). Their research sample consisted of 1698 children (877 boys, 821 girls; mean age 14.3 years).

Faced with a stressful situation, students will often interact with their peers, possibly as a means of support or to discuss the pending examination. Research has shown positive and negative effects from such interaction, which relate specifically to anxiety. Interacting with peers who suffer from test anxiety is more likely to exacerbate the individual's anxiety (Zalk, Kerr, Branje, Stattin, & Meeus, 2010); however, having a best friend present in a stressful situation can help to reduce the effects of anxiety (Adams, Santo, & Bukowski, 2011; Yantz & McCaffrey, 2009).

Alternatively, students also try to alleviate test anxiety through activities that distract their attention away from the exam. Studies of such activities have produced varying results depending on the respondent and the type of task to be performed. The effects of such activities are typically associated with changes in mood through arousal, enjoyment, and the stimulation of dopamine in the reward systems of the brain, which in turn can lead to reduced anxiety and improved cognitive performance (Angelucci, Ricci, Padua, Sabino, & Tonali, 2007; Goldenberg, Floyd, & Moyer, 2013).

For example, listening to music that is enjoyable to the listener, and at a time when the listener is receptive to hearing such music, can have an uplifting effect; stimulating arousal and mood which, in turn, can affect cognitive performance (Huang & Charyton, 2008; Schellenberg, 2005); however, music can act as a distraction and raise anxiety if the genre or time of listening is not to the preference of the listener (Angelucci et al., 2007). In their study of 87 undergraduate students (43 female, 44 male), Knight and Rickard (2001) measured anxiety, blood pressure, and heart rate of their respondents when exposed to a stressor in the presence of either music or silence. Their study found that exposure to music (Pachelbel's *Canon in D major*) was capable of preventing significant increases in anxiety, blood pressure, and heart rate. They also found that the effects were consistent in both male and female respondents.

Examining the effect of playing video games on mood and stress, Russoniello, O'Brien, and Parks (2009), found that respondents who played one of three simple video games displayed changes in brain wave activity and heart rate, along with reporting changes in their psychological mood. Their study, consisting of 134 respondents (57 female, 44 male [*sic*]; mean age 24 years), showed that, while all three games improved mood, their effects on brain wave activity were different. Results from a self-reporting assessment also showed that the three games had different, but positive effects on the psychological mood of the respondent, such as anger, stress, fatigue, and confusion. Barlett, Vowels, Shanteau, Crow, and Miller (2009) also studied the effect of different games on cognitive performance. In their study of 35 students (28 male, 7 female; 18 to 20 years), they measured the effect of playing violent and non-violent video games on their respondents' performance across four cognitive areas. Their results showed that respondents in the control group

did not display improved cognitive performance after the treatment session, whereas respondents in both the violent and non-violent groups displayed a significant increase in cognitive performance.

Research has shown that the presence of certain chemicals in the brain can have a significant influence on cognitive processing. Adrenaline and dopamine, for example, have been shown to enhance cognitive processing. The release of dopamine in the brain during exercise can affect movement and response times, working memory (Chaddock et al., 2010), and the flow of information between different areas of the brain (Fellous & Suri, 2002). Aerobic exercise, in particular, has been shown to physically improve the development of regions of the brain (Fellous & Suri, 2002; Hillman, Erickson, & Kramer, 2008; Nanda, Balde, & Manjunatha, 2013) and increase levels of concentration (Fellous & Suri, 2002); however, the effects on concentration, short-term memory, and long-term recognition are not universal (Etnier, Labban, Piepmeier, Davis, & Henning, 2014; Nanda et al., 2013), suggesting there may be a relationship between the type of exercise and different types of cognitive processing.

High levels of glucose have also been shown to trigger the release of dopamine in the brain (Koshimura, Tanaka, Murakami, & Kato, 2003), which can reduce anxiety and improve working memory and motor skills (Angelucci et al., 2007; Fellous & Suri, 2002; Goldenberg et al., 2013). Glucose in the body is consumed during tasks that involve cognitive and motor skills (Valentin & Mihaela, 2015), which manifests itself in the form of impaired cognition and coordination, and increased anxiety and confusion when the glucose levels in the body fall too low (Valentin & Mihaela, 2015). Maintaining a healthy balance of glucose in the blood, therefore, is of importance where

concentration and efficient cognitive function are concerned. In their research, Valentin and Mihaela (2015) measured the blood glucose levels of students before and after completing a series of tasks to test their cognitive and motor task skills. Their respondents, 32 students (5 male and 27 female; 19 to 40 years), completed a combination of COG test, STROOP, and "2HAND COORDINATION" tests based on the Vienna Test System. They reported a noticeable difference in cognitive and motor skill performance after continuous straining in tasks lasting at least 10 minutes. They also reported that the differences were more significant in the STROOP and "2HAND COORDINATION" tests.

