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The International Journal of Research and Review
An interdisciplinary journal on various fields of the Social Sciences

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3. Commentary article on theories and models – Issues on previous theories and models are acceptable.

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The Role of Self-regulated Learning in Enhancing Learning Performance
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Abstract
The paper aims to explore the relationship between students’ self-regulation ability and their learning performance. In this study, self-regulation ability is conceptualized by four dimensions: learning motivation, goal setting, action control and learning strategies. 6,524 students from 20 aided secondary schools in Hong Kong participated in the questionnaire survey. Factor analysis and reliability test were used to confirm the constructed validity and the reliability of the survey instrument. Multiple regression analysis was applied to explore the relationship among variables. The results showed that students’ learning motivation, goal setting, action control and learning strategies played a significant role in their learning performance.

Key Words: Self-regulated Learning, Learning Performance

Introduction
One of the most important aims of education reform in Hong Kong is to promote students’ ability in learning to learn (Education Commission, 2000). In order to achieve this aim, teachers need to teach students both knowledge and skills. In turn, students need to acquire said knowledge and skills, which will help them become capable lifelong learners after they leave school. In order to develop students’ ability in learning to learn, appropriate and effective teaching strategies are required. However, there is little empirical research on this area in Hong Kong. The purpose of this paper is to discuss how to assist Hong Kong teachers to develop suitable teaching strategies to enhance students’ ability in learning to learn.

Learning to learn is the ability to pursue and persist in learning, to organize one’s own learning, including through effective management of time and information. This is closely related to the theory of self-regulated learning that emerged in the 1980s. In the process of self-regulated learning, students monitor and adjust their learning strategies. Monitoring activities include checking the content of study, judging learning difficulties, assessing progress and predicting learning outcomes. Since self-regulated learning is a multi-dimensional activity which involves an individual’s cognition, emotion, action and surroundings, teachers need to
give advice to students on self-assessment, goal setting, learning strategies, motivation and monitoring.

Self-regulated learning is conceived of as a learning process in which learners employ self-regulatory skills, such as self-assessing, self-directing, controlling and adjusting, in order to acquire knowledge (Zimmerman 1989). Students who can conduct self-regulated learning, have a clear idea of how and why a specific self-regulatory strategy should be employed. They are active learners in terms of metacognition, motivation and action control. For example, they focus on enhancing their learning performance, employ self-regulatory strategies, give themselves feedback and improve their learning based on that feedback. As a result, they change their sense of self or learning strategies.

In the process of self-regulated learning, learners need to set their learning goals, make their learning plans, choose their learning strategies, monitor their learning processes, evaluate their learning outcomes and suppress interference. Lei and his research fellows (2002) believe that high achievers’ self-regulation ability is higher than that of low achievers. The importance of self-regulated learning lies in providing students with successful experience in order to enhance their intrinsic motivation and promote their self-regulation ability (Boekaerts, Pintrich & Zeidner, 2000). Teaching is not just about providing students with knowledge but also about helping students to develop their intrinsic motivation and self-efficacy and enhance their learning values. If learners do not have these abilities, they learn by depending on the guidance and monitoring of others and fail to achieve a high level of learning. Therefore, the establishment of a theoretical framework of self-regulated learning and the development of relevant teaching strategies are both beneficial in terms of promoting students’ ability in learning to learn.

Zimmerman was the first academic to propose the construct of self-regulated learning in educational psychology (1989). He believes that self-regulated learning is a process in which learners actively participate to some extent in their own learning in terms of metacognition, motivation and action. He also proposes a model of self-regulated learning in order to illustrate how learners actively employ specific strategies in their study to achieve the course objectives, based on their own willingness, motivation and metacognition. Zimmerman and Pons (1986) also believe that self-regulation ability is the best predictor of students’ learning performances.
Zimmerman, Bonner, and Kovach (1996, p.11) proposed a cyclical model of self-regulated learning which comprises four correlated processes: self-evaluation and monitoring, goal setting and strategic planning, strategy implementation and monitoring, and strategic-outcome monitoring. Self-evaluation and monitoring is the first phase, in which individuals evaluate their personal effectiveness in relation to a specific learning task. For example, students evaluate their self-efficacy and assess current learning progress based on their record of past learning performances and outcomes. The second phase is goal setting and strategic planning, which involves analysis of learning tasks, setting specific goals, creating learning plans and refining learning strategies. The third phase is strategy-implementation monitoring, in which students employ specific strategies in their learning according to their learning plans and monitor their accuracy in implementing these specific strategies. The last phase is strategic-outcome monitoring, in which students judge their personal effectiveness based on their learning performances and actual strategic processes. Zimmerman's model highlights the importance of motivation and strategies in self-regulated learning. They suggest that students' self-efficacy and their learning strategies play a crucial role in self-regulated learning. Furthermore, these four phases are closely related to each other. If students want to self-regulate their learning, they need both self-learning ability and motivation.

Pintrich’s framework for self-regulated learning is developed from Zimmerman’s social cognitive model of self-regulation (Puustinen & Pulkkinen, 2001). Pintrich (1999) believes that self-regulated learning refers to the strategies students use to regulate their cognition and manage resources, which means operating and controlling the environment. He thinks that self-regulation activities act as mediators between learners, the contexts and their overall learning performances. Self-regulated learning significantly influences individuals’ learning achievements. It is closely related to the application of metacognition. Pintrich (1990) focused on investigating learners’ individual learning behaviour. He examined the effect of learner motivation on the implementation of cognitive, metacognitive and self-regulated strategies for effective learning.

Pintrich and DeGroot (1990) point out there are three important general categories of self-regulated learning based on the results obtained from several studies on self-regulated learning. These three categories are: (a) learners' metacognitive strategies, which involve planning, monitoring
and assessing the learning process, (b) learners’ efforts and persistence in learning. For instance, students will achieve a high standard if they increase their level of attention and spend more time on a difficult object of learning, (c) learners’ cognitive strategies employed in learning, memorisation and comprehension. Different cognitive strategies such as practising, illustrating and organising learning content can effectively increase students’ own initiative in learning and further improve their learning performances.

Pintrich (2000) explains the relationship between motivation and self-regulated learning from the perspective of goal orientation. Pintrich classifies goal orientations into two types: mastery orientation and performance orientation. Mastery orientation relates to learners learning to use self-set goals or to improve themselves, while performance orientation refers to learners learning in order to surpass others. Pintrich’s theory of goal orientation can be generalised in that it describes individual motivation and its link with self-regulated learning. His framework for self-regulated learning involves learners’ cognition, motivation, behaviour and the context. There are several similarities between Pintrich’s (2000) framework and Zimmerman’s (1989) model. For example, both are developed from the theories of social cognition and define self-regulated learning in a similar way, starting from the phase of anticipation and ending with the phase of self-reflection. However, Pintrich’s framework highlights goal orientation in the research of self-regulated learning.


The innermost layer of the model concerns regulation of the processing mode, which means students choose different cognitive strategies according to different learning materials or objectives. The middle layer of the model pertains to regulation of the learning process, which refers to students employing strategies such as planning, monitoring, assessing and correcting in their learning process in order to direct their learning. The outermost layer of the model represents regulation of self, which involves use of the strategies of motivation control, willingness control and allocation of resources.
Boekaerts (1999) classifies the functions of self-regulation into two categories with six elements, each of which represents a type of prior knowledge. The first category pertains to self-regulation of cognition, while the second concerns self-regulation of motivation. Self-regulation of cognition is sub-classified into content knowledge, cognitive strategies and regulatory strategies. Self-regulation of motivation is also subdivided into motivational beliefs, motivational strategies and regulatory strategies. Boekaerts believes that self-regulated learners can regulate their strategies or behaviour according to their intrinsic feedback, but non-self-regulated learners deal with new information depending on extrinsic regulation. Boekaerts (1999) focuses on cognitive strategies in the research of self-regulated learning.

The above-mentioned three models all highlight that self-regulated learning is a process in which students think, feel and act on their own initiative in order to achieve their learning goals. In the process of self-regulated learning, learners implement strategies by which they choose, use, monitor and adjust learning strategies and employ the strategies to control action in order to achieve specific learning goals. The process at least involves learners’ learning motivation, goal setting, action control and learning strategies. These four components are assumed to be the predictive factors for students’ performance.

The study explores the relationship between the above-mentioned four components of students’ self-regulated learning and their learning performances. The theoretical framework for enhancing student learning performance via developing students’ self-regulation ability is shown in

**Figure 1. Theoretical framework of the study**
Method

Research Design

A predictive cross-sectional quantitative research design was used in this study to determine the relationship between students' self-regulated learning and their perception of learning effectiveness. The independent variables are the four factors of self-regulated learning and the dependent variable is the learning performance. A self-response quantitative questionnaire survey was designed to collect data from students of the selected aided schools in Hong Kong. The data was collected directly from the target subjects via the questionnaire.

Participants

The subjects in the study were students from aided secondary schools in Hong Kong. There are around 480 secondary schools in Hong Kong, of which 90% are aided schools, 5% are government schools, and the remaining 5% are direct subsidy schools. Only aided secondary schools were chosen for this study, because they form the major sector and constitute a homogeneous group. The sample schools were selected randomly by cluster sampling. This was more convenient when the population was very large or spread out over a wide geographical area in Hong Kong. It involved less time and expense, and was generally more convenient. There were smaller differences among the group means and the group variances, and the cluster sample in relation to a stratified sample was better. 20 aided secondary schools (4% of the total number of aided schools) were chosen in proportion to the total number of schools in the districts according to the list of schools from the Education Bureau. Eleven schools were drawn from the New Territories, five schools from Kowloon Peninsula, and the other four from Hong Kong Island. There are around 1,000 students per sample school. 6,524 valid questionnaires were collected for this study.

Instruments

An instrument was developed to investigate the students’ perceptions of their learning motivation, goal setting, action control, learning strategies and learning performance. The content of the scales was based
on a careful examination of the literature. Each variable was operationalised into 6 to 12 observable statements. The statements representing the 4 independent variables and the dependent variable were developed from Boekaerts (1999), Pintrich (2000) and Zimmerman, Bonner, and Kovach (1996). The data was treated as an interval scale. Students were asked to indicate the extent to which they conduct their learning in response to 36 statements. All statements were measured using a 6-point Likert-type scale ranging from 1 (strongly disagree) to 6 (strongly agree).

Data Analysis

Exploratory factors analysis and a reliability test were employed to confirm the constructed validity and internal consistency of the self-developed instrument. Factor analysis was performed to examine the factor structure of the instruments and to tap into the underlying constructs of the three variables. The factor with eigenvalue greater than 1 will be extracted. Reliability has been generally defined as the degree to which assessment results are free from errors of measurement, and so was examined using quantitative procedures to determine the degree of consistency or inconsistency inherent in this instrument. Principal axis factor (PAF) analysis with Promax rotation was used to select the items in data reduction by using the SPSS program, while Cronbach’s Alpha-reliability measure for internal consistency was used to test the reliability of the derived scales. The multiple regressions test was applied for analysing data in order to explore the relationships among multiple continuously distributed independent variables and a single dependent variable. The \( P \leq .05 \) level of significance was used as the criterion for rejection of the null hypotheses.

Results

The results of the exploratory factor analysis show that 5 factors emerged, namely Factor 1 (Learning Strategies), Factor 2 (Learning Performances), Factor 3 (Action Control), Factor 4 (Goal Setting) and Factor 5 (Learning Motivation), from 25 items (See Table 1).

The results indicate that the questionnaire has desirable construct validity. The Cronbach \( \alpha \) coefficients for the items on all variables were also calculated. They were 0.808 for Learning Strategies, 0.721 for Learning Performances, 0.761 for Action Control, 0.682 for Goal Setting, and 0.582 for Learning Motivation. Since a desirable Cronbach \( \alpha \) coefficient
is commonly expected to be higher than 0.5, these Cronbach α coefficients indicate that the items measuring all the five variables in the questionnaire have satisfactory reliability.

Table 1

<table>
<thead>
<tr>
<th>No. of items</th>
<th>Factor 1 Learning strategies</th>
<th>Factor 2 Learning performances</th>
<th>Factor 3 Action control</th>
<th>Factor 4 Goal setting</th>
<th>Factor 5 Learning motivation</th>
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<tbody>
<tr>
<td>1.</td>
<td>0.694</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>2.</td>
<td>0.577</td>
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<tr>
<td>3.</td>
<td>0.552</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>0.569</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>0.502</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>6.</td>
<td>0.494</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>7.</td>
<td>0.486</td>
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<td></td>
<td></td>
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<tr>
<td>8.</td>
<td>0.457</td>
<td></td>
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<tr>
<td>9.</td>
<td>0.428</td>
<td></td>
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<tr>
<td>10.</td>
<td>0.436</td>
<td></td>
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<tr>
<td>11.</td>
<td>0.352</td>
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<td>12.</td>
<td>0.300</td>
<td></td>
<td></td>
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<tr>
<td>13.</td>
<td></td>
<td>-1.022</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14.</td>
<td></td>
<td>-0.887</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>15.</td>
<td></td>
<td>-0.381</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>16.</td>
<td></td>
<td></td>
<td>-0.888</td>
<td></td>
<td></td>
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<tr>
<td>17.</td>
<td></td>
<td></td>
<td>-0.748</td>
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<td>18.</td>
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<td>-0.635</td>
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<td>19.</td>
<td></td>
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<td>-0.396</td>
<td></td>
<td></td>
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<td>20.</td>
<td></td>
<td></td>
<td>-0.369</td>
<td></td>
<td></td>
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<tr>
<td>21.</td>
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<td></td>
<td></td>
<td>0.973</td>
<td></td>
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<tr>
<td>22.</td>
<td></td>
<td></td>
<td></td>
<td>0.506</td>
<td></td>
</tr>
<tr>
<td>23.</td>
<td></td>
<td></td>
<td></td>
<td>0.433</td>
<td></td>
</tr>
<tr>
<td>24.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.556</td>
</tr>
<tr>
<td>25.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.568</td>
</tr>
</tbody>
</table>

Eigenvalue: 10.410, 2.063, 1.689, 1.428, 1.330
Variance: 32.053, 6.353, 5.202, 4.396, 4.097
Cronbach α coefficient: 0.808, 0.721, 0.761, 0.682, 0.582

Multiple linear regression analysis was conducted to investigate the influence of four variables (i.e. Learning Strategies, Action Control, Goal Setting and Learning Motivation) on Learning Performances. Table 2 illustrates the result of the analysis.
Table 2

<table>
<thead>
<tr>
<th>Variables</th>
<th>B</th>
<th>Std. Error</th>
<th>β</th>
<th>t</th>
<th>p</th>
<th>VIF</th>
<th>Adj-R²</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>0.246</td>
<td>0.062</td>
<td>--</td>
<td>4.276</td>
<td>0.000</td>
<td>--</td>
<td>0.359</td>
<td>914.675</td>
</tr>
<tr>
<td>Learning strategies</td>
<td>0.209</td>
<td>0.022</td>
<td>0.137</td>
<td>9.641</td>
<td>0.000</td>
<td>2.070</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Action control</td>
<td>0.304</td>
<td>0.015</td>
<td>0.262</td>
<td>19.644</td>
<td>0.000</td>
<td>1.804</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Goal setting</td>
<td>0.113</td>
<td>0.014</td>
<td>0.103</td>
<td>8.069</td>
<td>0.000</td>
<td>1.644</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Learning motivation</td>
<td>0.220</td>
<td>0.011</td>
<td>0.239</td>
<td>19.736</td>
<td>0.000</td>
<td>1.494</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*p ≤ 0.005

All the Variance Inflation Factors (VIF) are below 10, indicating that there is no overlap in any of the four independent variables. As shown in Table 3, the partial regression coefficients of the independent variables are all statistically significant and positively correlated to learning performances, which means that students who have higher learning motivation, are more capable of setting learning goals and have better mastery of action control and learning strategies, will learn better. Of the four independent variables, Action Control on Learning Performances has the greatest influence (β=0.304). After this comes Learning Motivation (β=0.220), followed by Learning Strategies (β=0.209) and Goal Setting (β=0.113). Figure 2 illustrates how students’ learning performance is related to these four variables.

Discussion

The questionnaire content was designed on the basis of the theories propounded by Zimmerman (1989), Pintrich (1999) and Boekaerts (1999). Factor Analysis confirmed the existence of the five variables measured in the questionnaire, indicating the satisfactory structural and inner validity of the questionnaire. The Cronbach α coefficients for the items on all variables were all higher than 0.5, verifying the reliability of the questionnaire. In addition, multiple linear regression analysis also revealed the positive relationships between learning strategies, action control, goal setting, learning motivation and learning performance.

The model gives teachers a direction in terms of developing students’ self-regulation ability. Since self-regulation ability is teachable (Pintrich, 1995), schools may consider injecting self-regulated learning into the
curriculum and teachers could set it as one of their teaching objectives. The following sections discuss how to develop students’ self-regulation ability, including goal setting, motivational promotion, learning strategies and self-monitoring.

Helping Students Set Learning Goals

In order to promote students’ self-regulated learning, teachers should first help them to set a specific learning goal. Setting goals can facilitate students' understanding of their own learning tasks (Lei, Wang & Tanjia, 2001). A perfect goal should be specific, measurable, feasible and timely. Teachers should assist students to move towards a determined goal by various measures including deciding a deadline, formulating a plan, anticipating achievements, encouraging and conducting self-assessment (Rader, 2005). In a first step, teachers can help students record their goals and the reasons for choosing their goals. After several days, the teachers ask students to check their records and delete the goals they are no longer interested in, and then set up their specific goals. The second step is to teach students how to decide the deadline for their goals according to the actual learning progress. The third step is to help students list the obstacles to achieving their learning goals, think about solutions and then make a strategic plan. The fourth step is to guide students to predict the outcome if they achieve their learning goals. The fifth step is to continuously encourage them to move towards their learning goals and give positive feedback on students’ weaknesses. Lastly, the teacher should assist students with self-assessment.

Because individual students set different learning goals and have different levels of learning ability, they cannot achieve their learning goals at the same time. Teachers should assist those students who achieve their learning goals to set themselves more challenging goals, and help those who do not achieve their learning goals to adjust their strategies and encourage them to make efforts to realise their learning goals. Irrespective of whether students achieve their learning goals, the teachers should acknowledge their efforts and performances.
Promoting Students’ Learning Motivation

Promoting students’ learning motivation is a key component of self-regulated learning (Boekaerts, 1995; Corno, 1986, 1987; Pintrich & DeGroot, 1990). Teachers should design long-term and short-term learning goals according to the learning objectives and encourage students to learn step by step. This learning model can help students improve their metacognition and self-efficacy and promote their learning motivation. The teacher can also use other strategies such as norm-referenced measurement and attributional feedback to promote students’ motivation (Zhang & Tai, 2004). Using norm-referenced measurement, the teacher avoids criticising students in class and publicising test results, which may have an adverse impact on students’ enthusiasm in terms of competing with others. In class, students are differentiated in terms of aptitude. Comparing students’ performances may frustrate some diligent students with lower achievement levels and lead them to give up on learning. Teachers should avoid merely giving marks or grades to students. Rather, they should point out students’ strengths and weaknesses and suggest a remedial plan to improve their learning. Their comments should highlight the progress in knowledge and skills made by the students and develop students’ mastery orientation. In addition, teachers should provide attributional feedback and emphasise that students’ progress is directly related to the effort applied. Lastly, teachers should explain to students the values of different subjects in class and relate subject topics to their real lives. The teacher should design assignments that target problem-solving in real life situations and use multiple teaching methods in order to increase students’ learning interests (Lin, 1997).

Developing Students’ Learning Strategies

The results of this study show that mastering the application of learning strategies can improve students’ learning performances. Schunk & Zimmerman (1998) propose a four-phase model for developing students’ learning strategies. The first phase is to assist students to develop necessary skills such as writing and note-taking strategies. The second phase involves checking and discussing students’ writing and introducing the objectives and strengths of teaching writing strategies and how and when to self-assess. The third phase is to demonstrate how to use
appropriate self-writing strategies such as defining questions, planning, using strategies, self-assessment, copying, correction, and self-enhancement. In the fourth phase, the students should memorise the steps of writing strategies and self-statement. They should be encouraged to explain the meanings and maintain creative meanings. Ultimately, students should use this strategy independently in their own work. If students always use self-regulatory strategies step by step, for example goal setting or self-assessment, they can start to work independently.

**Developing Students’ Self-regulated Ability**

Of all the factors considered in this study, action control makes the most significant contribution to students’ learning performances. Action control plays a critical role in the self-regulation process for monitoring students’ learning process. It not only reveals students’ learning weaknesses but also alerts them to the effectiveness of their learning strategies (Zimmerman & Paulsen, 1995). Teachers should demonstrate how to conduct self-regulation and choose strategies for learning by thinking aloud and teaching students the skills of self-monitoring through directed instruction (Zimmerman, Bonner and Kovach, 1996). For example, teachers may demonstrate their own self-monitoring tables or choose one strategy under specific circumstances and assess the outcomes of implementation, then modify the strategy based on the outcomes. By helping students develop self-monitoring skills, teachers can transfer the responsibility for learning to the students.

Zimmerman & Paulsen (1995) propose four teaching steps for developing students’ self-regulation ability. These are benchmark self-monitoring, structured self-monitoring, independent self-monitoring and self-regulatory monitoring. In benchmark self-monitoring, students collect the baseline data of their own learning difficulties and set up a benchmark. Teachers may ask students to record their reading materials and assess the efficacy of their reading comprehension, including start and end time, number of pages, location and environment. Students should regard their reading efficacy as a benchmark and add their own comments. After establishing the benchmark, they set up their reading objectives.

Structural self-monitoring means that students observe their learning according to the self-monitoring model provided by the teacher in class. Teachers should specifically define the requirements of learning activities
and assist students to self-monitor their learning on the basis of these requirements. For example, in a reading activity whose purpose is to understand the meaning of a text, teachers may demonstrate how self-questioning can help them monitor whether they really comprehend the text’s meaning. These questions are as follows:

1. Can I summarise the main idea of the text?
2. Can I list the five important learning points in this chapter?
3. Can I write a short comment?
4. Can I discuss the topic raised in this chapter?
5. Are the important learning points I list consistent with those proposed by my classmates and teacher?

After being taught the principles of structured self-monitoring, students should apply self-monitoring in their learning and develop their own independent monitoring mechanism. Independent self-monitoring refers to the internalisation of the structural self-monitoring model applied in the course of their individual learning. Teachers should use different types of structured monitoring models over several weeks and guide students to develop their own self-monitoring models in order to master the learning content. If students can apply their own monitoring model to regulate their learning progress by referring to the self-monitoring models provided by their teachers, their self-monitoring matures and develops.

Self-regulatory monitoring refers to students developing self-regulatory models targeting other learning activities. The teacher asks students to develop their own self-monitoring regulations and actions, for example taking the initiative to prepare for exams, refining their learning notes and writing up reading reports. In the process of self-regulated learning, the teacher does not directly teach students strategies but helps them to effectively self-regulate their learning (Wu, 2004). Therefore, when teachers develop students’ self-regulation ability, they must demonstrate different kinds of self-regulatory strategies and the efficacy of self-regulated learning, keep continuous records of students’ learning progress and predict students’ problems in self-regulated learning. They can then integrate self-regulated learning into their courses and modify their teaching methods according to their experiences of self-regulated learning.
Conclusion

The study established a model of self-regulated learning based on empirical evidence. It demonstrated that students’ learning performances were closely related to their learning motivation, goal setting, action control and learning strategies. The study also proposes some methods of developing students' learning to learn ability, which is one of the objectives of education reform in Hong Kong. The suggestions include assisting students to set up specific and feasible learning goals, guiding them to choose appropriate learning strategies, helping them learn to accurately self-monitor the learning process, and promoting positive attitudes towards learning outcomes. Self-regulated learners optimise their learning strategies through continuous self-assessment of their learning efficacy. It is in the interests of teachers to develop students' self-regulation ability if they really want to enhance students’ learning.

References


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Assessing the Relationship of Scientific Thinking, Self-regulation in Research, and Creativity in a Measurement Model

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Abstract
The present study investigated the relationship of the constructs scientific thinking, self-regulation in research, and creativity in a measurement model. The social cognitive theory and field theory explained that when individuals encounter a problem, they regulate their actions, they also think scientifically and use strategies to generate creative solutions. The scales were administered to 1000 undergraduate and 839 graduate students who are currently having their thesis/dissertation across universities in Luzon (Philippines). The initial results showed a four-factor structure of scientific thinking composed of practical inclination, analytical interest, intellectual independence, and discourse assertiveness. On the other hand, the eight factors of self-regulation contextualized in research were confirmed. The measurement model structured scientific thinking, self-regulation in research, and creativity with their subscales as the manifest variable. The model showed significant relationships and path estimates for each manifest variable. The two other models were tested for the undergraduate and graduate students showed model invariance.

Keywords: Scientific thinking, self-regulation in research, creativity

When students create a research work, they engage in cognitive strategies that enable them to achieve successful performance. The use of cognitive strategies to complete one research manifests scientific thinking. From conceptualizing a research, synthesizing literature reviews, presenting the proposal, gathering data, and writing the report requires the process of self-regulation. Self-regulation in doing research involves the use of cognitive strategies that enables the student to monitor, evaluate, seek solutions, and organize their work. The process of going through the entire research process is similar to what scientists engage in when they want to prove their theory. A student who is in the process of completing his thesis or research can likewise manifest characteristics of scientific thinking (Rushton, Murray, & Paunonen, 1987). Scientific thinking is important in the conduct of research. Scientific thinking involves exploring the environment, constructing models as a basis for understanding it, and revising those models as new evidence is generated, like students who endeavor to make sense of their environments by processing data and constructing mental models based on these data (Kuhn, 1989). These activities engaged by scientists and students are measured as a set of traits and personality dispositions that determines whether one becomes interested in science as a career or related careers that require scientific thinking (Gorman, 2008). There is a rich literature explaining the nature of scientific thinking as traits or characteristics (i.e., Bachtold & Werner, 1972; Busse & Mansfield, 1984; Feist, 1998; Helmreich, Spence, & Pred, 1988; Van Zelst & Kerr, 1954). There is a need to study scientific thought in a psychological perspective (Feist, 2006). A psychological
perspective in the study of scientific thought can (1) provide models to understand and further explain expertise and exemplified skills, (2) derive processes that help educators develop students with potential scientific-related careers, (3) focus on skills that further strengthen the scientific thinking for practitioners in science, and (4) integrate other psychological variables to create theories to explain it. In the present study, scientific thought is studied with self-regulation in research and creativity. Self-regulation in the conduct of research is related to scientific thought because every student in the field of science needs to demonstrate competence in research for the completion of their degree. Aside from this, there is a pressing issue that science literacy occupies a more central place in standards and curricula (Cavanagh, 2008). One way to develop science literacy is through training students in communicating research results. In the conduct of research, they need to be creative to generate viable and sound ideas. Andreasen (2006) explains that creative cognition is resulting from a self-organizing system. This self-organizing system is part of the self-regulation components (Zimmerman, 2002). There is evidence that creativity is meshed with scientific thought (Innamorato, 1998). Although in most reviews, authors tend to use scientific thought and scientific creativity interchangeably (i.e., Chung & Ro, 2004; Kind & Kind, 2007).

There is presently no exact theoretical model explaining the mechanism of scientific thought with self-regulation in the conduct of research and creativity. What is currently available in literature in the psychology of scientific thought are set of characteristics that make up its composition. In order to understand scientific thought better, other factors that coexist with it should also be studied like self-regulation in research and creativity. This coexistence is described as the occurrence of self-regulation process in research that increases scientific thinking and creativity. In the present study, the relationship of scientific thought, self-regulation in the conduct of research, and creativity was explored. Scientific thought in the present study was measured using a set of traits that include analytical interest, assertiveness, practical inclination, and assertiveness. Creativity is measured by creative characteristic, learning, motivation, and leadership. Self-regulation in the conduct of research include components on self-evaluating, organizing and transforming, goal-setting and planning, seeking information, keeping records and monitoring, environmental structuring, self-consequencing, rehearsing and memorizing, seeking assistance, and reviewing records.

**Scientific Thinking**

Scientific thinking is described in literature as both theory and practice. Kuhn (1989) describes the theoretical development of scientific thinking as metacognitive and strategic. This kind of thinking is beyond
understanding theory but would require thinking about theories in a metacognitive sense. The evidence proposed is thought about, rather than merely being influenced by it. Kuhn (1989) further describes this thinking as reflected in the attainment of control over the interaction of theories and evidence in one's own thinking. The general skills that encompass scientific thinking according to Kuhn involves: “The scientist (a) is able to consciously articulate a theory that he or she accepts, (b) knows what evidence does and could support it and what evidence does or would contradict it, and (c) is able to justify why the coordination of available theories and evidence has led him or her to accept that theory and reject others purporting to account for the same phenomena” (p. 674). The characteristics of scientists in their theoretical work are described in scientific epistemology. Scientific epistemology is manifested in creation of scientific knowledge, instrumentation, technical discourse, social relations, and visual displays used in scientific publications (Kirby, 2003). The theoretical beliefs of scientists would affect their evaluation and generation of evidence. The organizing influence of theoretical concepts on forms of cognition range from simple categorization to complex scientific thought (Alloy & Tabachnik, 1984; Fischhoff & Beyth-Marom, 1983; Holland et al., 1986; Murphy & Medin, 1985; Neisser, 1987). Aside from the role of the scientist on theoretical development, on the practical side, scientists need to inform, influence, and evaluate the impact of policy on issues of long-term importance to various fields such as economy, human health, national security, and the health of the ecological systems that sustain quality of life (Haseltine, 2006). The stakeholders in making decisions are encouraged to make use of scientific data to ensure proper outcome. Scientific information is carried out by communicating and disseminating their findings to the community. Peer review and publication in open journals is essential to maintaining scientific rigor and integrity and establishing a record of evidence that informs policy development (Haseltine, 2006). Lee and Roth (2008) described that scientists in practice should constitute situations where science and science learning are incorporated into “good citizenship practices.”

Aside from characterizing scientific thought, it is organized in different taxonomies based on how it is studied. For example, Dunbar and Fugelsang (2005) proposed four ways of studying scientific thinking:

1. Ex vivo research, in which a scientist is taken out of her or his laboratory and investigated using in vitro tasks. (2) In silico research, involving computational simulation and modeling of the cognitive processes underlying scientific thinking, including a diversity of approaches and case-studies (Dasgupta, 1994; Magnani, Nersessian, & Thagard, 1999; Shrager & Langley, 1990). (3) Sub specie historiae research, focusing on detailed historical accounts of scientific and technological problem-solving (Gooding & Addis, 1993; Nersessian,
Another classification involving scientific thinking is the being an expert and novice. Scientific thinking is a construct exhibited by expert that is defined as someone who has spent many hours training or solving problems in a domain such as geology, dance, linguistics, or auto repair (Ericsson & Lehman, 1996). Further characterizations of experts are abstract thinking skills, problem-solving strategies, storage and recall of a wide array of information, and ability to work flexibly within a knowledge domain all exemplify what it means to be an expert (Bransford et al. 2000). The scientist as an expert that generates complex cognitive tasks by analyzing underlying knowledge required by accurately interpreting concepts (Reif & Allen, 1992). These characteristics are exemplified in scientific thinking.

In the educational setting, there is a greater call to develop students with more scientific skills. This is usually accompanied by training students with research skills (Feuer, Towner, & Shavelson, 2002; McGinn & Roth, 1999; Pine & Aschbacher, 2006). An education centered on building a scientific culture promotes better research. This culture also establish practices of openness, continuous reflection, and judgment. Brown, Collins, and Duguid (1989) described this approach as cognitive-apprenticeship models where students are enculturated into the practice of laboratory sciences.

In the present study, scientific thinking is composed of a set of characteristics that includes: Practical inclination, analytical interest, intellectual independence, and assertiveness. These traits are based on Feist’s framework (1998) describing the classification of scientists and non-scientists traits. He was able to show that scientists and non-scientists differ in a variety of traits where scientists are high specifically on the areas of practical inclination, analytical interest, intellectual independence, and assertiveness. These classification of trait that are highly exemplified by scientists was also supported by other studies (Amabile, 1994; Charyton & Snelbecker, 2007; James & Ellison, 1973; Sansanwal & Sharma, 1993; Wilson & Jackson, 1994).

**Practical inclination.** One of the many skills that are important for a scientist is to acquire is practical inclination. Sternberg (2003) defined practical inclination as an intelligent factor which consists of subfactors on verbal, quantitative, and figural:

Practical–Verbal: Everyday reasoning. Students are presented with a set of everyday problems in the life of an adolescent and have to select the option that best solves each problem.
Practical–Quantitative: Everyday math. Students are presented with scenarios requiring the use of math in everyday life (e.g., buying tickets for a ballgame) and have to solve math problems based on the scenarios.

Practical–Figural: Route planning. Students are presented with a map of an area (e.g., an entertainment park) and have to answer questions about navigating effectively through the area depicted by the map.

Sternberg, Castejón, Hautamäki, and Grigorenko (2001) defined practical intelligence as adaptation to, shaping of, and selection of real-world environments. People high in practical intelligence are strong in using, implementing, and applying ideas and products. Laypersons have long recognized a distinction between academic intelligence (book smarts) and practical intelligence (street smarts). This distinction is represented in everyday parlance by expressions such as “learning the ropes” and “getting your feet wet.” This distinction also figures prominently in the implicit theories of intelligence held by both laypeople and researchers. Sternberg, Conway, Ketron, and Bernstein (1981) asked samples of laypeople in a supermarket, a library, and a train station, as well as samples of academic researchers who study intelligence, to provide and rate the importance of characteristics of intelligent individuals. Factor analyses of the ratings supported a distinction between academic and practical aspects of intelligence for laypeople and experts alike.

Analytical interest. According to Clough (2004) science-based analytical thinking is more essential than ever in a growing range of pursuits. The goal in analytical interest is to discover knowledge, and such thinking deals with concepts, hypotheses and theories, and abstractions. Scientific method is linear and hierarchical and aims to be independent of the thinker's personal and cultural value system so that results can be repeated by anyone. Santi and Higgins (2005) explained that geologists or hydrogeologists can gain the technical knowledge and skills they need through experience and self-education. Part of this skill is analytical interest. Analytical thinking skills can be taught through a variety of exercises that enhance the geology curriculum without adding new topics, including in-class discussion questions, homework and laboratory problems, and add-ons to mapping and semester projects.

Dunn (1982) described analytical thinkers to be linear sequential and logical. Analytic individuals capture and remember information best when it is presented in a step-by-step, methodical, sequential, little by little, leading toward an understanding of the concept or lessons presented. Analytics are usually persistent because they follow directions to complete a task and do things “sequentially.” They move from the beginning of a task to the end in a series of small, focused and goal-oriented steps.
Intellectual independence. Intellectual independence can be defined as the ability of a learner to make knowledge claims independent of the traditional authorities of the teacher and textbook (Oliver & Nichols, 2001). Intellectual independence is that singular feature that makes science uniquely science. Only when humankind became aware that knowledge could be created as a result of the examination of empirical evidence, independent of the traditional authority of gods, muses, or kings, did science come to exist. In using intellectual independence in teaching, the main point for the teacher to keep constantly in mind is that his student is an investigator, seeking by means of his own efforts to find out what is truth—not a mere imitator or verifier of the results obtained by others. The conclusions reached must be deductions from the evidence observed, not statements memorized from a text or learned from a teacher. The laws and principles derived must be inferences warranted by the conclusions from the evidence.

In describing an intellectual independent student, they should learn to trust his own powers and grow strong in the assurance of first-hand knowledge. He tests and observes for himself, and receives nothing upon mere authority. No other exercise so develops the freedom and confidence of independent thinking (Poteat, 1999). Poteat (1999) dissuaded teaching that would encourage students to accept assertions "upon mere authority."

Assertiveness. Paterson (2000) defined assertiveness as the ability to express one’s needs, wants, and feelings directly and honestly and to see the needs of others as equally important. Social or generalized assertiveness is the capacity to express the real self (Lieberman, 1972) without any sense of guilt (McFall & Lillesand, 1971). It is the ability to say "no" or "yes," as appropriate, to requests—to express positive/negative feelings and conveniently initiate, sustain or terminate a social discuss (Lazarus, 1973). Difficulties with assertiveness may even represent a core vulnerability for severe psychopathology and contribute to the maintenance of social and occupational impairment.

Most cross-cultural studies of assertiveness have suggested that it is culture bound (Brown & Cross, 1991; Furnham, 1979; Garrison & Jenkins, 1986; Hall & Beil-Warner, 1978; Lineberger & Calhoun, 1983; Ness, Donnan, & Jenkins, 1983). Researchers have found differences that support the contention that there are cultural variations in the situational determinants of assertiveness (Hall & Beil-Warner; Zane, Sue, Hu, & Kwon, 1991) and in perceptions of assertive and aggressive behavior (Garrison & Jenkins, 1986). Yet, there is little research that has examined how behavioral definitions of assertiveness differ across cultural groups and the extent to which the definitions are similar. Such empirically based information could prove useful when assisting clients from different cultures to formulate assertive responses. A study by Yashioka (2000) administered a sample of 115 low-income African American, Hispanic, and Caucasian women who participated
in 6 assertiveness role plays. A content analysis of their responses indicated that there are substantive differences in terms of what constitutes passive, assertive, and aggressive responses. On the other hand, Niikura (1999) investigated modes of self-expression as they reflect the quality of assertiveness among Japanese, Malaysian, Filipino, and U.S. white-collar workers. The author collected respondents’ answers to a questionnaire consisting of 33 items involving assertiveness related to modes of expression typical of the Japanese people. Several modes of expression considered specific to the Japanese people—styles of group-oriented behavior, younger people’s courtesy toward older people, and the deference of the individual to group consensus—were also found among the Malaysian and the Filipino respondents. These behaviors were in contrast to those observed among the U.S. respondents.

**Self-regulation in the Conduct of Research**

When scientific thinking is manifested by an expert, it is likely that they engage in complex cognitive tasks where they regulate their thoughts (Reif & Allen, 1992; Petcovic & Libarkin, 2007). According to Bandura (1986) that self-regulation constitutes sub-functions through self-reactive influence. The subprocesses involve self-observation, judgment process, and self-reaction. Zimmerman (2000) proposed self-regulation in cyclical phases: Forethought phase (task analysis, self-motivational beliefs), performance phase (self-control, self-observation), and self-reflection phase (self-judgment, self-reaction). Self-regulation is usually studied using the social cognitive theory where behavior is regulated by external outcomes, self-reflective, and self-reactive activities that enables them to exercise control over their thoughts, feeling, motivations, and actions (Bandura, 1991). Self-regulation in studies are usually used to predict successful performance whether it may be in academics, sports, health, and emotions. Self-regulation can be a domain specific factor for conducting research. The use of self-regulation in research is scarce but it is very evident in practice. For example when groups of students produce a scientific article, a significant relation was observed on sustained dialogue with telementors and careful hedging of knowledge claims (O’Neil, 2001). This sustained dialogue in producing increased knowledge claims is referred to as seeking assistance or resource use as a self-regulation activity. In this study, self-regulation occurred in the research process but it is not termed as such. The available studies on research behavior are related with self-efficacy (Maier & Curtin, 2005), interest in doing research (Bishop & Bieschke, 1998), and educational programs (Cash & Hucles, 1992). Majority of studies used social cognitive variables as factors related to students’ research interests and productivity (Bieschke, Bishop, & Herbert, 1995; Bieschke, Herbert, & Bard, in press: Gelso et al., 1996; Kahn & Scott, 1997). For example, the study by Bishop and Bieschke (1998) found that
research outcome expectations, research self-efficacy beliefs, investigative interests, artistic interests, and age were significant predictors of interest in research. On the other hand, Maier and Curtin (2005) proposed strategies for applying self-efficacy theory to research methods instruction. They found that students attending the experimental math therapy sessions showed significant improvement in fundamental math skills, overcoming a performance gap with other students in the course. The quantitative data indicates that self-efficacy theory also is a useful construct for understanding and dealing with innumeracy in the research methods classroom. Moreover, Cash and Sanchez-Hucles (1992) structured a course designed to prepare the clinical psychology student for the complex dissertation process. They found that the course significantly enhanced students' self-appraised knowledge and skills, strengthened self-efficacy expectations concerning the requisite tasks of the dissertation.

Self-regulation strategies are highly used in the conduct of research. For example, the use of self-regulation in writing a thesis manuscript involves planning or goal-setting, organizing, self-consequencing, seeking help and information, and environmental structuring (see Magno & Lajom, 2010).

Creativity

In the field of psychology, creativity can be explained with different perspectives. In the humanistic, existential, and positive psychology, creativity is associated with human nature. Creativity can also be seen as a social construct serving social purposes and reflecting the development of society (Silvia, 2007). It also reflects how people’s minds have gone far (Sternberg, 2006). Chapman (1978) sees creativity as a developmental activity, nurturing personal maturity and develops identity and openness to experience. Through creativity we emphasize and heighten the qualities of experience that we meet only accidentally when confronting other things and event in the world. In terms of cognition, creativity is explained in perceptual acuity, humaness, right brain growth (still questionable), mental development, and other mental skills (Neisser, 1976; Piirto, 2004).

The field of developmental psychology also explains how creativity is developed in an individual as they mature in life. In Bronfenbrenner’s ecological systems theory, creativity is developed as a feeling of individuality and identity that has a favorable effect on a person’s self-concept (Bronfenbrenner, 1979; Hurlock, 1982). Studies show that the forms of creativity depend upon individual interests and abilities, opportunities to do what they want to do, and activities that give the greatest satisfaction (Eisenstadt, 1978; Goertzel, Goertzel, & Goertzel, 1978; Simonton, 1984). Some young adults find a creative outlet in hobbies while others choose vocations in which they can express their creativity. There is also evidence
that creativity is weakened through constraints imposed by conventional socialization and challenging experiences like in the face of obstacles (Simonton, 1994).

In the 1960’s from the growing demand of research, creativity came to be widely recognized as a basis for scientific achievement (Anastasi, 1980). A research conducted by MacKinnon (1962) and his associates at the University of California investigated large and significant differences in a number of personality traits between creative and non-creative groups (Welsh, 1975). Most psychologists and educators generally recognize that creative talent is not synonymous with academic intelligence and is rarely covered by tests yielding an IQ (Anastasi, 1998). Thurstone (1951) emphasized this distinction and provided a provocative analysis of the possible role of ideational fluency, inductive reasoning, and certain perceptual tendencies in creative behavior. He also called special attention to the contribution of non-intellectual, temperamental factors to creative activity. He observed that creativity is encouraged by a receptive as contrasted to a critical attitude toward novel ideas and that creative solutions are likely to occur during period of relaxed, dispersed attention that during periods of active concentration on a problem.