In conclusion, the activities in which students participate before an exam, either for exam preparation or simply to pass the time, can have a positive or negative effect on their anxiety, memory, attention, or cognitive processing. In many cases, the mechanics behind such effects are not particularly well understood, and the effects, either positive or negative, are often short-lived and can be influenced by other factors, such as age, gender, and time and type of task. The effects of certain pre-exam activities can be attributed to the release of chemicals in the brain or a change in the mood of the individual.

Research Framework

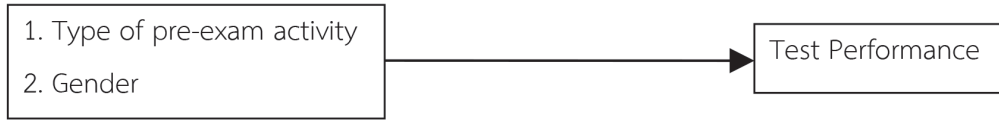

Figure1 Research Framework

Objectives

The objectives of this study were to:

1. Determine the significant effects of pre-exam activities on test performance by comparing the effects of different pre-exam activities on test performance.
2. Determine if the effects of pre-exam activity are dependent on gender by comparing the test performance of each gender based on the different pre-exam activities.

Hypotheses

Based on the research literature, the following two hypotheses were identified:

H_1 : The students' choice of pre-exam activities will have a significant influence on their test performance.

H_1 : The gender of the student will be a significant factor in the effects of pre-exam activities on their test performance.

Research Method

Context

This study was conducted in a specialised language programme within a large government school in Nakhon Si Thammarat, southern Thailand. The school houses students studying in mattayom levels one to six (age 12 to 18) and is divided into upper and lower secondary levels. The school is further divided into different programmes, in which students study with a particular bias towards one or more subjects. Within the context of this study, the population consisted only of students who study in the English programme, which houses only lower secondary level students, aged 12 to 15.

Participants

As this study was a census study, the sample group was the entire population of English programme students (*n* = 358, female = 224, male = 134). A minimum sample size of 187 was calculated using the formula defined by Krejcie and Morgan (1970), with a confidence level of 95% and a 5% margin of error.

Instruments and Validity

Data was collected through formal testing and a questionnaire. A census method of data collection was used because the population was not vast but heterogeneous. Although there was an even number of students for each age range, the ratio of male and female students varied between classes and grade levels.

A questionnaire was used to collect demographic data and pre-exam behavioural traits from each respondent. As the questionnaire used nominal data, reliability could not be established through Cronbach's Alpha; therefore, the questionnaire was evaluated by three experts. A live test was also performed to identify any semantic issues and to ensure that the data collected would be suitable and detailed enough to complete the study.

The test was a formal end of semester Social Studies exam. Face validity was established through independent screening of the test papers to ensure the required learning strands were assessed. Test reliability was established by having each level of students sit the same exam at the same time. Each test consisted of 50 multiple choice questions and approximately 20 written answers on similar course topics.

On the day of the study, questionnaires were distributed for completion at the end of the first exam. The students were instructed on the terms of the questionnaire and if they chose to complete it, to select a single response from each section. After collection of the completed questionnaires, they were screened for completeness and correctness. Incomplete and invalid questionnaires were rejected. Exam scores were collected at a later date after they had been approved by the school.

After completion of the main data collection, the data were screened for completeness and correctness to ensure no erroneous data could interfere with the final analysis.

Control and Consistency

In an attempt to reduce the effects of extraneous variables, such as exam room conditions, the completion of the exam and questionnaire were conducted in a single room capable of seating all three levels of students at the same time. Recency effect, due to time limitations in completing the questionnaire, was also controlled by preventing the collection of questionnaires until all respondents had finished. The completion of the exam and questionnaire was overseen by exam proctors, who followed exam procedures and specific instructions relating to the administration of the questionnaire.

Activity Grouping

The pre-exam activities offered in the questionnaire were arranged into five activity groups, namely “Practising Recall of Subject Material” (PRSM), “Writing/ Reviewing Course Notes” (WRCN), “Social Interaction” (SI), “Mood” and “Brain Chemical Stimuli” (BCS). The activity groups were not known to the respondents as they would be used only in the analysis

stage: Students who practised exam style questions from past papers, worksheets, or online quizzes were assigned to the PRSM group; Those who reviewed course notes and keywords, or wrote new study notes where assigned to the WRCN group; Those who talked with friends or used social media were assigned to the SI group; Those who participated in activities that, according to the literature, helped to reduce anxiety, such as playing games, listening to music, or watching movies, were assigned to the Mood group; Those who participated in activities that, according to the literature, had an effect on the chemicals in the brain, such as eating and exercising, where assigned to the BCS group.

Data Analysis

In preparation for analysis, the raw exam score for each student was coded into a lower, mean, or upper quartile range category based on quartile range scores calculated for each grade level. Individual pre-exam activities were assigned to one of the five activity groups. All data were screened for missing values and violations of the assumptions of the analysis of variance (ANOVA) and t-test analysis methods. There were no missing data or outliers, and, as the sample size was in excess of 200, Central Limit Theorem (CLT) of normality was assumed (Elliott & Woodward, 2007).

Research Results

Analysis of variance (ANOVA) of quartile range scores was found to be statistically significant [F (4, 343) = 2.747, p = .028].

Tukey multiple comparisons analysis, performed at the .05 significance level, found that the mean quartile range scores of a PRSM group were significantly higher than a BCS group score (p = .042); however, no significant

difference was found among the other three groups (WRCN, Mood, and SI group).

Independent-samples t-test analysis found that overall, exam scores were significantly different between the two genders [t (257.9) = -4.102, p < .001]; however, further analysis found a significant difference was only applicable to a WRCN group [t (171) = -2.642, p = .009], a Mood group [t (36.9) = -2.089, p = .044], and a SI group [t (25) = -4.944, p < .001]. Exam scores of female and male students in a PRSM group were not significantly different [t (92) = .128, p = .898]. Exam scores of female and male students in a BCS [t (13) = .159, p = .876] group were also not significantly different (Figure 1).

The ANOVA results indicate that the respondents' choice of pre-exam activity had a significant influence on their exam performance. Although an overall gender difference was observed, gender was not found to be a significant factor throughout all the activity groups. The greatest gender difference was found in the SI group, in which female students attained significantly higher exam scores than male students [t (25) = -4.944, p < .001].

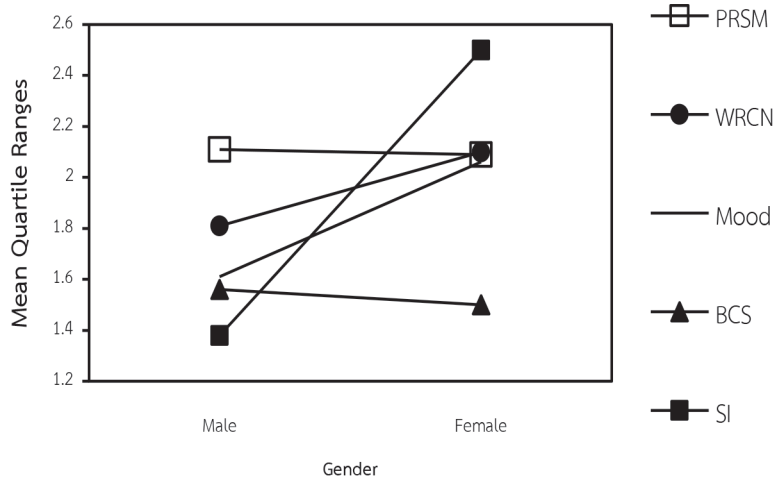

Figure 2 Activity Group Mean Quartile Range Scores by Gender.

Discussion

The results of this study have supported the findings of existing research literature relating to the significant positive or negative influences of pre-exam activities on exam performance; however, the results were inconclusive with regards to the effects of such activities when gender is a considering factor.

The process of reviewing course material has been shown to reinforce the encoding of information in the brain and assist in the recall of key facts in an exam situation (Kiewra et al., 1991; Peverly, Brobst, Graham, & Shaw, 2003), which was reflected in this study; however, based on the literature, students in the BCS group should have displayed characteristics such as heightened concentration (Chaddock et al., 2010) and cognitive performance (Chaddock et al., 2010; Nanda et al., 2013; Schellenberg, 2005), and reduced anxiety (Angelucci et al., 2007; Goldenberg et al., 2013), which was not observed in the overall results. One possible reason for this could be, while such attributes would be considered valuable in an exam situation, it is possible that concentration and cognition skills were of less significant value in the exam subject used in this study. In support of this, it is worth noting that the Social Studies exam covered a large amount of fact-based information, requiring students to recall specific dates, places, or persons while placing less emphasis on other skills where heightened cognition or concentration skills may have been advantageous.