Guilford (1959) arrived at creativity constructs that are components of creative work. These constructs are word fluency, ideational fluency, associational fluency, expresional fluency, alternate uses, plot titles, consequences, possible jobs, making objects, sketches, match problems, and decorations. Guilford uses these constructs in developing creativity test measure although it is still in its experimental form.

According to Goleman, Kaufman, and Ray (1993) that being creative at work includes certain correctness, usefulness, valuable, meaningful, flexible, and open to new possibilities. They also considered four new myriad faces of creativity: (a) Groundbreaking ideas (ex. debt for land swaps, saving tropical forests, helping impoverished countries, theory of relativity, concept of genetic engineering), (b) Imaginative expression of caring and compassion (concept of “meals and wheels,” birthing rooms, the AIDS quilt, Gandhi’s strategy for protesting injustice and non-violence), (c) Grand vision of hope and truth that show the way to others (ex. Bill of rights, Gettysburg address, Martin Luther King’s “I have a dream” speech, and (d) Bright ideas (includes useful and economical strategies of dealing with our practical living). These themes involve concepts of manifesting creativity with a sense of social purpose. These patterns demonstrate a purpose of improving and achieving for a larger societal benefit that will serve for other people as well. Creativity does not only manifest an individualistic concept but a societal or collective dimension as well (Markus & Kitayama, 1991; Sawyer, 2006; Weisberg, 2006).

According to Gardner (1982), being creative mean looking at an individual’s specific field or domain. He refutes the concept of creativity as a global talent but rather observing an individual carrying over a specialized
task. Observing a person’s task involves how they carry over the problem and how their solution is received. And the individual has the ability to do the entire process regularly. In line with his theory of multiple intelligences, creativity is characterized by the ability to adapt to almost any situation and to make situation and to make do with whatever is at hand to reach their goals.

A contemporary view of creativity as an intelligence is explained by Sternberg (2006) in theory of successful intelligences. In this theory, creative intelligence comes out when individuals are faced with problems and they assess how well they can cope with relative novelty. In measures of intelligence, it is important to include problems that are relatively novel in nature. This theory explains creativity when individuals experience problems and how they come up with solutions considering each problem is a new task.

Abra (1997) explains that creativity can be linked with science, or any area of human endeavor is the need for motivation or impetus for self-expression. What consistently sets individuals who successfully engage in the creative process apart from those who are less successful is their dedication, commitment, steadfastness, vigor, and intensity—their motivation for creative work. Eysenck (1997) reinforces this view by proposing that creativity is a personality variable, not an ability. His research and theory added to the foundation for the study of creative problem-solving style.

**Relationship of Scientific thinking, Self-regulation, and Creativity**

Holmes (2004) in his book explains that across the century, famous experimentalist like Pavlov, Watson, and Tolin did not only make discoveries but their discoveries were made possible because of their creative pursuits in science. However, at the beginning of the 21st century, it has been recognized that in order to make creative pursuits workable, individuals use self-regulatory functions to monitor, evaluate, and strategically act on their behavior. This notion is recognized by some empirical evidences.

Chung and Ro (2004) in their study proposed that creativity in the classroom is developed through active employment of scientific thinking through the activity-centered decision-making process. Creativity is further developed if teaching is conducted according to the problem-solving model. They found in the study that creativity subscales on fluency, flexibility, and originality increased from pre-test when scientific thinking was injected with the problem solving task. Furthermore, Innamorato (1998) explained that creativity have been considered as a substantive foundation from which scientific skills develop. The findings of Chung and Ro also support Croce on the value of aesthetics in science learning. He stated that the sciences are only tools to realize aesthetic potential. He contrasts imaginative knowledge vs. intellectual knowledge and suggests that imagination precedes thought. He claims that an artistic activity of the mind is a prerequisite to logical
concept-forming activity: "Man is an artist long before he reasons" (Croce, in Carr, 1917, p. 35). Phenix (1964) shares a similar view that the language of science merely describes the scientists' interactions with the holistic elements: "the creations of science and of art are imaginative abstractions yielding aesthetic meanings" (p. 85).

Ivcevic and Mayer (2007) found that the scholar creative type is high on self-regulation components such as risk taking than other creative types (conventional, everyday creative, artist). They explained that this set of traits showed by the scholars make them find enjoyment and challenge in work (intrinsic motivation), are willing to take chances in the professional and financial areas (risk-taking), and are able to generate multiple ideas when presented with a problem (divergent thinking). They further explain that the predictive validity of these traits of creative scholarship is less than for the set of creativity-general traits, indicating that personality traits are most successful in predicting a fundamental decision to engage in creativity and less successful in prediction of the domain-specific nature of creativity. They also found that when people get involved in artistic or activities of intellectual creativity, they are most likely to primarily pursue one kind of work, while also having a creative life-style. This indicates that creativity is domain specific.

However, the study Shin and Zhou (2007) indicates that creativity need not be domain specific to make it work. They examined conditions under which teams' educational specialization heterogeneity was positively related to team creativity. Using a sample of 75 research and development teams, the authors theorized and found that transformational leadership and educational specialization heterogeneity interacted to affect team creativity in such a way that when transformational leadership was high, teams with greater educational specialization heterogeneity exhibited greater team creativity. In addition, teams' creative efficacy mediated this moderated relationship among educational specialization heterogeneity, transformational leadership, and team creativity.

One mechanism of self-regulation employed by creators is their willingness to take moderate risks (Sternberg & Lubart, 1995a). An individual can choose a familiar and relatively commonplace option or a more unconventional route leading to greater originality. Risk-taking is related to originality on tests of creative ability (Friedman & Foerster, 2001; Glover & Sautter, 1977), involvement and enjoyment in drawing and writing, creativity on a laboratory drawing task, and unconventionality in writing (Sternberg & Lubart, 1995b). Creativity also requires discipline, hard work, and persistence. While persistence is not significantly related to creative performance on short laboratory tasks (Sternberg & Lubart, 1995b), it predicts real life creativity that requires long periods of sustained activity, often times in face of substantial obstacles. For example, Wilson (1990) found that poets persisted in writing even in times of prolonged economic...
deprivation and long periods without critical acceptance for their work.

Conceptual Framework

In the present study, it is proposed that scientific thinking, self-regulation in conducting research and creativity are related. Scientific thinking is defined as a mode of exploring and coming to know the world that is within the competence of research practitioners (Kuhn, 1989). Scientific thinking makes cognitive demands that professional scientists are able to fulfill (Faust, 1984). Self-regulation in conducting research is defined as individuals' awareness of their learning processes and select useful strategies to complete a task such as conducting research (Bandura 1986; Zimmerman 1986). Self-regulation when applied to doing research includes such processes as choosing practice techniques, using memory aids, finding suitable places to work, asking relevant questions, and setting interim goals. Students become self-regulated in doing research when they monitor what they are doing, compare their progress to some internal standard, criticize or praise themselves, and have confidence in their skills. Creativity is generally defined as the production of novel and useful ideas in the research process (Amabile, Conti, Coon, Lazenby, & Heron, 1996). Creativity in the present study is defined as a set of noncognitive traits such as motivation (e.g., impulse expression, desire for novelty, risk-taking), and facilitatory personal properties like flexibility, tolerance for independence, or positive attitudes to differentness (Cropley, 2000). Ivcevic and Mayer (2007) defined a domain specific creativity such as scientific creativity which is commitment and achievement in respective domains.

The relationship among scientific thinking, self-regulation in research, and creativity is anchored in the social cognitive theory and field theories. The social cognitive theory (SCT) and field theory have a common explanation that human behavior is extensively motivated and regulated by the ongoing exercise of self-influence (Bandura, 1991; Lewin, 1936).

The SCT explain that when individuals regulate their actions, it has a strong impact on their personal agency. Social Cognitive Theory (SCT) describes learning in terms of the interrelationship between behavior, environmental factors, and personal factors. Generally, the learner acquires knowledge as his or her environment converges with personal characteristics and personal experience. Bandura explains that in the social cognitive theory, self-regulation is at the center of causal processes. Self-regulation mediates the effect of external influences to behavior. Self-regulated individuals who anticipate consequences of their actions, set goals and plan for their future, they are likely to produce desired outcomes.

On the other hand, the field theory explains that when an individual encounters a problem, one think scientifically and use strategies to generate creative solutions. The field theory is the "proposition that human behavior is
the function of both the person and the environment. This means that one’s behavior is related both to one’s personal characteristics and to the social situation in which one finds oneself. When students in particular conceptualize their undergraduate thesis, they regulate most of their behavior with a purpose of performing well. The self-regulation process involves scientific thinking to accompany self-regulation for the desired goal. Hence, it is hypothesized that self-regulation in research increases scientific thinking. A student needs to come up with creative ways to regulate their actions in the research phases. Creativity serves as a mechanism how self-regulation behavior is carried out effectively. Ivcevic and Mayer (2007) explain that creativity is a result of self-regulation. They further explain that self-regulation supervises creative personality and manages their operation for desired outcomes. The function of self-regulation is to oversee and balance the process of creation and sustain conscious effort in creative activity (Sternberg & Lubart, 1995). On the other hand, creativity is also related to scientific thinking. Kind and Kind (2007) explains how they are related in two ways: (1) aspects of creativity is seen in scientific research, and (2) the approach in science is authentic in nature. The further explain that creativity in science can be contextualized in the classroom setting though creative teaching, art and science, inquiry science, and the nature of science. It is proposed that creativity increases with self-regulation and scientific thinking. These three constructs are influencing each other in order to produce a desirable result.

The social cognitive theory and Field theory also encompasses two propositions that explains the scientific thinking, self-regulation, and creativity. Winchester’s thesis (1985) and Sternberg’s Triarchic theory of abilities on the other hand explains the relationship between scientific thinking and creativity. Winchester’s thesis (1985; 2007) rationalized the relationship among creativity and scientific skills. The thesis or proposition explains scientific creation as contiguous. This contiguity occurs as students reflect on scientific information ethically and aesthetically so that they are able to derive personal meaning from this knowledge and capsulize this knowledge into a framework of understanding. The process of deriving personal meaning of scientific information bridges the gap between scientific skills and creativity. When individuals find meaning on their work is a reflection of increased creativity. The framework of understanding is derived by the use of self-regulation processes. This also concords with Sternberg’s triarchic abilities (1985) where analytic, creative, and practical abilities are related. These three aspects are automatized for the purposes of adaptation to, shaping of, and selection of environments. According to the theory of successful intelligence, creative intelligence is particularly how well an individual can cope with relative novelty. According to Sternberg (2006) that “creative people are ones who are willing and able to ‘buy low and sell high’ in the realm of ideas. Buying low means pursuing ideas that are unknown or
out of favor but that have growth potential. Often, when these ideas are first presented, they encounter resistance. The creative individual persists in the face of this resistance, and eventually sells high, moving on to the next new, or unpopular idea” (p. 4). These three aspects are covered in the variables proposed in the present study. The analytic aspect is reflected in the use of self-regulation process where strategies are applied thinking on abstract and often relatively academic problems. The creative aspect of thinking involves applying the components to relatively novel and unfamiliar problems. People high in creative intelligence are strong in discovering, creating, and inventing ideas and products (Sternberg, Castejon, Prieto, Hautamaki, & Grigorenko, 2001). The practical component involves using, implementing, and applying ideas and products which are covered greatly in scientific thinking. Practical inclination is also proposed as one factors of scientific thinking which was anchored on Sternberg’s theory. The link of these three aspects are further proven through confirmatory factor analysis conducted (CFA) (Sternberg, Castejon, Prieto, Hautamaki, & Grigorenko, 2001). The CFA showed that these three factors are related across two measurement models where data fits the model well.

The purpose of the present study is to assess how scientific thinking, self-regulation in research, and creativity exercise to influence each other. This is carried out by measuring these three factors with different components. To establish the relationship of these three factors in a measurement model, confirmatory factors analysis will be used. The specific research problems of the study are as follows:

1. Does scientific thought, self-regulation in conducting research, and creativity increase with each other?
2. Will the factors of scientific thought, self-regulation in conducting research, and creativity yield significant path estimates to their respective constructs?
3. Will the data fit the overall model of relating scientific thought, self-regulation in conducting research, and creativity yield significant paths to their respective factors?
4. Which sample (undergraduate students who are currently doing their research or graduate students) will the proposed model have better fit?

Method

Research Design

The design employed in the study is descriptive. In the procedure, the constructs scientific thought, self-regulation in conducting research, and creativity were intercorrelated that indicate how these constructs vary together though Confirmatory Factor Analysis (CFA). The CFA also enable to
test whether the factors of the said constructs was significant. The procedure also allowed to test the general fit of the model for undergraduate and graduate students who are currently doing their research.

Participants

The participants were 1839 Filipino undergraduate and graduate college students from different universities in Luzon. The students were selected using purposive sampling. The inclusion criteria includes students who: (1) are currently in the proposal or data gathering phase of their thesis, (2) are working with their mentor in the study, (3) have written other research reports prior to the thesis, and (3) are majors in any courses in the social sciences (ex. psychology, behavioral science, educational psychology, science education etc.). The model is tested for both graduate and undergraduate students to determine if their characteristics fit the proposed model.

The participants were selected who belong in the universities selected in the study. There were seven universities selected in Luzon. Five universities were selected in Metro Manila, one each for Laguna, Nueva Ecija, Baguio, and Cavite. These universities were selected because (1) they offers graduate studies and have a thrust on research as indicated in their mission and vision, and (2) the size of student population in the graduate programs is sufficient for the expected number of participants.

Instruments

Scale for Scientific Thinking. The scale for scientific thinking was devised by Magno (2010) that measures characterization of a scientist. It comprises both traits and dispositions to carry out theoretical work. The scale is composed of the factors practical inclination (24 items), analytical interest (31 items), intellectual independence (35 items), and discourse assertiveness (33 items). A 4-point Lickert scale was used for each item (4=strongly agree, 3=agree, 2=disagree, 1=strongly disagree). The items have high internal consistencies of .96, .96, .95, and .95 for practical inclination, analytical interest, intellectual independence, and discourse assertiveness respectively. Convergent valifity was also established where the four factors are all highly correlated with each other. The four factors structure was obtained using an initial principal components analysis. In another sample, the four-factor model was supported in a measurement model with all significant items with acceptable goodness of fit $\chi^2=28935.92$, df=7374, RMS Standardized Residual=.03, RMSEA=.04. The IRT Graded Response model was used and showed appropriateness of the threshold categories for the four point scale. There is precision at 95% in the Test Information Function and all 123 items turned out to fit the Rasch model (MNSQ) values within .8 to 1.2).
Self-regulation for Research Questionnaire (SRRQ). The SRRQ is a domain specific measure of self-regulation on conducting research. Items written for each of the 10 self-regulation components (self-evaluating, organizing and transforming, goal-setting and planning, seeking information, keeping records and monitoring, environmental structuring, self-consequencing, rehearsing and memorizing, seeking assistance, and reviewing records) based on the classification arrived at by Zimmerman and Martinez-Pons (1986). The eight factors were confirmed using CFA (N=1839). The results showed that an eight factor solution of the self-regulation in research had a good fit as indicated by $\chi^2=47432.81$, $df=8745$, $RMS$ Standardized Residual=.01, $RMSEA=.01$, $NFI=.91$, $GFI=.95$, $PGI=.96$. All the 112 items when used as indicators for each self-regulation in research factor had significant path loadings. The eight factors in the measurement model also had significant relationships ($p<.01$). Zero order correlation of the self-regulation in research factors showed to have significant relationships, $p<.01$. The internal consistencies of the factors also showed to be very high ranging from .89 to .97. The items were calibrated for each component based on a Graded Response Rasch Model. The analysis determined the items that required more skills to implement. Most of the items fit the Rasch Model with appropriate threshold categories.

Creativity Scale. The creativity scale measures personal creativity characteristics by Renzulli et al. (1976). The scale is based on a multiple talent approach to the identification of gifted students, these scales help identify student strengths in the areas of motivation, creativity, learning, and leadership. The factors of the scale are creative characteristics, motivational characteristics, learning characteristics, and leadership characteristics. The stability of the scale ranged from .77 to .91 where N=78, interjudge reliability was .67 to .91 where N=80. The reliability of the scale was recomputed in the present study and its factor structure was confirmed. The participants answered in a four-point scale indicating 1=Seldom or never observed this characteristic, 2=Observed this characteristic occasionally, 3=Observed this characteristic to a considerable degree, 4=Observed this characteristic almost all of the time.

Procedure

Testing personnel were trained to administer the scales to effectively carry out the instructions. The students first answer the preliminary part of the questionnaire to determine if they are qualified as participants in the study (see Participants). Standard operational procedures were implemented such as voice quality and material preparation. After the students have answered, the questionnaire and answer sheets were collected and they were debriefed about the purpose of the study.
**Descriptive statistics.** The mean was used to report the levels of each measure in the scales. The standard deviation was also reported to determine the variability of the scores. All the factors of the measures were intercorrelated to establish the relationship of the factors to be entered in the Confirmatory Factor Analysis.

**Confirmatory Factor Analysis (CFA).** The CFA was used to assess the measurement models in the study. In the analysis, the degree to which the solution fit the data provided evidence for or against the factors of each scale in the study. In the present study, two measurements models were tested. For each measurement model, the factor scores were directly measured (manifest) and the construct being measured were the latent variable. This procedure showed whether the factors loaded significantly on the construct being measured by determining the parameter estimates. After estimating the parameters of the model, the goodness of fit of the solution to the data is evaluated. The Goodness of fit indices that will be used are RMSEA, Chi-square, Joreskog GFI/AGFI, Akaike Information Criterion, Schwarz's Bayesian Criterion, Browne-Cudeck Cross Validation Index, Bentler-Bonett, James-Mulaik-Brett Parsimonious Fit Index, and Bollen's Rho. Two common factor models were tested in the study: One for undergraduate students and another for the graduate students.

**Results**

The purpose of the study is to assess the relationship of scientific thinking, self-regulation in research self-regulation, creativity in a measurement model. From the overall model, two models will be further tested, one for the undergraduate and another for the graduate sample. This procedure is done by comparing which set of sample will the model fit better. The invariance of the model is tested for the graduate and undergraduate sample to by comparing fit indices of the two models.

The initial model is tested that includes all N=1839 respondents that includes undergraduate and graduate students from Luzon. This procedure is done to test whether the model fit the overall sample of the study and to assess the parameter estimates. The results for the overall model showed that scientific thinking, self-regulation in research, and creativity are significantly related to each other with path estimates .90** (between scientific thinking and self-regulation and research), .53** (between scientific thinking and creativity), and .44** (between self-regulation and creativity). All the paths for each subscale of the latent variables (scientific thinking, self-regulation in research, and creativity) are also significant (p<.001) with path estimates ranging from .30 to .64 (see Figure 1). The fit of the measurement model was found to be adequate with values $\chi^2=1004.20$, $df=101$, RMS Standardized Residual=.019, RMSEA=.07, PGI=.94, Adjusted
PGI=.92, Joreskog GFI=.94, Bentler-Bonett Normed fit Index=.98, Bentler-Bonett Non-Normed fit Index=.97, Butler Comparative Fit Index=.98, and Bollen’s rho=.98. The fit indices obtained for the omnibus model showed that noncentrality estimations are low (RMS and RMSEA) and single sample goodness of fit were high (Joreskog, Bentler-Bonett). This indicates that interrelationship among scientific thinking, self-regulation in research, and creativity is a plausible explanatory model.

The data for the undergraduate students (N=1000) were isolated and the same model is tested with the same indicators and constraints. The result showed that scientific thinking, self-regulation in research, and creativity are significantly related to each other with path estimates .71** (between scientific thinking and self-regulation in research), .85** (between scientific thinking and creativity), and .72** (between self-regulation and creativity). All the paths for each subscale of the latent variables (scientific thinking, self-regulation in research, and creativity) are also significant (p<.001) with path estimates ranging from .20 to .38 (see Figure 2). The fit of the measurement model was found to be adequate with values $\chi^2=451.99$, $df=101$, RMS Standardized Residual=.03, RMSEA=.06, PGI=.96, Adjusted PGI=.94, Joreskog GFI=.95, Bentler-Bonett Normed fit Index=.96, Bentler-Bonett Non-Normed fit Index=.96, Butler Comparative Fit Index=.97, and Bollen’s rho=.96. These results indicate that interrelationship among scientific thinking, self-regulation in research, and creativity for the undergraduate sample is also a plausible explanatory model.

The same with the same indicators and constraints was tested for the graduate students (N=839). The result showed that scientific thinking, self-regulation in research, and creativity are significantly related to each other with path estimates .94** (between scientific thinking and self-regulation in research), .43** (between scientific thinking and creativity), and .28** (between self-regulation and creativity). All the paths for each subscale of the latent variables (scientific thinking, self-regulation in research, and creativity) are also significant (p<.001) with path estimates ranging from .22 to .83 (see Figure 3). The fit of the measurement model was found to be adequate with values $\chi^2=846.11$, $df=100$, RMS Standardized Residual=.02, RMSEA=.09, PGI=.89, Adjusted PGI=.85, Joreskog GFI=.88, Bentler-Bonett Normed fit Index=.96, Bentler-Bonett Non-Normed fit Index=.96, Butler Comparative Fit Index=.96, and Bollen’s rho=.97. These results indicate that interrelationship among scientific thinking, self-regulation in research, and creativity for the graduate sample is also a plausible explanatory model.
**Figure 1.** Measurement Model for Scientific Thinking, Self-regulation in Research, and Creativity
Figure 2. Measurement Model for Scientific Thinking, Self-regulation in Research, and Creativity for Undergraduate Students
Figure 3. Measurement Model for Scientific Thinking, Self-regulation in Research, and Creativity for Graduate Students
Table 1
Comparing the Fit of the Measurement Model for Undergraduate and Graduate Sample

<table>
<thead>
<tr>
<th>Model</th>
<th>$\chi^2$</th>
<th>df</th>
<th>$\Delta\chi^2$</th>
<th>$p$</th>
<th>AIC</th>
<th>SBC</th>
<th>BCCVI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Undergraduate</td>
<td>451.99</td>
<td>101</td>
<td>.52</td>
<td>.69</td>
<td>.52</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Graduate</td>
<td>886.11</td>
<td>100</td>
<td>434.12**</td>
<td>.000</td>
<td>1.14</td>
<td>1.77</td>
<td>1.14</td>
</tr>
</tbody>
</table>

Note. AIC: Akaike Information Criterion, SBC: Schwartz Bayesian Criterion, BCCVI: Browne-Cudeck Cross Validation Index

In testing for the invariance of the model for the graduate and undergraduate sample, the goodness if fit indices were compared. Chi-square ($\chi^2$) values were compared and if the probability of the difference ($\Delta\chi^2$) exceeded 95% or 99%, then the model is invariant (Byrne, 2000). In the case of the present study, the chi-square difference 434.12 that exceeding 99% probability. There is a difference between the measurement models for undergraduate and graduate samples. Other goodness of fit indices is used to test the invariance of the model. The AIC is useful primarily for deciding which of several nested models provides the best approximation to the data. When trying to decide between several models, the one with the smallest Akaiake criterion is the best fitting model. The SBC is also used for deciding among several models. When deciding among several models, same like the AIC, the one with the smallest Schwarz criterion value is the best fitting model. The BCCVI requires two samples, the calibration sample for fitting the models, and the cross-validation sample. Given the obtained values for the undergraduate and graduate sample, the model consistently favors the observation for the undergraduate sample (AIC=.52, SBC=.69, BCCVI=.52). This is also consistent with the chi-square having a significantly lower value as compared with the graduate sample. This indicates that the interrelationship among scientific thinking, self-regulation in research, and creativity fits better for the undergraduate sample.

Differences in the parameter estimates between the three latent variables (scientific thinking, self-regulation in research, and creativity) were also tested. It was found that the relationship between scientific thinking and self-regulation in research is significantly stronger for the graduate sample ($p<.001$). However, the relationship between creativity and scientific thinking and between creativity and self-regulation in research was significantly stronger for the undergraduate sample ($p>001$). When the path estimates for the specific indicators of the latent constructs were tested for significant differences, the estimates for scientific thinking and self-regulation in research was significantly higher for the graduate sample while the parameter estimates for creativity was significantly higher for the undergraduate sample on motivation and creativity.

Table 17
Comparing Path Estimates of the Manifest Variables

<table>
<thead>
<tr>
<th>Manifest Variable</th>
<th>Estimates for the Undergraduate sample (N=1000)</th>
<th>Estimates for the Graduate sample (N=839)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scientific thinking</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Practical Inclination</td>
<td>.33</td>
<td>.78</td>
<td>.000</td>
</tr>
<tr>
<td>Analytical Interest</td>
<td>.35</td>
<td>.77</td>
<td>.000</td>
</tr>
<tr>
<td>Intellectual Independence</td>
<td>.34</td>
<td>.77</td>
<td>.000</td>
</tr>
<tr>
<td>Discourse Assertiveness</td>
<td>.20</td>
<td>.78</td>
<td>.000</td>
</tr>
<tr>
<td>Self-regulation in Research</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Self-Evaluation</td>
<td>.30</td>
<td>.83</td>
<td>.000</td>
</tr>
<tr>
<td>Organizing</td>
<td>.33</td>
<td>.81</td>
<td>.000</td>
</tr>
<tr>
<td>Goal-Setting</td>
<td>.37</td>
<td>.82</td>
<td>.000</td>
</tr>
<tr>
<td>Seeking Information</td>
<td>.37</td>
<td>.80</td>
<td>.000</td>
</tr>
<tr>
<td>Keeping Records</td>
<td>.38</td>
<td>.82</td>
<td>.000</td>
</tr>
<tr>
<td>Environmental Structuring</td>
<td>.36</td>
<td>.82</td>
<td>.000</td>
</tr>
<tr>
<td>Self-Consequencing</td>
<td>.36</td>
<td>.82</td>
<td>.000</td>
</tr>
<tr>
<td>Rehearsing and memorizing</td>
<td>.37</td>
<td>.83</td>
<td>.000</td>
</tr>
<tr>
<td>Creativity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Creativity</td>
<td>.36</td>
<td>.22</td>
<td>.001</td>
</tr>
<tr>
<td>Motivation</td>
<td>.37</td>
<td>.26</td>
<td>.009</td>
</tr>
<tr>
<td>Learning</td>
<td>.34</td>
<td>.42</td>
<td>.04</td>
</tr>
<tr>
<td>Leadership</td>
<td>.31</td>
<td>.35</td>
<td>.33</td>
</tr>
</tbody>
</table>

Discussion

The factors confirmed for scientific thinking and self-regulation in conducting research together with creativity were structured in a measurement model to test if they are related. It was previously hypothesized that the constructs scientific thinking, self-regulation in research, and creativity converge with each other. Their point of convergence was primarily explained in the social cognitive theory and field theory. The hypothesis was supported in the present study. The constructs scientific thinking, self-regulation in research, and creativity were significantly correlated in the measurement model. The relationship of the three constructs support the assertions made by Cropley (2000), Ivcevic and Mayer (2000), and Sternberg and Lubart (1995).

The findings indicate that there is convergence when a student thinks scientifically, uses self-regulation in the conduct of research and manifests creativity. Their relationship is stringed within a scientific research domain where students’ who engage in research work requires to think scientifically in order to effectively go through the process. When students engage in the
research process, they would need to be self-regulated to execute the specific tasks well. Engaging in a research would need one to have creative pursuits to develop scientific attitude. Given this scenario, scientific thinking, self-regulation in research, and creativity explains a dynamic scientific research pursuit. This dynamic scientific research pursuit is trifocal in nature. The triad in this case is composed of the attitude aspect which is scientific thinking, a cognition factor such as self-regulation, and creativity as a disposition factor.

The feature of the triad is explained in terms of its function and utility. The functional aspect of the triad is the convergence of the three constructs. It serves to explain the tendency of learners in their increased use of one variable and the other. A research task is a scientific pursuit by nature and it is exemplified by people who are strong in scientific thinking. In the execution part, the research focus would require the individual to control their cognition and learning to effectively produce the right outcome, thus they use self-regulation strategies. A scientific attitude strengthened by the use of self-regulation requires a creative disposition in order to make novel theories and solutions. Moreover, the function of the triad is to deliberately explain what undergoes in the scientific research pursuit by looking at how these three variables are interrelated. A research task engaged by a student would exemplify these three characteristics and his or her effectiveness in accomplishing the task can be explained in the dynamics of the three constructs.

Another feature of the triad is its utility. The triad is valuable in explaining the interplay of cognition and disposition in scientific research. The triad is important because it links three important variables that interplay when an individual engages in a scientific pursuit such as research. When an individual thinks scientifically and who are self-regulated, they reflect a more creative character as demonstrated in the measurement model tested in the study. The model did not only include a cognitive part such as the scientific thinking but also a disposition variable such as creativity. The triad is useful in a sense that it combined variables in two different domains. Moreover, the relationship of scientific thinking, self-regulation in research, and creativity contributes to the theoretical foundation of explaining how experts within the line of science and research think and process information.

The triad is useful in explaining the distinctions of the model across different levels of students such as those in the undergraduate and graduate level. Two measurement models were tested for these two groups and significant model invariance was found. The model was more representative for the undergraduate level but the relationships of the variables were stronger for the graduate level. This shows that the triad is generally manifested for the undergraduate level but stronger relationship happens for graduate students. For the case of the undergraduate model, the fit suggests that the triad is feasible in explaining their cognitions and dispositions when
engaged in a scientific research pursuit. However, for the graduate students their scientific thinking is largely integrated with their self-regulation and creativity when engaged in research as compared to the undergraduate. This shows that graduate students have the ability to use multiple tasks, skills, and dispositions when faced with a task. This complexity is brought about by their developmental maturity. However, for the undergraduate students the triad is useful in explaining their cognitions.

References


**Author Notes**

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Seeking Solutions: Of Radio/Television Advertisement and Patients/Non-Patients’ Perception of Traditional Medicine in Edo State, Nigeria

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**Abstract**

Arguments have trailed the services of traditional medicine practitioners (TMPS) in Edo State, Nigeria, with regard to the effectiveness of their medicines. Many people get to know and possibly seek the services of TMPS by viewing/listening to TMPS’ advertisements on television (TV) and radio channels. It is against this backcloth that this paper adopts the survey methodology to investigate Nigerians’ ever-use of traditional medicine and their perceptions of its provision and effects, using Edo State as a case study. To achieve this, the researchers analyzed the views of 300 respondents who have sought the services of TMPS, having heard or watched radio/TV programmes that advertised TMPS’ services. In the end, it was found that much of the claims of cure of ailments by TMPS are suspect and leave much to be desired. Therefore, the paper concludes by suggesting that stakeholders, including government, broadcast media should help to refocus the agencies charged with traditional medicine with a view to professionalising the activities of the rather many TMPS in Edo State and that TMPS with genuine nous should be encouraged to make available their expertise in a strategic synergy with orthodox medicine practitioners for the overall good of the healthcare delivery system.

Keywords: broadcast media, cure, Edo state, efficacy, TMPS, traditional medicine, healthcare.

**Introduction**

Research interest in traditional medicine is strong given the multitude of people using it, particularly in the Southern Hemisphere, such as Nigeria. At the core of this interest lies the need to investigate whether the use of the said medicine is effectual or not, or whether the users themselves are “cured” of their ailments as a result. Commonly, the analytical lens or framework for
examining the efficacy of traditional medicine is governed by the evidence or rationale-based perspectives of modern, western-based medicine. Some scholars are adverse to this because, according to them, there is enough evidence in traditional medicine practices in China, India, Nigeria, Nepal, and elsewhere whose methodologies are different from that of western medicine (Mume, 1976; Roseman, 1988; Aluede, 2010). In the history of medicine with special reference to the cause of diseases and how to maintain health, “The Emergence and the Objective of Islamic Medicine for the Promotion of Health” (2004) asserts that health which is a dynamic condition of balance is the result of an individual’s ability to cope with internal and external influences. Thus, an individual needs not only create an internal balance within him/her but have to cope with external elements.

The multiplicity of universal influences upon any individual is numerous, ranging from the most subtle, such as spirit, to the most gross, such as the sun. Indeed, much of what has been discussed concerning preservation of health and therapeutics in Islamic/African/Asian medical practice may be best understood and justified by referring to the physiology which all of preventive medicine is based on. Consequently, bodily health is displayed when the body and each of its organs achieve and maintain suitable balance of the elements, air, earth, fire and water. Corresponding with the four elements are the four temperaments, hot, cold, dry and moist. In addition to these are four humours, blood, phlegm, yellow bile and black bile. This concept is also relevant to modern medicine, especially if we refer to the question of tissue transplant. Actually, tissue transplant involves the same concept of elements and temperaments in the human body. Medical doctors, whether in the western, orthodox sense or in the traditional, alternative medicine sense as practised in Asia and Africa cannot transplant the kidney of one person to another unless the tissues match and are similar. In other words, one man is not going to accept the tissue of a second man unless the two can match. It is because of this and for a variety of little understood reasons, whether from the action of placebos (Ernst, 2001), credulity and plain availability, these local unsystematic and seemingly unscientific systems (i.e., traditional medicines) have had and continue to have a record of successfully meeting the needs of a far wider range of psychological and physiological sufferers (Tanner, 2010).

Tanner (2010) further asserts that most of the western, scientific medicines have only been available to the well-to-do, a small proportion of any population. Many procedures are too expensive for general use so that their application is rationed by the cost of the medicines, the cost of the necessary training and maintaining specialized personnel and the absence of an economy that can maintain large scale social welfare. Although, western, scientific medicine has had substantial short-term effects in coping with many mass diseases such as poliomyelitis, cholera, malaria in developing countries with the marked exception of HIV/AIDS, it has had little more than
palliative success with degenerative diseases. This leaves a majority of the world’s population with the alternatives of using traditional medical systems as may be modified by culture, religion, race, cost or social change to meet their health needs. Here, perhaps, lies the raison d'être why traditional medicine as an alternative to western, orthodox medication in Nigeria may be gaining ground. One of the latest dimensions in this trend is that most of the traditional medicine practitioners (TMPS) employ the broadcast media, radio and television channels to reach their seemingly growing number of clientele. Debates in the public space have also trailed the efficacy of their products/services in contemporary Nigeria.

Since time immemorial, each community in Nigeria had had a peculiar way of dealing with its health problems. Mume (1976), Ohaeri (1988) and Ogunleye (2006) assert that the early method of treating ill health among Nigerians in antiquity is through traditional medicine and it is believed to be efficacious. Ogunleye (2006) further contends that traditional medicine otherwise known as indigenous medicine is a therapeutic practice that has been in existence for hundreds of years before the development and spread of modern medicine. Mume (1976) sees it as the transmission by word of mouth and by example the knowledge and practice based on customary methods of natural healing or treatment of diseases. Among other tags, traditional medicine has been called natural medicine, alternative medicine, complementary medicine, native medicine, herbal medicine, ethno medicine, holistic medicine in Nigeria (Africa), where a majority of the people reside in the rural areas. According to Chinsembu (2009), herbal medicines are the first line of treatment for 60 percent of African children that catch malaria. And this is not just for the rural dwellers. Even urbanites buy herbal medications to treat flu and colds. While contending that some African herbs are more efficacious than western medicines, he gives the instance of the vuka vuka, which is widely used in southern Africa. Chinsembu (2009) further observes that, some lucky women will attest that even before the advent of Viagra, vuka vuka was already performing aphrodisiac wonders in their husbands. Hence, he concludes with an instructive poser that who knows whether the knowledge of vuka vuka led to Pfizer's Viagra?

Besides, Artemisia, a medicinal herb is widely used in Uganda for the cure of malaria fever (African Independent Television, 2010). Similarly, Okoegwale and Olumese (2001), Okoegwale and Omofezi (2001), Ilondu and Okoegwale (2002) and Okoegwale (2010) have reported in their ethno botany researches the medicinal propensities of certain plants for emphasis, popularization and usage in Edo State, Nigeria. Using the concept of healing foods as put forward by Houseman and Hurley (1989), they found out that a hedge plant called Draceana mannii “a monocotyledon, ‘Udielimhin’ in Esan language could be used for the management of impetigo, an acute contagious inflammatory skin disease. They also reported that Garcina cola (Bitter kola) could be used in the management of hepatitis of the liver. The decoction of
the root could be used as an aphrodisiac, evacuant and also for dysentery, headache and respiratory ailments. The decoction of the stem bark is effective in arthritis. They also identified Commelina benghalensis, a perennial herb with blue petals as being very effective in the management of colic ulcer. These and many more have been the fulcrum of their past and current research efforts and stakeholders in traditional medicine practice, including the government ought to pay more than a cursory look at these works because of their capacity for authenticating and standardizing alternative medical practice in Nigeria.

At another level, Lambo (1955), Mume (1976), Ohaeri (1988), Osunwole (1990), Kongo (1997), Erinosho (1998), Adelowo (2005), Aluede & Omoera (2009a) hold the view that, among Africans, a complex of factors - including microbes, germs and/or infections or hereditary factors, psychological, medical, spiritual/mystical, socio-environmental and cultural variables – are responsible for ailments. This implies that a consideration of all possible causative factors is necessary when treating illnesses: the physical, socio-spiritual and mental conditions are taken into account while treating an ailing individual. Discussing specifically the Esan (in Nigeria) belief system of illness causation and therapeutic interventions, Aluede & Omoera (2009a); Aluede and Omoera (2009b) identified four classes of illness causation. These are Emianmhen, Emianmhen – Ason, Emianmhen – Elimhin and Emianmhen – Arialusi. According to them, the Emianmhen is sickness, which is natural and very tractable. The ailments under this category are those from poor living conditions, hereditary and through sexual promiscuity. The Emianmhen – Ason, which means night sickness, refers to illness caused by witches, wizards and witchets. The Emianmhen – Elimhin, is sickness caused by ancestors, gods and spirits while the Emianmhen – Arialusi is the kind of sickness which is carried over from past earth life. While the first category of illness may respond to western, orthodox medication, treating any sickness from the last three categories may never be successful unless there is recourse to traditional medicine.

Aluede and Omoera (2009a) further support their submissions with concrete experiments and vivid illustrations from the Iyayi community in Esan. In that study, they reaffirmed the consensus that ill health can be caused by many factors, including community taboos and ancestral issues. For instance, going against the community’s will through eating forbidden food or fruits can result in an intractable fever and diarrhoea, having canal knowledge of a sister could result in having symptoms of mental disorder like feeling lonely in the midst of friends, being afraid to relate with people, feeling of being discussed behind, being always uneasy and tensed up. An attempt to treat such cases medically (in the western, conventional sense) will end in futility if the ancestors or gods or spirits are not approached or propitiated for appropriate remedies. Tanner (1958) earlier made this point when he examined ancestor propitiation ceremonies in Sukumaland.
Sharing some views on Kenya’s notion of illness causation and belief, Aggrey (2008) observes that it is a common belief among many ethnic tribes in Kenya that western or modern medicine alone cannot cure patients without integrating herbal or traditional medicine. Assessing the Cameroonian experience, Hillenbrand (2006) asserts that for economic reasons as well as personal preferences, Cameroonians of all ranks and backgrounds use traditional medicine, often simultaneously with conventional care. Hillenbrand (2006) however regrets that the incorporation of traditional medicine into mainstream medicine is not a national priority in Cameroon. This appears to be the scenario in most countries on the continent of Africa, including Nigeria where mistrust, mutual suspicion and lack of cooperation continually tears apart the band that ties conventional medicine practitioners and traditional medicine practitioners.

This attitude goes against the grain of the thinking of the World Health Organization (WHO) which recognizes traditional medicine as a vital healthcare resource in developing countries and has encouraged governments to adopt policies to officially acknowledge and regulate the practice of traditional medicine (Hillenbrand, 2006: WHO Report, 1990). The victims of this untoward situation are the poor masses across the African continent that now and then, take ill and might be ripped off by some charlatan practitioners of modern or traditional medicines. Worst, in many urban, suburban and rural settings in Nigeria, Liberia, Sierra Leone, Cameroon and other developing areas of Africa, there abounds cases of untimely deaths of people due to widespread sales and administration of fake and adulterated drugs by con artists turned medicine men and women. This reprehensible phenomenon is probably best emblematized by the albatross of the “Ariaria drug market in Onitsha”, which hangs dangerously on the neck of Nigeria as a country.

In the midst of this seeming ambivalence and confusion, some unscrupulous conventional and traditional medicine practitioners appear to be having field days in many areas of Nigeria and elsewhere. Apart from economic gains, many of them especially the TMPS are making daring claims everywhere to whoever cares to pay attention that they can cure what orthodox medicine practitioners finds bewildering. This position is corroborated by the Enogie of Opoji (Personal Communication, November 5, 2007) who notes that one of his subjects was rushed from a modern medical facility in Benin City to a TMP in his domain and within a few months the patient was healed of severe stroke. Similarly, TMPS every now and then, buy air time on radio and television stations to make bold claims on how they have cured different ailments. It is not uncommon to hear/see TMPS on Edo Broadcasting Service Radio, Benin City or Television, Independent Television or Radio, Benin City, Nigerian Television Authority, Benin, Nigerian Television Authority, Iruekpen, Nigerian Television Authority, Jattu, to mention a few, making claims. They brandish special concoctions,
tablets, infusions, solid preparations, decoctions, among others, as cure for diverse ailments. The list of the ailments that could be cured is always endless. They include ailments such as hernia, high blood pressure (hypertension), hypotension, arthritis, asthma, weak erection and barrenness in women, sterility in men, rheumatism, gonorrhoea, syphilis and many others. In fact, one TMP, Dr. Tony Ebose of Ima Herbal Centre, who is based in Ekpoma, has claimed on Independent Television (ITV) Benin City that he had a cure for HIV/AIDS way back in 2005 (“Good Morning from Benin”, a programme on Independent Television (ITV) Benin City, September 16, 2005).