While these results are supportive to a common viewpoint of educators, that the reviewing of course material is the most effective way in which students should prepare for their exams, it is suggested that such a bias towards recall skills in the exam may have significantly influenced the

results. Based on this apparent bias towards testing recall skills, it can be concluded that the relatively poorer performance of students in the BCS group is consistent with the findings of Etnier et al. (2014), who reported no effects of aerobic exercise on short and long-term memory recall. The literature relating to activities in the BCS group also highlights that the effects relate more to cognition, concentration, and anxiety rather than memory recall function. This, it is proposed, was a contributing factor in the poorer exam performance of students in this group when faced with such a demand for recall skills.

Although the analysis showed that overall, female students performed statistically better than males, a significant difference was only observed in three of the five activity groups when compared individually by gender (WRCN, Mood, and SI). A consistent gender difference had been anticipated based on a higher sensitivity to test anxiety in girls (Trifoni & Shahini, 2011; Walsh et al., 2004), however, this was not universally supported in the results. It is proposed, therefore, that anxiety was not the main intermediate variable being influenced.

Overall, when compared by gender, the SI group had the most positive effect on exam performance for female students, but the most negative effect on exam performance for males. This raises a number of questions regarding the specific effects on each gender, such as concentration, cognitive performance, or anxiety; also the content or form of interaction that took place in the lead-up to the exam. For example, were students supportive of each other (Adams et al., 2011), or did they tease and ridicule one another? Many exam preparation guides warn specifically against discussing the test or concerns relating to it with other students taking the

test because this can lead to increased anxiety (Morgan, 2014; Upchurch, Henry, Pine, & Rickles, 2014; Vernon, 2013). It is proposed that discussing the exam, expected difficulty, or how much time was spent on revision in comparison to their peers may well have resulted in increased anxiety or reduced confidence amongst the male students, leading to their poorer performance when compared to females in the same activity group.

Conclusion, Implications, and Recommendations

With so much importance placed on exam performance, students face ever-increasing pressure to attain high scores and high rankings. Educators and parents alike also place high expectations on students, which in turn creates greater stress and pressure on the individual. This study has given an insight into the ways in which students attempt to alleviate this pressure in the lead-up to their exams. It was observed in this study that students have distinct motives for the ways in which they occupy themselves before or between exams, many of which relate more to psychological conditioning rather than academic preparation. It is important for parents and educators to be aware of the students' exam preparation needs and for them to learn and understand, not only what motivates the student to perform such activities, but also the influence each activity has on aspects of cognition, concentration, and anxiety.

It is hoped that the findings of this case study can be utilised to advise students on ways to reduce or manage their test anxiety, improve their confidence, and hone their exam skills.

Future research should look at individual activities and their influence on the intermediate variables in order to identify the underlying influences on exam performance. Such influences could then be studied using subjects

that focus on different forms of cognition. This would be particularly useful to assess whether the same student would opt to do the same pre-exam activity when preparing for a different subject exam where they might expect to encounter other forms of assessment, such as problem-solving, reasoning, or spatial awareness. It would also be beneficial to perform a deeper study into the form and style of interaction amongst the male and female students in the SI group, and the influences on exam performance in each case. Finally, a repeat of this study in other schools located in different provinces of Thailand would be particularly valuable in understanding the pre-exam behaviour of students throughout the country and to compare any difference in behaviour, motives, and effects on test performance in different regions. It would be of particular interest to compare the results where gender differences are concerned.

Limitations of the Study

There are a number of limitations to this study that should be considered. Firstly, the study focused only on the relationship between a given type of activity, and a variance in test performance for a single subject exam. Other subject exams may focus on different cognitive skills and, hence, produce different results. Secondly, it is accepted that some students may be more proficient in certain subjects than others, or harbour different emotions towards a given subject, which may, in turn, have impacted on their test performance. In cases where the student has different emotions towards the subject or anticipates a different style of exam questioning, it is possible that they may choose to participate in different pre-exam activities. As the aim of the study was to attempt to measure the effects of pre-exam activity on test performance, other subject proficiency measurements, such as coursework

or GPA were not taken into account. Finally, the study did not attempt to examine the effects of pre-exam activities on specific cognitive or motor skills or examine the effects of specific attributes of each activity, such as game or music genre.

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