While these claims on the air waves and elsewhere are spiralling to an all-time high, some other stakeholders in the health sector have insistently argued that traditional medicine is unscientific. They say it is abstruse in terms of diagnosis, procedure and drug administration. Hillenbrand (2006) remarks that advocates of western, conventional medicine argue that traditional medicine is fraught with problems of imprecise dosage, poor diagnosis, charlatanism, exaggerated claims of abilities, and inadequate knowledge of anatomy, hygiene, and disease transmission, all of which put their patients’ health and lives at risk. Although some practitioners of western, conventional medicine have also been found guilty of this same charge at least from the Nigerian perspective, Dr. Jimoh Salaudeen of the Nigerian Medical Association (NMA), Asaba branch thinks that hawking of traditional drugs on radio and television should be banned (Personal Communication on the barrage of traditional medicine advertisements on radio and television channels in Nigeria, August 23, 2007). His position may have arisen from the widespread allegation of quackery and unproven treatment among TMPS in many areas in Nigeria. Advertising Practitioners Council of Nigeria (APCON) has also issued on the Nigerian Television Authority (NTA) Network News that all advertisements on general goods and services put on radio, television and other media of advertisement with effect from 1st October 2007 must be vetted by the council. This decision may not be unconnected with the ever-increasing use of radio and television to advertise traditional or herbal products/services which APCON claims that many Nigerians are complaining about.

Besides, the National Agency for Food Drug Administration and Control (NAFDAC) has always insisted that the approval given to many of the TMPS’ products is just to certify that the products are safe for human consumption, not whether they are efficacious or not. With reference to adverts on the broadcast media, ThisDay Online (2007) reported that NAFDAC has warned television and radio stations to pass any advert or programme on traditional medicine through its lens before they are fed to the Nigerian public. Though NAFDAC’s operation appears to be outside the scope of whether TMPS’ products are efficacious or not, it nonetheless underscores why the effectiveness or otherwise of traditional medicine has generated
considerable public interest in Nigeria. The public is daily inundated with the radio and TV commercials of TMPS such as Iyabiye Tayashe, Dr Oosa, Baba and Mama Farin, Dr Fire Fire, Baba Oke Ogun, Baba Ijebu, Ayo Ade Naturalist Care, among many others, and it is by means of these advert platforms that this paper explores Nigerians' ever-use of traditional medicine and their perceptions of its provision and effects, using Edo State as a case study.

Method

Setting

The study was carried out in Edo State, Nigeria. The state is made up of 18 Local Government areas (LGAs). For the purpose of this study, the state was divided into three zones: the south represented by Benin City; the central represented by Ekpoma and the north represented by Auchi. The choice of these towns in each zone was informed by the fact that each has at least one tertiary institution and each is cosmopolitan in outlook. The residents of these towns are exposed to various television and radio programmes, including adverts of TMPS’ services. Besides, each of these three centres have played host to tradition medicine/ herbal fairs where TMPS’ products were displayed. Therefore, there is every possibility that the residents could give informed views/opinions on TMPS’ services.

Participants

A total number of 300 respondents participated in this study. They represent the residents of the three selected towns. 135 (45%) respondents male; 165 (55%) female. 160 (53.3%) Christian, 120 (40%) Muslim and 20 (6.7%) respondents did not indicate their religion. 177 (59%) University/Polytechnic/College of Education Graduate, 108 (36%) Senior School Certificate holder while 15 (5%) did not indicate their qualification.

Design

The study employed an ex-post facto design. This design is appropriate because the participants have sought the service of TMPS, having heard/watched radio/TV programmes on TMPS’ services. Therefore questionnaires were administered to the participants to elicit information about the perceptions of traditional medicine in relation to the efficaciousness of TMPS' products/services.
Sample Size

The sample size used for the research was 300 participants selected from the three towns each representing the three senatorial districts/areas that make up Edo State.

Instrument

The instrument used to draw responses from the subjects was a carefully designed questionnaire. It consisted of two sections. Section A tapped information on the respondents’ demographic variables while section B comprised of items that measured the efficacy of TMPS’ services. The items were structured using 3-point response format, ranging from Yes to Undecided.

Procedure

A total number of 1000 questionnaires were initially distributed in the three designated towns. 400 questionnaires were administered in Benin City, 300 questionnaires in Ekpoma and another 300 questionnaires were administered in Auchi. The reason for the allotment is that Benin City is the state capital and obviously the most populous setting followed by Auchi and Ekpoma (National Population Commission, 2006). The questionnaires were administered to respondents in major public places such as shopping malls, markets, schools, in these towns. To make the process of administering the questionnaire easy, the researchers employed the services of research assistants who were familiar with the towns under investigation. 700 questionnaires were retrieved from the field. Out of these, 300 questionnaires that were filled by respondents who have heard/watched TMPS’ advertisements/programmes on radio/TV and sought either as patients or as close relatives of patients (non-patients) were separated for use in the research. The reason for this separation is because the study sought to find out patients/non-patients’ perceptions of traditional medicine and TMPS against the backdrop of the frenzied advertisements of their products on the radio and TV stations in Edo State. In other words, only participants who have heard/watched radio/TV programmes advertising the wares of TMPS and eventually sought their services were isolated for the study.

The data were collected and analyzed using descriptive statistics such as frequency tables and percentages to interpret results.

Result

The results show that a relatively high number of the respondents have sought the services of the TMPS and can reasonably give their
perceptions on traditional medicine and the use of TMPS' products/services, especially in relation to whether they are efficacious or not.

Table 1

Questions to Ascertain Respondents Who Have Sought the Services of TMPS Having Heard/Watched Radio/TV Advertisements on Traditional Medicine

<table>
<thead>
<tr>
<th>Statements</th>
<th>Response</th>
<th>Frequency</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Have you heard/watched on radio/television, the adverts of Iyabiye Tayashe, Dr Oosa, Baba and Mama Farin, Dr Fire Fire, and other traditional medicine men or women?</td>
<td>Yes</td>
<td>650</td>
<td>93</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>30</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Undecided</td>
<td>20</td>
<td>3</td>
</tr>
<tr>
<td>Have you ever sought the services of traditional medicine men or women over any ailment after listening to/watching radio/TV commercials of their services/products?</td>
<td>YES</td>
<td>280</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td>NO</td>
<td>420</td>
<td>60</td>
</tr>
<tr>
<td></td>
<td>Undecided</td>
<td>=</td>
<td>=</td>
</tr>
<tr>
<td>Have you ever accompanied any one to seek the services of traditional medicine men or women after listening to/watching radio/TV commercials of their services/products?</td>
<td>Yes</td>
<td>20</td>
<td>2.857</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>680</td>
<td>97.14</td>
</tr>
<tr>
<td></td>
<td>Undecided</td>
<td>=</td>
<td>=</td>
</tr>
</tbody>
</table>

Table 1 shows that 650 (93%) respondents have heard/watched TMPS' advertisements on radio/television, 30 (4%) have not heard/watched TMPS' adverts while 20 (3%) are undecided. 280 (40%) respondents have sought the service of TMPS while 420 (60%) have never visited any TMP over any ailment. 20 (3%) have accompanied their people/relatives to seek the services of TMPS while 580 (97%) have never accompany anyone to seek TMPS' services.

Table 2

Questions that Elicit Respondents' Impression about TMPS' Products

<table>
<thead>
<tr>
<th>Questions</th>
<th>Respondent</th>
<th>Frequency</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Would you say tradition medicine men and women properly assess clients' ailments before prescription?</td>
<td>Yes</td>
<td>115</td>
<td>38</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>185</td>
<td>62</td>
</tr>
<tr>
<td></td>
<td>Undecided</td>
<td>=</td>
<td>=</td>
</tr>
<tr>
<td>Do you like the way drugs are administered by traditional medicine practitioners?</td>
<td>Yes</td>
<td>97</td>
<td>32</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>203</td>
<td>68</td>
</tr>
<tr>
<td></td>
<td>Undecided</td>
<td>=</td>
<td>=</td>
</tr>
<tr>
<td>Would you say the environments where most traditional medicine practitioners operate are hygienic?</td>
<td>Yes</td>
<td>51</td>
<td>17</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>249</td>
<td>83</td>
</tr>
<tr>
<td></td>
<td>Undecided</td>
<td>=</td>
<td>=</td>
</tr>
<tr>
<td>Do you think the traditional medicine practitioners deliver on their promises as seen/heard over radio and TV?</td>
<td>Yes</td>
<td>130</td>
<td>43</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>170</td>
<td>57</td>
</tr>
<tr>
<td></td>
<td>Undecided</td>
<td>=</td>
<td>=</td>
</tr>
</tbody>
</table>
Table 2 shows that 185 (62%) respondents believe that traditional medicine men/women do not properly assess clients’ ailments before prescription while 115 respondents (48%) are of the opinion that TMPS properly assess their clients before prescription. 203 (68%) respondents do not like the way TMPS administer their drugs to patient while 97 (32%) like the way TMPS administer drugs. 249 (83%) are of the opinion that most TMPS operate in an unhygienic environment while 51 (17%) say that the environment where most TMPS operate is hygienic. 170 (57%) think that the TMPS do not deliver on their promises as against 130 (43%) who believe otherwise.

Table 3

<table>
<thead>
<tr>
<th>Questions that Draw Respondent’s Satisfaction about TMPS’ Services</th>
<th>Response</th>
<th>Frequency</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Having been treated by a traditional medicine practitioner, were you fully healed?</td>
<td>Yes</td>
<td>95</td>
<td>32</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>205</td>
<td>68</td>
</tr>
<tr>
<td></td>
<td>Undecided</td>
<td>=</td>
<td>=</td>
</tr>
<tr>
<td>Did you/your relation experience relapses having been fully treated?</td>
<td>Yes</td>
<td>205</td>
<td>68</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>95</td>
<td>32</td>
</tr>
<tr>
<td></td>
<td>Undecided</td>
<td>=</td>
<td>=</td>
</tr>
<tr>
<td>Would you say you/your relation are/were satisfied with the methods used for treatment and the services offered by the traditional medicine men or women?</td>
<td>YES</td>
<td>72</td>
<td>34</td>
</tr>
<tr>
<td></td>
<td>NO</td>
<td>228</td>
<td>76</td>
</tr>
<tr>
<td></td>
<td>Undecided</td>
<td>=</td>
<td>=</td>
</tr>
</tbody>
</table>

Table 3 shows that 205 (68%) respondents do not subscribe to the opinion that having been treated, they were fully healed. 95 (32%) subscribe to the idea that having been treated, they or their relatives were fully treated. 205 (68%) respondents said having been treated fully, they or their relatives experienced relapses while 95 (32%) said they or their relations did not experience any relapse. 228 (76%) said they were not satisfied with the methods used for the treatment while 72 (34%) said they were satisfied.

**Discussion**

The study has examined the perception of persons who have heard/watched and sought the services of traditional medicine practitioners in Edo State, Nigeria. In the analysis, 300 respondents were drawn from the three zones of the state. The result shows that traditional medicine practitioners (TMPS) do not properly assess their clients’ ailments before prescription or treatment. It also reveals that the environment where they operate is largely unkempt. This supports the position of Hillenbrand (2006) and the NMA as presented by Salaudeen (2007), which holds that traditional medicine in Africa (Nigeria) is to large extent, unscientific and abstruse in
terms of diagnosis and drug administration procedures. Respondents’ perception in this study might have stemmed from the fact that a majority of them were brought up within the colonial contexts and prisms of western thinking and ideology which they are still striving to keep not minding the depressing consequences such dreams might have engendered. For instance, western medication have not been able to put degenerative diseases under effective check (Tanner, 2010), neither has its prohibitive cost of administration made it accessible to the masses in developing areas, including Nigeria where public health systems which are mainly designed following western paradigms are failing.

Another issue that needs to be put into perspective is thinking that there are categories of illness as identified by Tanner (1958); Aluede & Omoera (2010a); Aluede and Omoera (2010b) which are beyond western medicine and can only be managed/cured/treated through native, indigenous medical remedies. It is in the light of this that we think that traditional medicine and its practitioners should be encouraged to improve on their services to take care of certain medical cases that are beyond western, orthodox medical comprehension and remediation. In this regard, dedicated TMPS, the government, the media and other stakeholders should make concerted effort at systematizing/sanitizing the TMPS’ operations, especially in relation to their environment where they operate, their treatment procedures and drug administration. Along this line of sanitization must also be how to address the challenge of charlatanism among the ranks of TMPS. Although the problem have also been found to exist in orthodox medical practice, Ojei (2008), a renowned alternative/traditional medicine practitioner in Nigeria contends that they (TMPS) have 99% of fraudsters, people who could not finish primary school parading themselves as alternative medical doctors in Nigeria. If Ojie’s view is anything to go by, then a closer look must be paid the traditional medicine sector of the healthcare delivery system in Edo State in particular and in Nigeria generally.

The problem of charlatanism may not be unconnected with the fact that there is no strong regulatory body superintending the traditional medicine sector in the country, needless to mention Edo State, which is the area under survey. Again, the fact that traditional medicine system in Nigeria has been in existence from time immemorial (Ogunleye, 2006), before the introduction of western medicine may have also made it an all comers’ affair. The implication of this is that TMPS from the outset in Nigeria did not have to subject their medication to western scientific assessment before successfully treating their clients. This much Mume (1976); Adelowo (2005); Aluede & Omoera (2010a); Aluede & Omoera (2010b) have exemplified though many of the respondents in this present study think otherwise. Besides, the current influx of people into the field of traditional/alternative medicine in Nigeria may have arisen from the problem of unemployment and
the inordinate drive for some people to make quick money. Therefore, with the inability of many Nigerians, especially those in the rural areas to access orthodox medical services/facilities, some smart ales among the TMPS and even pretenders among orthodox medical practitioners catch in on patients’ medical predicaments to frisk them of their hard earned money.

Furthermore, the result reveals that a greater number of people that patronize TMPS are not satisfied with their medical services. This is in sharp contrast to the loud advertisements that are placed on radio/television channels by many TMPS as regards the efficacy of their products. A significant number of TMPS’ clients affirmed that they were either not fully healed or that they experienced relapses after full treatment. This is probably due to the fact that a large number of TMPS advertise on radio and television that a single drug could cure up to 8 or 9 ailments. Apparently, this “cure-all” drugs sound magical when viewed against the backdrop that most of the ailments have different underlying causes. This observation is corroborated by the remark of Martins (2007), which states that people in their desperate need to cure exotic diseases have met their untimely death in the hands of unscrupulous mythical traditional doctors.

Hence, this study suggests that the loud claims on television and radio advertisements by TMPS should be further scrutinized as they appear not to reflect, significantly, in the efficaciousness of their medicines. The activities of TMPS should be put under the watchful eyes of a regulatory body which should strive to realign their operations and possibly see how traditional medicine could be integrated into the mainstream medical delivery system in Edo State of Nigeria for the greater benefit of the people. This thinking is based on the fact that there are numerous fauna and flora in the African rain forest areas of Edo State whose parts such as skin, fluid, bark, leaves, among others, have been reported to be of immense help in ethno medicine. Indeed there has been a considerable effort at documenting plants of medicinal relevance in various communities in Edo state (Okoegwale, 2010) and efforts must now be made by dedicated stakeholders to harness the medicinal properties of these natural substances in the environment for the benefit of sufferers/patients and relatives of sufferers/would-be sufferers/non-patients of ailments.

**Conclusion**

Regardless of the ambivalence that seems to be surrounding traditional or indigenous medicine in Edo State, Nigeria, it is still the medicine for the masses today and probably for long time to come because of the short supply of modern medical facilities (in the western sense), the prohibitive cost of procuring treatments and training orthodox medical personnel. Thus, traditional medicine or what could be called the people’s medicine cannot be wished away because it involves the use of herbs, roots,
barks, grasses, and leaves, animals and other natural substances which abound everywhere. Though it does not give much room for scientific assessment along the lines of western medical paradigms, its place and usefulness in the healthcare delivery system in Edo State, Nigeria could be felt more if certain realignments are made. This is particularly so because the technological wherewithal to provide up-to-date orthodox medical services is in short supply in Nigeria and the political leadership in the country is far from confronting this challenge head-on. In the circumstances, the Indian, the Nepalese and the Chinese examples of incorporating their traditional medical practices into orthodox medicine practices seem appealing and most practicable because a majority of Nigerians live in the rural areas where they cannot access the few modern medical facilities available. This category of Nigerians, including a growing number of people in urban areas depends heavily on ethno medicine and TMPS for their medical needs. It is on the strength of the foregoing that the following recommendations are made:

1. TMPS that have real knowledge of ethno medicine should be encouraged by the government and other stakeholders, including broadcast media outfits to come out and share their expertise for the common good of Edo people and other Nigerians.

2. Government and other stakeholders, including the broadcast media should help to refocus the agencies charged with traditional/alternative medicine with a view to honing the skills of the rather many and poorly trained alternative medicine practitioners.

3. The broadcast media professionals in Nigeria should create special forums where TMPS could productively meet minds with western, orthodox medicine practitioners.

4. National Broadcasting Commission (NBC), APCON and other relevant regulatory agencies should work hand in hand to verify claims of TMPS before they are placed on the broadcast media in Nigeria. In this connection, agencies such as NAFDAC, Consumer Protection Agency (CPA), and Standard Organization of NIGERIA (SON) should be further strengthened to check any unwholesome practice among the ranks of TMPS in Edo State, Nigeria.

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The Thin Is In: Am I Thin Enough?
Perfectionism and Self-Esteem in Anorexia

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Abstract
The study looked into the eating habits and attitudes of female college students who are involved in dance, theater and sports. The levels of perfectionism and self-esteem were also explored in relation to their eating attitudes. Seventy-five students who are theater performers, ballet and cultural dancers, cheerleaders, and athletes were selected in an urban college. Data obtained was analyzed utilizing descriptive statistics namely, frequency count, percentage, mean and standard deviation. Pearson correlation was used to measure the relationship of eating attitudes with self-esteem and perfectionism. Results showed that perfectionism is a significant predictor of eating disorder while self-esteem is not significant. Some respondents said they engage in binge eating, vomiting behaviors, and laxative and diet pills use to control their weight. Twelve percent of them mentioned they have been treated for eating disorders. Twenty four percent of the respondents admitted having thought and attempted suicide. This study implies that the respondents are a high risk group for anorexia and other eating disorders.

Keywords: Perfectionism, Anorexia, self-esteem

Introduction

When anorexia nervosa claimed the life of the popular singer Karen Carpenter in 1983, the “starving disease” made headlines in America and the rest of the world. Information on eating disorders has been taken more seriously since Karen’s death. Other celebrities and models through the years have admitted their own struggles with eating disorders.

Eating disorders are serious emotional and physical problems that can have life-threatening consequences. Eating disorders such as anorexia, bulimia, and binge eating include extreme emotions, attitudes, and behaviors surrounding weight and food issues. Anorexia nervosa is a self-imposed starvation in an obsessive effort to lose weight and become thin while bulimia is characterized by recurring binge eating usually followed by some method of purging such as vomiting, diuretic or laxative abuse or excessive exercise. Binge eating is defined as eating an amount of food that is definitely larger than most people would eat during a similar period of time.

Recent research evidence shows that the development of anorexia and bulimia come from media and peer influences, enmeshment and criticism from family, low self-esteem and body dissatisfaction (Herman & Polivy, 2002). Nowadays, fashion magazines, billboards and television advertise the thinnest women. Wafer thin models display designer clothes in sizes the majority of women can never wear. The distorted belief on the value of
thinness ushered the onset of extremes in diet and exercise. Eating disorders became prevalent as women struggle to break their ties with food and tie their self-esteem with a dress size.

Female adolescents are mostly influenced by this hype on thinness as they learn to use the mirror as an indispensable measure of their worth as human beings. As Hesse-Biber (1997) suggests, young women are influenced by the powerful message that only the beautiful and the thin are valued and loved. Achieving the thin body ideal thus becomes a preoccupation for many young people. However, according to Graber (2002), perfectionism and unhealthy eating habits can put female adolescent at risk of becoming anorexic later in life. Furthermore, numerous reports support the contention that low self-esteem is often present before the development of an eating disorder, and that low self-esteem is a significant risk factor for both bulimia and anorexia among young, school-age girls (Ghaderi, 2001; White, 2000).

As a college counselor, the researcher has come across thin clients who admitted being dissatisfied with their body size and that they follow strict diet and exercise regimen. The researcher also observed the prevalence of female students in the campus who seem to be underweight for their height. Since there has been no study done in the college to investigate eating disorder issues, the researcher embarked on a study that looked into the eating habits and attitudes of female college students who are involved in theater, dance and sports. The levels of their self-esteem and perfectionism in relation to their eating patterns were also explored. The study hopes to provide valuable information and insights to administrators, teachers and counselors of the college especially those who are directly in charge of the athletes, dancers and theater performers. This paper can hopefully assist them in identifying early symptoms of anorexia which may be present in the group of respondents as well as the rest of the college population.

Many studies have been written about eating disorders, media influence and unrealistic cultural demands on women to be thin. It seems that women’s response to the thin phenomenon is preoccupation with diet and exercise to achieve the standards society has set for them. This is reiterated in a research conducted by Barry, Grilo, & Masheb (2002) which states that women tend to have higher drive for thinness than men and they tend to place a greater value on weight and shape and in how they feel about themselves.

As Hesse-Biber (1997) noted, our cultural mirrors have undergone a massive transition since the 1950s. The illustrated pages of Cosmopolitan and Vogue reflect these changes over the past four decades. In the late 1950s the ideal woman’s body had soft curves and the tiny waistline was in. During the 1960s fashion moved away from the hourglass shape to a more stick-like figure and so the waistline disappeared. Today, a woman’s body is expected to be thin and firm through diet and exercise. Varied diet and exercise programs flood the internet which has become an integral part of women’s lives.
The perfect picture of today’s woman as dictated by socio-cultural norms compels women to conform at all cost. Berel and Irving (1998) cited previous studies where college women reported greater pressure to be thin coming from the media than from peers and family, thereby implicating the media as the most salient carrier of the thin beauty standard. They found that individuals who read magazines for purposes of self-evaluation and self-improvement were more likely to compare themselves to models that were superior in physical attractiveness. A related study of Harrison and Cantor (1997) assessed the impact of media use on eating disorders symptomatology. Their findings indicate that media which promoted or depicted thinness, significantly predicted women’s eating disorder symptomatology. These findings suggest that media may be most influential and harmful to women who use media as a tool for self-evaluation.

Another study done by Halmi, Sunday, Strober, Kaplan, Woodside, Fichter, Treasure, Wade, Bernettini and Kaye (2000) showed that perfectionism is a robust, discriminating characteristic of anorexia. Kaye (2000) further suggests that people with anorexia share traits that make them more susceptible to the disease. They tend to be perfectionist, anxious and obsessive. The kind of obsessiveness is focused on doing things right, being exact, having things symmetrical. These clusters of factors seem to be there in people before they develop anorexia.

Another area to consider is the presence of perfectionism in parent-child relationships. Parents’ perfectionist expectations according to Stein (1996), may limit the child’s development of autonomy, consequently creating an environment where the child is reliant on parental expectations rather than on individual needs and desires. As these children grow into adolescents, they may develop an eating disorder as a way of defining self and establishing a sense of control.

In another study, Ghaderi (2001) concluded that low self-esteem, along with other factors, not only puts women at greater risk for the development of an eating disorder but also serves to maintain an eating disorder. Furthermore, Martinez-Gonzales (2003) qualifies that low self-esteem that result from a single-parent home environment might be the onset of an eating disorder. Similar findings are confirmed by Crocker (2002). She concluded that college students who based their self-worth on external sources – including appearance, approval from others, and even their academic performance—reported more stress, anger, academic problems, relationship conflicts, inclination to drug and alcohol use, and eating disorders.

Studies indicate that specific groups in the college population seem to be more at risk for eating disorders. According to Steiner-Adair, Sjostrom, Franko, Pai, Tucker, Becker & Heizog (2002), athletes, such as dancers, gymnasts, runners and cheerleaders tend to be at higher risk for eating disorders. Many coaches and trainers encourage thinness to win. There is
also a higher risk of eating disorders in models and stage actresses who may experience social pressures to be thin. In a similar light, Kirk, Singh & Getz (2001) point out that the prevalence of eating disorders is significant among female athletes. Although both men and women do not meet the diagnostic criteria for an eating disorder as delineated in the DSM-IV-TR, there appears to be a large percentage of female athletes (Overdoff & Gill, 1994) and a growing number of males (Pope, Phillips, & Olivardia, 2000) with subclinical eating problems. According to Brown (2004), successful athletes often seek perfection, are goal oriented and driven to excel. They may also be independent, persistent, and able to tolerate pain. Unfortunately, these are the same personality traits seen in people who develop two clinical eating disorders - anorexia and bulimia.

This study focuses on two variables namely, perfectionism and self-esteem which may bring about the occurrence of eating disorders. The hypothesis that perfectionism and self-esteem are predictors of eating disorders in female college students involved in theater, dance and sports is tested.

Method

Participants

The participants of this study were 75 female college students who are involved in theater, dance and sports. Their ages range from 16 to 23 with a mean age of 18.83. Eighteen are theater performers, 25 are cheerleaders, ballet and cultural dancers and 32 are athletes. Fifty nine of them come from Metro Manila while 16 are from the province. Fifty-eight of them live with their parents and 27 stay in dorms, condominiums, apartments or with relatives.

Research Instruments

Eating Attitudes Test. The Eating Attitudes Test (EAT-26) was the screening instrument used in the 1998 National Eating Disorders Screening program. It was developed by David M. Garner & Paul E. Garfinkel (1979), David M. Garner, et al., (1982). The Eat-26 is probably the most widely used standardized measure of symptoms and concerns that characterize eating disorders. The test is scored by adding the scores for a total. For all items except #25, the responses Always, Usually and Often receive 3, 2, 1 values respectively while Sometimes, Rarely, and Never have 0 values. Item #25 is reverse-scored with the same values.
Rosenberg Self-Esteem Scale. The scale was originally developed by Dr. Morris Rosenberg (1965) to assess self-esteem among adolescents. It is a brief and unidimensional measure of global self-esteem. It consists of 10 statements related to overall feelings of self-worth or self-acceptance. The items are answered on a four-point scale ranging from strongly agree to strongly disagree. It can be completed in five minutes. The RSE is scored by a simple totaling of the individual 6-point items after reverse-scoring the negatively-worded items.

Perfectionism Test – Abridged. The Perfectionism Test measures the level of perfectionism in various areas of life, whether or not one has strong perfectionism tendencies and what affect that could have in life. The test combines Likert scale type questions and assessment of the most likely behavior in typical situations. It was developed by Jacobson, Jerabek and Tidman (2000). The test is suitable for adults and adolescents. A general score yields overall level of perfectionism.

Procedure

The dance program chairperson, artistic director, and the sports development head were contacted to get referrals for prospective respondents. A majority of the participants were then gathered in a classroom for the test administration. Some of them were asked to fill up the questionnaires while waiting for their training or rehearsals.

Pearson correlation was used to determine the relationship of self-esteem and perfectionism with eating attitudes. Descriptive statistics such as frequency, percentage, mean and standard deviation were also used in the data analysis.

Results

One objective of the study was to explore the eating habits and attitudes of the respondents. Eleven respondents have the cut-off score 20 and above in the EAT-26 test. Table 1 shows that 19 of the respondents (25.3%) answered they engage in binge eating while 9 of them (12 %) admitted they have been treated for an eating disorder. Thirteen respondents (17.3%) said they use diet pills or laxatives and 9 respondents (12%) disclosed they use vomiting to control their weight. It is not surprising to note that 18 or 24% of them have confirmed that they have thought or attempted suicide.

Table 1
Summary of Eating Behaviors
Taking the respondents by groups, as shown in Table 2, the theater performers ranked highest in eating attitudes and perfectionism variables, with 1.44 and 1.94 means respectively. They also got the lowest self-esteem mean (1.94). The dancers group had the highest mean (2.48) in the self-esteem variable while the athletes got the lowest means (1.16) in eating attitudes and (1.75) in perfectionism.

Table 2
Descriptive Statistics of Predictor Variables

<table>
<thead>
<tr>
<th>Factor</th>
<th>N</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eating attitudes</td>
<td>1</td>
<td>18</td>
<td>1.44</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>25</td>
<td>1.32</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>32</td>
<td>1.16</td>
</tr>
<tr>
<td>Self-esteem</td>
<td>1</td>
<td>18</td>
<td>1.94</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>25</td>
<td>2.48</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>32</td>
<td>2.16</td>
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<tr>
<td>Perfectionism</td>
<td>1</td>
<td>18</td>
<td>1.94</td>
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<tr>
<td></td>
<td>2</td>
<td>25</td>
<td>1.80</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>32</td>
<td>1.75</td>
</tr>
</tbody>
</table>

Meanwhile, the perfectionism factor yielded significant results (0.390**) with eating attitudes. Self-esteem on the other hand, is not significant (-0.16).

Discussion

The goal of the study was to explore the eating attitudes in relation to the perfectionism and self-esteem of the athletes, theater performers and dancers in an urban college. The researcher hopes to make recommendations to the offices concerned depending on the outcome of the study.

Athletes appeared to be somewhat more at risk for eating problems than non athletes. Dancers and elite athletes especially those in sports emphasizing thinness, were at risk (Smolak, Murnen, Ruble, 2000). Dancers and athletes are usually confronted with pressures to be thin either by standards imposed by coaches and trainers or by criticisms from peers.
The results of the study suggest that some of the respondents appear to have concerns with their eating patterns as evidenced by the high scores in the eating attitudes test. The percentage may be minimal but the levels of concern can still be alarming. The presence of binge and vomiting behaviors, diet pills and laxative use, as well as the incidence of suicide thoughts and attempts present a probable picture of eating disorder in some respondents. This is somewhat corroborated by the significant correlation of the perfectionism variable with eating attitudes. There is an implication that most of the respondents have perfectionist tendencies. It can be noted further that the theater group had the highest perfectionism mean. This may be due to the fact that they tend to maintain high standards in their physical appearance and stage performance output and they undergo rigorous rehearsals. The theater performers are more or less consistent in the three areas of concern. They ranked highest in the eating attitudes test and in perfectionism, but they have the lowest self-esteem mean. Such profile seems indicative of anorexia symptoms, as personality attributes such as perfectionism and low self-esteem are recognized as predisposing personality traits in anorexia (Hartley, 1998). The athletes group, surprisingly, seems not so inclined to perfectionism and on being preoccupied with weight concerns. The reason could be the athletes group consists mostly of basketball and volleyball players while only a few are swimmers and members of the fencing team. The ballet/cultural dancers and cheerleaders group has the highest mean in self-esteem. They seem to feel good about themselves since most of them come from Metro Manila and their dance and pep squad groups are reputed to be elite in the campus.

Conclusions and Recommendations

Based on the results, it can be concluded that perfectionism is a significant predictor of eating disorders. They may have distorted views on body size and eating behaviors which could have emanated from pressures and standards in their social milieu. The prevalence of behaviors such as vomiting and laxative use to control weight indicates a degree of adherence to the thin craze and to the mistaken beliefs about beauty and social acceptance. This makes them being a high risk group for anorexia and other eating disorders. The findings somehow project a grim picture of young people who may be potential victims of the deadliest psychological disorder.

The findings of the study can be utilized primarily by teachers, trainers, coaches, counselors and parents of the respondents. They can be enlightened with regard to being more prudent in giving comments and criticisms about weight concerns and performance output. Coaches, parents and trainers need to educate themselves on the health threats as well as the signs and symptoms for early identification of the starvation disease.
Intensive information dissemination on anorexia and bulimia and their fatal consequences can be done to educate them as well as the general student population in the campus. Meanwhile, the respondents of the study can be provided with activities that will enhance their identity formation, problem-solving ability, self-esteem, and peer support. The counselors can also provide cognitive-behavioral therapy to the theater performers and other respondents who seem to be potential anorexics and refer them to health professionals, if necessary. Support groups can also be organized to help them verbalize their fears, struggles and aspirations. Furthermore, the counseling center with the support of the school administration can implement programs that will encourage healthy eating habits, positive self-image, and peer support.

Meanwhile, a study focused on the incidence of eating disorders among the male counterpart of the respondents is recommended to investigate their eating attitudes. A follow-up study can also be done in the same set of respondents after a year to find out their progress or decline in the anorexia web. Other variables such as preoccupation with body image, insomnia, trigger events and co-morbid conditions can be considered.

References


**About the Author**

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Testing Effect for Visual-Symbolic Material: Enhancing the Learning of Filipino Children of Low Socio-Economic Status in the Public School System

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Abstract

Providing tests enhances the retention of learned material compared with further study. This relationship has been known as the testing effect. Studies have shown that the testing effect can also be applied to the transfer of learning, i.e. novel demonstrations of the learned material. The author tested this relationship with Filipino Elementary School children (n = 32) of low socio-economic status in an underprivileged school setting. In a within-subjects experimental design, the participants underwent two different study procedures on two sets of visual symbols, including a study-only and a test-study condition. After a one hour retention interval, they took retrieval and transfer final tests on both sets. A significant testing effect (p < .05) was found only on final tests requiring transfer but not on final tests only requiring retrieval. Even though participants in higher Elementary School grades performed better on both final tests, there was no interaction effect of grade level with the testing effect. The present study confirms that the testing effect also applies to the transfer of learning, and that the testing effect is even bigger for transfer than for simple retrieval. The study also suggests that the testing effect applies to children in all grade levels of Elementary School, to children of low socio-economic status in the Philippine public school system, and to visual-symbolic materials.

Keywords: testing effect, retrieval practice, retention, transfer, learning, visual-symbolic memory, education, street children, public school, Philippines

Testing effect

Studies have shown that material is better remembered when the study of the material included at least one test of the material, compared re-studying the material. This so-called testing-effect has been observed for a wide variety of materials, such as word lists (Carpenter & DeLosh, 2006; Shana, & Harold, 2007; Karpike, & Zaromb, 2010), text passages (Roediger & Karpicke, 2006b; Agarwal, Karpicke, Kang, Roediger, & McDermott, 2008; Richland, Kornell, & Kao, 2009), face-name pairings (Carpenter & DeLosh, 2005), multimedia materials (Johnson & Mayer, 2009), facts and concepts (Butler, 2010; Jacoby, Wahlheim, & Coane, 2010), visual-spatial materials (Carpenter & Pashler, 2007; Rohrer, Taylor & Sholar, 2010), foreign language vocabulary (Toppino & Cohen, 2009), and skills learning (Kromann, Jensen, & Ringsted, 2009).

The testing effect has also proven to be robust throughout different kinds of recall tests, such as free-recall tests (Roediger & Karpicke, 2006b), cued recall tests (Carpenter & DeLosh, 2006), multiple choice tests
(McDaniel, Anderson, Derbish, & Morisette, 2007; Odegard, & Koen, 2007), recognition memory and classification (Jacoby, et al., 2010), open and closed book tests (Agarwal, et al., 2008), group quizzes (Cranney, Mihyun, McKinnon, Morris, & Watts, 2009), and tests requiring transfer of learning (Butler, 2010; Rohrer et al., 2010).

Even if retrieval during the test was unsuccessful or occurred before the actual study situation, it still improved retention, as long as actual answers are given after the initial test. In fact, unsuccessful tests may enhance future learning by providing additional challenge to the learner (Richland, Kronell, & Kao, 2009).

Feedback on tests has been shown to facilitate the correction of errors and to improve retention (McDaniel, et al., 2007; Voydanoska, Cranney, & Newell, 2010). On the other hand, a testing effect was still evident with no corrective feedback or additional exposure to the material (Roediger & Kaprice, 2006b; Carpenter & DeLosh, 2005).

Metacognitive awareness of the benefits of a learning strategy involving tests was found to enhance memory retention (Jacoby, et al., 2010). On the other hand, students who re-studied material instead of taking tests showed increased confidence that they would remember the material, but they performed worse than those who took tests (Roediger & Kaprike, 2006a; Agarwal, et al., 2008). This finding shows that they were unaware of the benefits of testing.

Roediger and Kaprice (2006b) found an interaction between the retention interval and the testing effect, whereas for a retention interval of five minutes, further study improved recall; but for a retention interval of two days or one week, testing produced substantially greater retention. Toppino and Cohen (2009) found the same interaction, whereas recall for study was insignificantly better for a two and five minutes retention interval, but recall for testing was significantly better after a two days retention interval. These results suggest that testing improves long term retention while additional study may only be of advantage for very short retention intervals.

The strong benefits of the testing effect has led many researchers to advocate for the more frequent use of tests in the educational setting in all levels, not just to assess learning, but as a strategy to improve learning and enhance retention (e. g. Roediger & Kapricke, 2006a; Agarwal, et al., 2008; Johnson & Mayer, 2009; Rohrer, et al., 2010). Recent research has investigated the application of the testing effect with college students in the real classroom setting, and has demonstrated improved retention through the use of quizzes as a learning strategy (McDaniel, et al., 2007; Cranney, et al., 2009).
Theoretical Accounts of the Testing Effect

The transfer-appropriate processing hypothesis predicts that memory performance not only depends on the depth of processing, but also on the similarity of the processes involved in encoding and decoding (Morris, Bransford, & Franks, 1977). According to the transfer-appropriate processing theory, the testing effect can be explained by the similarity between the learning strategy and the manner of the final test. The inclusion of initial tests in the learning strategy is more effective because the initial test provides transfer-appropriate processing and increases the chance of final retrieval. For example in a study conducted by Johnson & Mayer (2009), participants performed better on a delayed retention test after a practice retention test than after a practice transfer test (a test requiring novel demonstration of learning); but the opposite pattern was true on a delayed transfer test. Also, a testing effect was found for both for the practice retention test group and the practice transfer test group versus the restudy groups. The results of this study support the explanation of the testing effect based on transfer-appropriate processing. Other studies however have not supported the conjuncture that the match of initial and final test format leads to better results on the final test. (e.g. Carpenter & DeLosh, 2006). In many testing effect studies however, initial and final test were identical (e.g. Kuo & Hirschmann, 1996; Carpenter & DeLosh, 2005; Roediger & Karpicke, 2006b).

The finding that the retention interval interacts with the testing effect (Roediger & Kaprike, 2006b; Toppino & Cohen, 2009), suggests that different processes are involved in studying and testing. An alternative explanation of the testing effect attributes the testing effect to the retrieval process that happens during testing (Glover & Krug, 1990). Roediger and Karpike (2006a) discussed how retrieval during an initial test might benefit retention. They suggest that retrieval might help to differentiate material well learned from material less well learned, and therefore help to apply encoding strategies to items that most need it. Even if no corrective feedback is provided (Roediger & Kaprike, 2006b; Carpenter & DeLosh, 2005) or if the retrieval during the test was unsuccessful (Richland, Kronell, & Kao, 2009), tests still enhance memory retention. Roediger and Kaprike (2006a) referred to this as the direct benefits of testing. In other words: the retrieval processes involved in testing alone and even without correction of errors enhance memory of the tested material.

The elaborative retrieval hypothesis explains this finding through “elaborative information related to the target response” that is activated during the retrieval process and thereby increases “the chances that activation of any of this information will facilitate later retrieval of the
target” (Carpenter, 2009). Carpenter and DeLosh (2006) investigated the elaborative retrieval hypothesis in contrast with transfer-appropriate processing. They used wordlists as study material and manipulated the format of initial and final test in a factorial design, using both initial and final tests that required recognition, cued recall and free recall. Retention was best for final tests when the initial test was a free recall, regardless of the type of the final test. The finding suggests, contrary to transfer-appropriate processing view, that the testing effect is not based on the similarity of the initial and final test, but on the quality of the retrieval processes involved in the initial test, predicting that performance on a final test is greater if the initial test required greater retrieval difficulty.

Carpenter (2009) in a follow-up study used cue-target word pairs that were strongly associated and cue-target word pairs that were weakly associated with both a cue-target recall test and a restudy condition. A final test requiring free recall of the targets showed that tested items were retained better than studied items, and targets recalled from weak cues were retained best over time. Strong cues produced quick and easy answers on an initial test as evidenced by the faster and more accurate recall on the same test, but weak cues needed longer processing and seemed to have produced more elaborative information on the target, leading to better recall over time.

Other studies have also shown that greater difficulty on an initial test produces better retention. For example, Kaprike and Zaromb (2010) found that intentional retrieval produced better retention than incidental retrieval. Also, learning procedures including production tests (short answer or essay) have been found to be better in improving retention than cognition multiple-choice tests (Mc Daniel, et al. 2007). These studies provide further evidence that indeed elaborative retrieval processes play an important role in the testing effect.

Studies on the Testing Effect with a Final Test Requiring Transfer

Rohrer et al. (2010) raised the important question if the testing effect diminishes if the final test requires transfer of learning. Transfer is understood as a novel demonstration of learning where material learned does not only need to be recalled in the exact same form, but has to be transformed into different forms and applied to new situations. Transfer is sometimes said to be the aim of learning. According to the transfer-appropriate hypothesis, transfer on a final test should reduce the size of the testing effect, since initial and final test are dissimilar. If the testing effect really diminishes in size when applied to the transfer of learning; that would mean that the testing effect does not really have much practical application in the educational setting. In other words: if a learning strategy that involves
testing only improves performance on exactly the same test than the initial test, then it could only be applied to settings were format and content of the final test are already known.

Only a few studies have investigated the testing effect on the transfer of learning. McDaniel, et al. (2007) conducted an experimental study with college students in the classroom setting. They used paired questions based on the reading assignments from an undergraduate textbook. The questions represented a forward and reverse association of the same fact (i.e. A => B vs. B => A). One of the paired questions appeared on the initial test, and the other on the final test. Initial tests enhanced learning compared to additional reading, and the testing effect was significant even with a final test requiring transfer.

Johnson and Mayer (2009), used a narrated animation about lighting that was either re-watched by the participants, or tested on a practice retention test or a practice transfer test. The participants that were tested performed better on a final test than those who re-watched the animation, and that held true also for final test questions requiring transfer.

Butler (2010) used different passages about various topics and administered repeated study and testing conditions on the material. The repeated testing conditions included the same questions, new inferential questions based on the same knowledge domain, and inferential questions based on different knowledge domains. Repeated testing produced better results both on retention and transfer final tests.

Rohrer, et al. (2010) used maps in two different learning procedures including a study-only condition and a study-test condition. Testing effects were highly significant on both retention and transfer final tests, where as the testing effect was even slightly bigger for transfer.

**Methodological Problems in Testing Effect Studies**

Carrier and Pashler (1992) pointed out methodological problems in testing effect studies. Using the same exposure time for studied and tested word pairs, they reported solid testing effects and proved that the testing effect is not confounded through further study opportunities provided during the corrective feedback of initial tests. Kuo and Hirshman (1996) listed three methodological problems that could confound the testing effect. First, low retrieval rates on the initial test may produce an underestimate of the testing effect. Second, presentation conditions of re-study and test might be different. Specifically, during test conditions, sometimes participants write down tested items and are able to see all the previously administered items. The testing effect might therefore be confounded through simultaneous viewing. Third, if a sequence of test and study conditions is being administered, previously
tested items might be re-studied, and the testing effect might be due to re-study rather than due to different processes involved in testing and studying. Kuo and Hirshman (1996) used three word lists that were administered in different sequences of study and test conditions. The same output conditions for test (T) and study (S) procedures were used, and the three word lists produced high retrieval rates on test conditions. A study-test sequence of STTTT produced better performance on a final retrieval test than a SSSSS condition, demonstrating that re-studying of previously tested material was not confounding the testing effect. The authors argue that the processes underlying test and study differ and they suggest that item-specific factors contribute to the testing effect.

The present research has adopted the methodology of Rohrer, et al. (2010), which addresses the three methodological problems discussed by Kuo and Hirshman (1996). Low retrieval rates on the initial test have been counteracted by providing immediate corrective feedback. The feedback was however so short that it provided very limited opportunity for further study. Output conditions for both study and test cycles were exactly the same, and simultaneous viewing of previous and present items was prevented because only sequential numbers were written down by the participants. The methodology made use of a re-study procedure of five cycles and a test procedure of five cycles, following a format of SSSSS and STTTT. Both test and study procedures had exactly the same total exposure time for each item.

Rationale for the Present Research

There are only a few studies available so far that investigate the testing effect on the transfer of learning, and all those studies have been done in the US context. Since there have been no studies reported in the Filipino context and with children from low socio-economic status deprived of educational opportunities, the author wanted to test if the testing effect also applies to children with limited academic stimulation in the Philippines.

The studies previously reported provide evidence that the testing effect does also apply to transfer, even though only Rohrer, et al. (2010) so far have provided results were the testing effect was greater on a transfer final test than on a retention final test. The author of the present study tested this conjecture by reduplicating the experiment reported by Rohrer, et al. (2010). Instead of using maps as the learning material, the author used visual symbols with an assigned meaning, making use of visual-symbolic and verbal memory in the assumption that the combination of different learning styles will benefit underprivileged children. Since the author is working among street children in Manila with an NGO providing residential care and community based interventions such as educational assistance and non-
formal education, it is of his personal interest to work towards improving the educational opportunities and learning strategies of underprivileged and academically delayed children.

The author tested the hypotheses that there is a significant testing effect on both a transfer and a standard final test with underprivileged Filipino children in the public education system for visual-symbolic memory learned with a test-study learning strategy compared to material learned with a study-only learning strategy. Furthermore, the author tested the hypothesis that the testing effect on transfer final test is greater than the testing effect on a standard final test, using the same visual-symbolic materials.

Method

Overview

The experiment investigated the testing-effect of visual-symbolic material both for a standard and a transfer final test with Filipino Elementary School children of low socio-economic status in the public education system. The students memorized visual symbols that represented nouns in the Philippine National Language (Tagalog). The so-called standard or retrieval final test required participants to perform the same test they had practiced during the learning session: assign the right noun to the corresponding symbol. On the transfer final test, they had to answer ten questions involving transfer of the learned symbol meanings.

Participants

Both learning and test sessions were completed by 32 Filipino Elementary School students of low socio-economic status who were enrolled in the public school system. The participants were 8-14 years old ($M = 10.6$, $SD = 1.7$) and enrolled in Grade 2-6 ($M = 3.7$, $SD = 1.4$). 17 were in lower elementary level (Grade 2-3) and 15 in higher elementary (Grade 4-6). Only 12 (37.5%) children were in the grade that corresponds with their age, while 20 (62.5%) were advanced in age. The mean years participants were advanced in age was 0.97 ($SD = 1.03$). 19 were female (59.4%) and 13 male (40.6%). All participants were clients of the Educational Assistance Program or the Residential Shelter of Onesimo Bulilit Foundation. They qualified for these programs due to their low socio-economic status. They had been living on the streets, under bridges or in make-shift shelters along the sidewalks, and were deprived of educational opportunities. The children in the Residential Shelter either came from abusive family situations and / or their
parents were in jail. The fact that 62.5% of the children were over age compared to their grade level shows that that schooling has been a low priority for their caregivers.

The public school which the participants attended has class sizes of 50-60 students, and the students go to class either on a morning schedule from 6am to 11:30am or on an afternoon schedule from 12pm to 5:30pm. Language of instruction is mostly Tagalog, but the nationwide exams have written instructions in English, except for the Filipino (Tagalog) subject. Children from underprivileged backgrounds are not exposed to English in their homes or communities, though English is a subject being taught. Students are mainly taught through rote learning and memorization. There is a limited emphasis on comprehension, critical thinking, and metacognition.

Materials

Two sets of 10 visual symbols each with an assigned meaning of a two-syllable noun in Filipino (Tagalog) were used for the learning and test procedures. The nouns were chosen from a reading book for Grade 1 that had been studied by all students. The nouns could be easily read with a Grade 2 reading level and they were familiar to all participants due to daily usage. Some of the nouns were objects of daily life, some food items, and some were animals. The symbols were taken from Wingdings and Wingdings2 fonts. Both sets consisted of a few symbols each that were similar in shape and design, in order to make memorization more challenging. The meanings were randomly assigned to the symbols. An additional sample set of 5 visual symbols was used during tutorials (See Figure 1).

Procedure

The 32 participants were assigned to four groups by matching them according to their grade level. Each group then underwent a tutorial procedure, followed by a test-study (TS) and a study only (SO) learning procedure on one set each. The materials were presented to each group on a 15-inch computer screen via timed power point presentation.

Both the order of the TS and SO procedures and the pairing of the procedures and set of symbols were counterbalanced so that each of the matched groups was randomly assigned to one of the four different schedules. Group 1 underwent first a TS procedure on set 1 followed by a SO procedure on set 2. Group 2 underwent first a SO procedure on set 1 followed by a TS procedure and set 2. Group 3 did TS first on set 2 and than SO on set 1, while Group 4 did SO on set 2 first followed by TS on set 1. The counterbalancing ruled out that the variable of two different sets used and the sequence of the
learning procedure confounded the testing effect. Group 1 and 3 underwent their learning procedure simultaneously in two separate rooms. After the learning procedure, both groups watched for one hour a part of the movie *Narnia*, which served as distraction before the final retrieval tests. While Group 1 and 3 watched the movie, Group 2 and 4 underwent their learning procedures. After their learning procedure, they also watched for one hour a part of the movie *Narnia*. After the one-hour retention interval, Group 1 and 3 took their final tests first, followed by the final tests Group 2 and 4 also after one hour of movie watching. Both transfer final tests were administered first, followed by both standard final tests, in order to rule out that recall during the supposedly easier standard final test would improve performance on the transfer final test, and therefore confounding the testing effect on the transfer final test. Half of the participants (group 1 and 3) were administered the final test for the set learned with the TS procedure first, in order to rule out order effects of the set studied first.

**Tutorial.** Before the learning procedure, each group first underwent a tutorial procedure with the sample set familiarizing them with both learning procedures and with a sample final test. They underwent an initial exposure cycle, where each of the five symbols together with its meaning was shown on the screen (black font on white background) for 6 seconds. A sequential number was also shown at the top of the screen (see figure 2). During the initial exposure cycle, the participants were asked to just watch and study the symbols with their meanings. Then the participants cycled through four learning cycles, two according to the SO procedure and two according to the TS procedure (see below). Once they finished the learning procedures, they underwent a sample transfer final test that consisted of three questions.

**SO Procedure.** The participants were given a worksheet that five tables with all the ten symbols listed and blank spaces behind them, one table for each learning cycle. They then underwent an initial exposure cycle which was the same than during tutorials. After initial exposure, the participants cycled through five learning cycles. Each symbol was now shown for 10 seconds together with its meaning. A sequential number was also shown at the top portion of power point slide. The participants were instructed to write the sequential number shown on the blank space behind the correct symbol on their worksheet. The sequence of the 5 cycles was varied systematically across cycles so that no two symbols appeared consecutively in more than one cycle. Total exposure time for each symbol therefore was 6 seconds initial exposure plus 50 seconds re-study, a total of 56 seconds.
**TS Procedure.** The TS procedure was basically the same as the SO Procedure. There was one initial exposure cycle followed by five learning cycles. The participants also used the same format of worksheet to write the sequential numbers. During the learning cycles, however, for the first 7 seconds only the meaning was shown without the symbol and the participants were instructed to write the sequential number shown on the blank space behind the correct symbol on their worksheet. Immediately afterwards, the correct symbol was faded in during 0.5 seconds, and was shown for 2.5 seconds, to provide immediate correction of the answer given. Total time spent on each symbol in each cycle was therefore 10 seconds, exactly the same than in the SO procedure.

**Standard final test.** The participants were provided with a list of the symbols and a numbered list of the meanings, and they had to assign the correct number to each of the 10 symbols. The standard final test therefore followed exactly the same format than the learning procedure, were assignment of the correct meaning to the symbol was required. The accuracy of the answers was calculated in percent.

**Transfer final test.** The participants were asked a total of 10 questions requiring transfer of learning, one for each symbol. The transfer questions were inherently more difficult, since they required the participants to either relate newly learned material to previous knowledge, or to recall and produce material through drawing or writing that was previously learned through assignment. Three questions were multiple choice questions, for example: *Bilugan ang hayop* (cycle the animal): ♦ ▼ ▼. Seven were production questions that required either recall of the meaning or recall of the symbol. Examples are:

*Iguhit ang symbolo ng* (draw the symbol of): bata ________.

*Isulat ang ibig sabihin ng* (write the meaning of): ➔ __________________.

The accuracy of the answers was calculated in percent.

**Analysis**

For the data analysis, *t*-tests were run for the two learning strategies (TS and SO) for both final tests (transfer and standard). Additionally, Cohen’s *d* was calculated for the testing effect of both final tests. *T*-tests were run to rule out order effects between the set studied first and set studied last. A 2x2 ANOVA was run to rule out that grade level (lower elementary vs. higher elementary) interacted with the testing effect on each final test.
Results

There was a mean difference between SO and TS learning strategy on both the standard final test ($M_{SO} = 57.8\%$, $M_{TS} = 64.1\%$) and the transfer final test ($M_{SO} = 54.1\%$, $M_{TS} = 60.0\%$). The testing effect however was only significant for the transfer final test, $t(31) = 2.07$, $p < .05$, but not for the standard final test. For both final tests, the effect size was small, $d = 0.21$ (transfer) and $d = 0.18$ (standard).

Order effects of the set first studied and the set last studied were insignificant for both transfer and standard final tests.

Even though there was a significant main effect for grade level (lower elementary vs. higher elementary) on both transfer final test, $F(1,30) = 5.30$, $p < .05$, and standard final test, $F(1,30) = 5.53$, $p < .05$, there was no significant interaction effect of grade level and learning procedure (SO vs. TS).

Discussion

A test-study learning condition only significantly improved the accuracy on a final test requiring transfer of the memorized visual-symbolic material, but not on a standard retrieval final test. The testing effect on the transfer final test was slightly bigger than the testing effect on the standard final test; however, both effect sizes were small. Since order effects were insignificant and there was no interaction of grade level with the testing effect, it can be concluded that the test-study learning condition improved performance on the transfer final test, but not on the standard final test. The testing effect was therefore greater on the transfer final test than on the standard final test.

The study of Rohrer et al. (2010), in contrast, reported significant testing effects for both final tests on both replications of the experiment on a significance level of $alpha < .01$, while testing effects for transfer final tests were greater ($d = .76$ and $d = .57$) than testing effects for standard final tests ($d = .64$ and $d = .54$). Nevertheless, the study confirms the finding the testing effect does not diminish for final tests requiring transfer, but is actually larger than on retrieval final tests.

Rohrer et al. (2010) showed that the testing effect can be applied to children in Elementary School. The present study suggests that the testing effect applies to children in all grade levels of Elementary School, to children of low socio-economic status in the Philippine public school system, and to visual-symbolic materials.

There is a significant effect for grade level on both final tests, showing that children in the higher grade level performed significantly better on both
final tests than children in the lower grade level. Further studies limiting the variance in the grade level may produce data with a smaller variance, therefore enhancing the testing effect.

Further factors might also have contributed to a smaller testing effect in the current study. In further studies, the test-study learning procedure should be improved. During the test-study condition, the instruction was given to the participants to answer on their worksheet while only the meaning was shown, and afterwards check their answer when the symbol appeared. Nevertheless, the examiner observed some of the participants waiting for the solution until they wrote their answer. It is possible that they didn’t really try to retrieve the right answer during the test phase, compromising the quality of the test-study condition. The participants may not have had the metacognitive awareness of the benefits of the test-study condition, which has been proven to enhance the testing effect. An improvement in the test-study condition could also be to alternate test and study cycles, without giving correct answers during test cycles, but providing feedback through re-study after testing. Also, providing further information to the participants about test-based learning strategies could improve their metacognitive awareness. Further studies may also consider including metacognitive measures (compare with Jacoby, et al., 2010).

Rohrer et al. (2010) used retention intervals of one day, while the present study used an interval of one hour. Previous studies have shown that the testing effect increases with increased retention interval. Future studies may either extend the retention interval or include groups with different intervals.

It might also be possible that the testing effect is greater for children in a private school setting who are used to enhanced methods of learning compared to children of low socio-economic status in the public school system. One factor might be that the public school system does not raise the awareness of the benefits of test-enhanced learning strategies, but mainly emphasizes learning based on repetition and memorization. Further research will be needed to test this hypothesis by administering similar experiments to children of different socio-economic statuses in public and in private schools.

The present study was able to demonstrate the benefits of test-enhanced learning strategies applied to the Philippine school setting. Such strategies remain underutilized, especially in the public school system. Educators should make regular use of tests as a learning strategy, and not just to assess learning. They should also work towards educating children on the benefits of tests, and how they can improve their learning by making use of tests and feedback.
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Appendix A

Set 1

| 🌼 | suka | vinegar |
| 👲 | pera | money   |
| 🖕 | aso  | dog     |
| 🔓 | lobo | balloon |
| →  | tabo | scoop   |

| ✱  | susi | key    |
| ✱  | lapis | pencil |
| ✱  | bata | child  |
| ✱  | baso | glass  |
| ✱  | ube  | yam    |

Set 2

| ♦  | kaha | box    |
| 😊 | sopas | soup   |
| ♈  | tela  | cloth  |
| ♈  | ahas | snake  |
| ✷  | poso | pump   |

| ♥  | sili | chilli |
| ♠  | pito | whistle|
| ♠  | kuko | nail   |
| ♠  | pusa | cat    |
| ★  | gatas | milk  |

Tutorial Set

| ➖  | bato | stone |
| ☞  | ibon | bird  |
| ☞  | mesa | table |
| ☞  | bahay | house |
| ☞  | tali | string |

Figure 1: The twenty visual symbols used for the experiment (set 1 and 2) and for the tutorial procedure (tutorial set) with their assigned meaning in Filipino (Tagalog) and the English translation.
Appendix B

Figure 2: Screen display during initial exposure and SO learning procedure.

A sequential number was shown on the top of the screen, and the symbol together with its meaning was shown below. Exposure lasted for 10 seconds.
Appendix C

Figure 3: Screen display during TS learning procedure. A sequential number was shown on the top of the screen, and the meaning was shown at the bottom. The correct symbol was faded in after 7 seconds. Total exposure lasted for 10 seconds.
Appendix D

Figure 4. Mean differences in percent on the transfer final test for study-only (SO) and test-study (TS) learning strategy.
Appendix E

Figure 5. Mean differences in percent on the standard final test for study-only (SO) and test-study (TS) learning strategy.
Comparison of Study Strategies with Interference in Reading a Passage

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Abstract
In 2010, Weinstein, McDermott, and Roediger compared study strategies in reading a passage to determine which among rereading, answering comprehension questions, or generating own questions was most useful for students to remember information. The present study replicated their comparison of study strategies in reading a passage, except for the generate questions condition. Instead, a control condition of studying the passage once was implemented. The author also introduced an additional distracter passage to be read in all conditions. This similar but easier passage served as the interference in recalling information from the previously read passage. The study aimed to investigate the robustness and magnitude of the testing effect by comparing study strategies with interference in reading a passage. After the experiment, the author subjected the participants’ performance and estimates of retained information to between-subjects analyses of variance with study strategy (study/reread/answer comprehension questions) as the independent variable.

Keywords: study strategies, interference in reading

Introduction

In a 2010 study by Weinstein, McDermott, and Roediger, they compared different study strategies in reading several passages to determine which among rereading, answering comprehension questions, or generating own questions was most useful for students to remember information from the passages. Results of their study showed that answering and generating questions were better strategies in facilitating recall of information from the passages than rereading, although the latter strategy was more time-consuming than the former. This finding demonstrated the phenomenon called the testing effect: it happens when students remember information better because they took a test about the material compared with not taking a test (Roediger & Karpicke, 2006b). However, it appears that people are yet to be convinced (or are misinformed) of the effectiveness of testing as majority of students still prefer rereading as a study strategy over taking a test (Karpicke, Butler, & Roediger, 2009). Even after students took both open- and closed-book tests, they still predicted that rereading would allow them to recall more information on a later test (Agarwal, Karpicke, Kang, Roediger, & McDermott, 2008).
Studies on the Testing Effect

Most studies about the testing effect compared learning through a form of repeated studying with repeated testing, only with some variations (Agarwal et al., 2008; Butler, 2010; Butler & Roediger, 2007; Carpenter, 2009; Carpenter & Pashler, 2007; Carpenter, Pashler, & Cepeda, 2009; Chan, McDermott, & Roediger, 2006; Cull, 2000; Johnson & Mayer, 2009; Kang, McDermott, & Roediger, 2007; McDaniel, Anderson, Derbish, & Morrise, 2007; Roediger & Karpicke, 2006a; Szpunar, McDermott, & Roediger, 2008; Weinstein et al., 2010; Wheeler, Ewers, & Buonanno, 2003). Consequently, these studies compared the amount of retained information of their participants after some time, usually after a period of five minutes, one day, two days, three days, and one week. The longest interval between exposure to a restudy or test condition and test of retained information was 16 weeks (Carpenter et al., 2009). Results of these studies consistently showed that repeated studying produced short-term benefits, whereas repeated testing produced long-term benefits on learning. Students who repeatedly studied recalled more information on the studied material when immediately tested (i.e. after five minutes) compared with students who repeatedly took tests. However, after an interval of days and weeks, students who repeatedly took tests retained more information on the studied material compared with students who repeatedly studied. These results showed that greater forgetting was evident in the repeated studying condition than in the repeated testing condition (Wheeler et al., 2003).

Studies on the testing effect also tried to establish the generalizability and ecological validity of this phenomenon in a wide variety of materials, including Graduate Record Exam items (Karpicke & Roediger, 2007), journal articles (Kang et al., 2007), maps (Carpenter & Pashler, 2007; Rohrer, Taylor, & Sholar, 2010), multimedia tools (i.e. videotaped lectures on art history and narrated animation) (Butler & Roediger, 2007; Johnson & Mayer, 2009), prose passages (Agarwal et al., 2008; Butler, 2010; Chan et al., 2006; McDaniel et al., 2007; Weinstein et al., 2010), Test of English as a Foreign Language preparation items (Roediger & Karpicke, 2006a), U.S. history facts (Carpenter et al, 2009), and word lists (Carpenter, 2009; Chan & McDermott, 2007; Cull, 2000; Szpunar et al., 2008; Toppino & Cohen, 2009; Wheeler et al., 2003). On the other hand, the tests commonly used to measure amount of retention in these studies were either through associated cue-target pairs or analogy, free-recall, recognition (i.e. multiple choice), or recall (i.e. identification). Findings from these studies showed that the testing effect is not limited to memory tests that require simple verbal responses, but also apply to complex tasks that require spatial manipulations and other nonverbal answers (Carpenter & Pashler, 2007). However, among the different test formats, recall tests best produced long-term retention and robust benefits of testing. Recall tests may even be the most effective format
in enhancing student learning in various educational situations (Butler & Roediger, 2007; Kang et al., 2007; McDaniel et al., 2007). Researchers of the testing effect largely attributed this finding to the greater effort students exert in recollecting information among recall tests, whereas in other test formats such as recognition tests, recollection may also depend on the familiarity of items (Butler & Roediger, 2007; Chan & McDermott, 2007).

Aside from the long term retention of information, some studies demonstrated the advantage of the testing effect on the transfer of learning in a variety of contexts (Butler, 2010; Rohrer et al., 2010; Weinstein et al., 2010). These researches tried to disprove the criticism that the testing effect can only be explained by the similarity between the learning strategy and manner of assessment, and thus only manifests in situations that require specific and similar responses. If this criticism was true, it violates the goal of education or vocational training which is the transfer of learning in life situations (Butler, 2010). However, these studies successfully established that the benefits of the testing effect are not compromised when transfer is required (Rohrer et al, 2010). This means that the testing effect is not dependent on the similarity between the initial and final tests (Carpenter, 2009).

The Present Study

Although there has been a considerable amount of studies on the testing effect in the past five years mostly by researchers from the Washington University in St. Louis (i.e. by Agarwal, Butler, Chan, Derbish, Kang, Karpicke, McDaniel, McDermott, Roediger, Szpunar, and Weinstein), no study has yet thoroughly investigated the possible influence or effect of interference in studying a passage. But this does not mean that it has not yet been thought of to affect test performance or recall of information. In fact, Roediger and Karpicke (2006b) recognized the possible influence of interference in learning. However, they did not believe that interference has the ability to compromise the benefits of the testing effect. In their words, “the positive effects of testing are often so large that in most circumstances they will overwhelm the relatively modest interference effects,” (p. 203).

A review of studies on interference and task-switching by Kiesel et al (2010) found that interference happens when there is a strong association between the stimuli and task sets. In short, performance is affected by stimuli from similar tasks because the tasks compete with one another. Another study on forgetting in working memory by Portrat, Barrouillet, and Camos (2008) showed that even when time is kept constant between two task conditions, a task that is more challenging and requires more processing time will be more difficult to recall compared with an easier task. These studies, therefore, suggest that interference could influence learning and test performance.
In the present study, the author replicated the comparison of study strategies in reading a passage by Weinstein et al. (2010), except for the generate questions condition. Instead, the author implemented a control condition of studying the passage once. In line with the studies on interference cited, it was also interesting to examine the strength of the testing effect when subjected to an interfering material—which is a similar but easier task—in studying a passage. Hence, the participants read a distracter passage in all study strategy conditions. The study’s introduction of a distracter passage served as the interference in recalling information from the previously read passage.

The following are some of the questions the present study aimed to answer: Will answering a comprehension test remain a better strategy (testing effect) in studying a passage even when presented with an interfering passage? Will rereading be a better study strategy than just studying the passage once? Will the similar interfering passage compete with the original passage during information recall at the final test?

The author hypothesized that answering a comprehension test would yield a difference compared to the study and reread passage conditions, and thus would demonstrate the testing effect. The author also hypothesized that this phenomenon would affect the amount of information retained among the three conditions even with interference. Thus the main aim of the study was to investigate the robustness and magnitude of the testing effect by comparing the different study strategies with interference in reading a passage.

Other than comparing study strategies in Weinstein et al.’s (2010) study, they also measured the perceived retained amount of information of the participants. Results of their study showed that students in the conditions of answer comprehension questions and generate own questions had higher estimates of retained information than students in the reread condition. In the present study, apart from the actual performance on the final tests, the estimates of retained information after doing the conditions were also measured. In addition to the abovementioned hypotheses, the author hypothesized that the estimates of retained information of the participants in the answer comprehension questions condition would be higher than the estimates of participants in the study once and reread conditions.

**Rationale of the replication.** The present study replicated Weinstein et al.’s (2010) comparison of study strategies in reading a passage. Their study served as the backbone of the present research because it is one of the most recent contributions to the growing literature about the testing effect. Moreover, their study has sensible implications to students’ study habits, educators’ teaching styles, and scholastic undertakings, in general. The author also chose to replicate Weinstein et al.’s study on passages instead of
other materials because of its practicality and convenience. Passages are part of the educational tradition that students must read and study at all levels of their education, from grade school to high school, to college, and sometimes, even extends until they land a job. The difference between the present study and original study was the exclusion of the generate questions condition. The author removed this condition because Weinstein et al. found that it had no difference with the answer comprehension questions condition, and that generating own questions consumed time the most. In spite of the present study’s no deliberate manipulation of interference, it also marked a slight deviation to the original study by Weinstein et al. The introduction of an interfering material aimed to investigate the robustness and magnitude of the testing effect, and how it could affect the participants’ final test performance and recall of information. Finally, the present replication study tried to determine the generalizability and benefits of the testing effect to Filipino students.

Relevance of the study. More than contributing to the body of knowledge about the testing effect, the author’s primary motivation behind the study was to encourage people to maximize testing in various forms of learning situations in the Philippines. By doing so, Filipino educators and students could take advantage of the phenomenon, and apply it in their scholastic undertakings. On the one hand, educators would be more interested to construct diagnostic tests with the goal of helping students retain information in the long-term memory. On the other hand, students would be more focused in studying lessons as they anticipate a diagnostic test with the goal of obtaining better marks in examinations and retaining more information over time.

Method

Participants

Eighty seven students from De La Salle-College of Saint Benilde, Manila, participated in the study for extra course credit. All students were freshmen taking a General Psychology class. Their age range was 15 to 20 years with a mean age of 16.98 years ($SD = 0.93$). Of the 87 participants, 42 were male, 44 were female, and one student with undeclared sex. Participants were composed of 80 Filipino, two Chinese, one Dutch, one Filipino-Japanese, and three undeclared nationality. The author grouped the participants according to their sections, and sampled by convenience.
Materials

The study used two passages adapting Wikipedia pages on the Taj Mahal and the Harry Potter book series. The passage on the Taj Mahal was the same passage used by the study of Weinstein et al (2010), but was reduced from 575 words down to approximately 432 words. An excerpt of the Taj Mahal passage is the following:

The Taj Mahal is a monument located in Agra, India, that was constructed in the twenty-two years between 1631-1653 by a workforce of twenty-two thousand. It is one of the finest examples of Mughal architectural style. The Emperor Shah Jahan used his vast wealth to commission the construction of the Taj Mahal as a mausoleum for his favorite wife, Mumtaz Mahal, who died during childbirth.

Meanwhile, the Harry Potter passage served as the distracter passage and had approximately 422 words. An excerpt of the Harry Potter passage is the following:

Harry Potter is a series of seven fantasy novels written by British author J. K. Rowling. The books chronicle the adventures of the adolescent wizard Harry Potter and his best friends Ron Weasley and Hermione Granger, all of whom are students at Hogwarts School of Witchcraft and Wizardry.

For the six-item final test, the same questions devised by Weinstein et al were used with two questions obtained from each paragraph. All questions could be answered by a single word or a short phrase.

In addition to the final test, participants took another six-item comprehension test about the Taj Mahal. Participants assigned in the answer comprehension questions took the comprehension test, while all participants from all conditions (study, reread, answer comprehension questions) took the final test after the experiment. The same comprehension test devised by Weinstein et al (2010) was used in the study. All questions could be answered by a single word or a short phrase. Some of the questions in the final test had the same questions found in the comprehension test but were worded differently.

The author obtained the participants’ age, sex, program, school, year level, nationality, assigned study strategy, preferred study strategy, and estimate of retained information after doing the assigned conditions using a questionnaire. Responses on the estimate of retention ranged from 0 (“not remember anything at all”) to 100 (“remember everything perfectly”).

Design

The study used a between-subjects design with study strategy (study, reread, answer comprehension questions) as the independent variable. The
use of a fishbowl technique randomly determined the order of conditions and assignment of conditions to the class sections.

**Procedure**

Students participated in the study voluntarily. They also completed the study as a section with the experimenter and their General Psychology professor present in the room during the session. The author told the participants that they would study a three-paragraph passage for five minutes for a later test. They were also told that they would do an assigned study strategy, answer a questionnaire, and read an additional material for another five minutes.

Depending on the assigned condition, participants read the passage about the Taj Mahal for five minutes; did the assigned study strategy (reread, answer comprehension questions) for five minutes except for the control condition; answered the questionnaire for five minutes; read the Harry Potter passage for another five minutes; and finally, answered the final test about the Taj Mahal for five minutes. The answer comprehension questions condition was an open-book test. After the experiment, the author debriefed all the participants about the purpose and nature of the study. Sessions took an average of 30 minutes.

**Results**

Presented below are the results of the comparison of study strategies as a function of estimates of retained information (how much information participants thought they would remember on the final test); and actual test performance (how many test questions were the participants able to answer correctly). These two dependent variables were subjected to between-subjects analyses of variance (ANOVAs), with study strategy (study/reread/answer comprehension questions) as the independent variable. Results were not significant at \( p > .05 \).

**Estimates of Retained Information**

Participants estimated the amount of information they would remember from the Taj Mahal passage on a scale of 0 ("not remember anything at all") to 100 ("remember everything perfectly") after doing the assigned study strategy (study/reread/answer comprehension questions). Participants were somehow convinced that they would do better on the final test (i.e. retained more information from the passage) after doing the assigned study strategy of answering comprehension questions \( (M_{estimates} = 68.52; \ SD = 14.06) \) than after reading the passage twice \( (M_{estimates} = 65.71; \ SD = 13.40) \) or studying the passage once \( (M_{estimates} = 66.78; \ SD = 13.51) \).
However, there was no significant difference in the estimates of retained information among the three study strategies, $F(2, 84) = 0.28, p > .05$.

![Study Strategies Comparison](image)

**Figure 1.** Mean estimates of retained information on a scale of 0 (“not remember anything at all”) to 100 (“remember everything perfectly”) among the three study strategies.

**Actual Performance**

Performance was measured in terms of the questions answered correctly in the six-item final test. Each answer was scored as either correct or incorrect, and no half-points were awarded. Questions could be answered by a single word or a short phrase. Points were not deducted for incorrect spellings or grammatically incorrect phrases. For questions that required short phrases, as long as the main idea was included in the answer, it was considered as correct. For example, in the question “In 1983, the Taj Mahal was declared as what site?”, the correct answer is “UNESCO World Heritage Site.” Participants would get a point for answers such as “UNESCO,” “Heritage Site,” “UNESCO Heritage Site,” “UNESCO Site,” and “World Heritage Site.”
In terms of actual performance, participants somehow performed better after reading the passage twice ($M_{\text{performance}} = 3.57; \ SD = 1.37$) than studying the passage once ($M_{\text{performance}} = 3.12; \ SD = 1.41$) and answering the comprehension questions ($M_{\text{performance}} = 3.08; \ SD = 1.53$). However, there was no significant difference in the actual performance of the participants among the three study strategies, $F(2, 84) = 1.03, \ p > .05$.

Discussion

The main aim of the study was to investigate the robustness and magnitude of the testing effect by comparing the different study strategies with interference in reading a passage. The author hypothesized that answering a comprehension test would yield a difference between the study and reread passage conditions, and thus would demonstrate the testing effect. The author also hypothesized that this phenomenon would affect the amount of information retained among the three conditions even with interference. However, the results yielded no significant difference among the study strategy conditions in terms of the participants’ actual performance. In addition, the author hypothesized that the estimates of retained information would reflect the participants’ actual performance. In this case, the results of the estimates of retained information indeed reflected
the actual performance of the participants, which led to a non-significant difference. Nevertheless, the results of the study were still in line with previous researches on the testing effect.

**Actual Performance**

The trend of the means in the actual performance was consistent with the findings of Roediger and Karpicke’s (2006a), Toppino and Cohen’s (2009), and Wheeler et al’s (2003) studies. In Roediger and Karpicke’s experiment 1, after five minutes, participants who studied the passage twice recalled more compared with those in the study once and initial test conditions. Similarly, in Wheeler et al’s experiment 1, after five minutes, participants in the repeated study condition recalled more than those in the repeated test condition. Most importantly, in Toppino and Cohen’s experiment 2, after five minutes, additional studying yielded a small but non-significant recall advantage over testing.

A probable explanation for the non-significant difference of actual performance among the study strategies was that testing effect had not yet manifested its magnitude. As what was demonstrated in various studies by advocates of the testing effect (i.e. by Agarwal, Butler, Chan, Derbish, Kang, Karpicke, McDaniel, McDermott, Roediger, Szpunar, and Weinstein), it was only after an interval of days and weeks that the initial testing, and the testing effect, had manifested its benefits on the long-term retention of information. Consequently, when retention intervals are extended in days or weeks forgetting becomes more evident in the study condition, whereas higher recall is observed in the test condition (Wheeler et al., 2003). Hence, in the present study, the immediate recall test after five minutes was not enough to demonstrate the testing effect.

Another likely explanation for the non-significant difference in the actual performance of the participants was the influence of interference (i.e. the passage about the Harry Potter book series) on the recall of information from the Taj Mahal passage. As Kiesel et al (2010) summarized in their review of studies on interference, any task is potentially an interfering material if its task sets have similar features in the original task that is supposed to be recalled or retrieved. In this case, the passage about the Harry Potter series almost contained the same amount of word number as the passage about the Taj Mahal. Moreover, the study by Portrat et al (2008) showed that a more difficult task would be harder to retrieve or recall after an interfering material. In this case, the subject matter of the passage about the Taj Mahal was essentially meant to be informative, whereas the passage about the Harry Potter book series could be entertaining. Thus, the Taj Mahal passage was more difficult to read than the Harry Potter passage.

Likewise, recall could be affected by the type of reading material a particular task entails. Linderholm and van den Brock in their 2002 study
tested the assumption that readers vary in the type of cognitive processes used when reading expository texts as part of studying compared with reading for entertainment. They found that “readers tailor the types of cognitive processes and strategies they use depending on the reason for reading, and the pattern of cognitive processes that these readers engage in during reading has an effect on the retention of information,” (p. 778).

**Estimates of Retained Information**

The trend of the means in the estimates of retained information followed that of the predictions made by the participants in Weinstein et al’s (2010) study. In their study, results showed that students in the conditions of answer comprehension questions and generate own questions had higher estimates of retained information than students in the reread condition. In this study, the same pattern of favoring the condition of taking a test (i.e. answer comprehension questions) was observed. This suggests that participants felt that they would remember more information on the final test after answering the comprehension questions. This also indicates that students are aware of the benefits of testing on information recall and long-term retention.

However, a likely reason for the non-significant difference of estimated retention among the study strategies was the overestimation of the perceived benefits of studying once and rereading in learning among students (Karpicke et al, 2009). Although students are aware of the benefits of testing, students tend to prefer rereading over other study strategies because it yields short-term benefits, and because students “base their predictions of future performance on what produces rapid short-term gains,” (Roediger & Karpicke, 2006a, p. 254). The same preference was found in the study. Of the 87 participants, 60 students indicated in their questionnaire of favoring the study strategy of rereading than any other study strategy

**Limitations and Recommendations**

The most obvious limitation of the present study was the lack of subsequent recall tests among the study strategies after the immediate five-minute recall test. Due to time constraints, the author was only able to test the classes in one session, thereby failing to establish and produce the benefits of the testing effect. As what was demonstrated in the literature of the testing effect, it usually takes days or weeks before the advantage of the testing effect over any other study strategy is manifested. Future researchers must make it a point to do subsequent recall intervals if the testing effect is the focus of the study.

Second, similar to Carpenter et al’s (2009) study limitations, the participants of the present study were not individually randomized to the
study strategy conditions, but instead were assigned to groups according to their class section. There is always that possibility that some other extraneous variables, like individual differences, might have had influenced the composition of the groups. Future researchers should take this into consideration; perhaps a randomized block design is preferable.

Third, the administration of the questionnaire before the introduction of the interference passage in all study strategy conditions might have confounded the experiment. Instead of just the purported five-minute interference caused by distracter passage, the addition of the five minute interval during the filling up of the questionnaire might have increased the possible influence or effect of the interference. Hence, instead of having a planned five-minute interference period, a ten-minute interference period could have actually taken effect. Administering the questionnaire before or after the experiment might be advisable in future researches.

Finally, the reduction from the original eight-item comprehension tests and final recall tests used in Weinstein et al’s (2010) study down to six-item tests might have made the tests too short. The reduction of the items might have influenced the allowable correct number of responses in the final recall test, thereby providing fewer chances for the participants to answer items correctly. Future researchers might consider retaining the original items and passages used by Weinstein et al in their study.

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The Effect of Interactive Media on Elementary School Childrens’ Story Memory

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Abstract
An experimental study examined the influence of interactive media on primary graders memory. A sample of 40 first graders from an Elementary School in the Philippines were randomly assigned to experience a computer-based story in 1 of 4 presentation modes (audio narration of the story; similar to radio; audiovisual presentation, similar to television; interactive viewing; and interactive observation). They were asked to listen, watch, interactively participate or observe during a storytelling activity and were asked later to answer a (a) narration-based questions; (b) visually-dependent questions; and (c) inference questions. The results showed that among students who had the storytelling activity, the ones under the condition of audio only remembered the story poorly, including the story facts and ability to make inferences. However, the effect of interactive media for this present study was identified to be non-contributing factor of facilitation of memory retrieval. Participants in the Audio-visual condition (M= 2.65, SD=.03) performed better than those in the Audio condition (M=2.02, SD=.15); t(9) = -3.720, p=.005. Likewise, participants in the Audio-visual condition (M= 2.65, SD=.03) performed better than those in the interactive (M= 2.19, SD=.11); t (9) = 3.743, p=.005. Lastly, Audio-visual participants performed better than those in the interactive observer (M= 2.04, SD=.11); t(9) =4.788, p=.001.

Keywords: interactivity, media, memory retrieval, comprehension, children

Introduction

Learning process is no longer confine with the traditional banking system of education, wherein pupils are seen as mere participants. Advancement in technology provides children the opportunity to explore and learn through different media. In particular, children’s access to computer is becoming increasingly important, both at home and in the school settings (Ricci, 2002). These media includes devices such as audio components, digital video cameras, television and computer-based programs and games). These gadgets aid both the pupils and the teachers in actively achieving the learning objectives in a classroom setting. The introduction of such media encourages active learning and participation of pupils in the learning process. Active learning approach gives people control over their own learning (Bell & Kozlowski, 2008). Simply stated, active learning let pupils make crucial learning decisions such as selecting, judging and appreciating learning
materials. In comparison with passive learning wherein pupils are mere expectators of what the teachers will present in the learning process.

Integrating computers into classroom is widely observed in schools and other educational institutions. There are different computer-based activities and software gear towards individual pleasure and leisure and for others; educational purposes. This is evident in the incorporation of computer-based literacy programs in word analysis, text comprehension, and fluency, alongside shared stories (Savage, Abrami, Hipps, & Deault, 2009). Computers inside the classroom are incrementally utilized in many schools such as the traditional, progressive and eclectic educational institutions. As the utilization of computers in the classroom increases since the start of the decade, its potential impact on children’s information remembering and comprehension is vastly unexplored.

The history of utilization of interactive media in education has unclear beginnings. But as early as 1960’s, there were already efforts of integrating this type of media in educational system. The following had their contributions: Frank Rosenblatt invented the “perceptron” in 1957 at the Cornell Aeronautical Laboratory in an attempt to understand human memory and cognition (Rosenblatt, 1958). A Physics professor at U.C. Berkely produced 163 high school physics lessons at Pittsburgh’s PBS station WQED that were broadcast into public schools in the area. Each 30 minute lesson was filmed to be distributed in public television stations. Equally important during the early 1960’s, Rath, Anderson and Brainerd reported a project using an IBM 650 to teach binary arithmetic in the University of Chicago which later did a series of courses delivered through the television. On the mid-1960’s, Douglas Engelbart, a professor from the Stanford Research Institute published his seminal paper entitled “Augmenting Human Intellect: a conceptual framework (Engelbart, 1960). In this paper, he proposed using computers to augment training. And by the way, Engelbart is also the inventor of the computer mouse and a prototype is constructed by Bill English. And in 1965, the IBM via its subsidiary Science Research Associates, Inc., introduces Coursewriter for the IBM 1500, an online interactive CAI system in the 1960’s. Standford University participated in the research and development that predated the IBM 1500s release (Silver et al, 1966). On the other parts of the globe, particularly in France, in one of the universities in Paris research in the field of computer assisted instruction began. Additionally, the Havering Computer Managed Learning System was developed in London, England (Broderick et. al, 1980). By 1980, it became popularly used by over 10,000 students and 100 teachers in applications that include mathematics, career guidance and industrial training. Another significant research study entitled “Examination of Obstacles to the Development of Computer Assisted Instruction” was created. Dr. Bernard Luskin, proponent of the mentioned study, directed a two year project funded
by the District of California, which aims to determine the potential needs of distance education in the future.

Not from the distant past, the K-12 learning management system named Sucessmaker is a software that emphasizes reading, spelling and numeracy (Zinn, 1980).

Nowadays, most computer-based programs allow active learning by allowing pupils to interact with the presented information. The interactivity involved in computer-based programs differentiates it greatly from other forms of media, such as audio components and television. This current study aims to investigate the possible impact of interactivity in pupils’ information remembering and comprehension.

Previous researches conducted to examine the impact of interactivity in information remembering and comprehension revealed that when video, sounds, music, and oral text are combined in the multimedia storybook, children at risk seem to profit more from such repeated story experiences as is indicated by the more complete retellings (Verhallen, Bus, & de Jong, 2006). Support for the said finding can be found using Neuman’s (2006) theory of synergy in multimedia wherein extra nonverbal features including video, music, and sounds seem to function additively when children are making inferences about a story’s structure and when abstracting the story line.

Another hypothesis is that zoom shots and other visual and auditory effects help focus attention on significant visual details (Calvert et al., 1982; Gibbons et al., 1986). Short stories, accompanied by a helpful video framework, supported 6-year-old children’s story recall and interpretation more than stories accompanied by mainly static images (Sharp et al., 1995). In examining third graders’ recall and inferential abilities, Neuman (1989) found that the students who watched a multimedia story recalled more story elements than students exposed to only one medium.

Theoretically it is possible that live-action video and other formal features of multimedia books may impede the development of narrative comprehension, because they divert attention from the story line and the language, resulting in lower story comprehension and language skills (Hayes, Chemelski, & Birnbaum, 1981). According to this hypothesis the richness of multimedia symbols in multimedia presentations may elicit most attention from young children at the expense of verbal information processing (Hayes & Birnbaum, 1980; Hayes et al., 1981).

Development such as the introduction of computer-based programs provides convenience without sacrificing the objectives of the learning. It serves as an additional tool in order to deliver lessons in accordance with the learning objectives being implemented in school. In particular, use of computer, both through games and programs by children in school settings is being utilized (Annetta, 2010; Lee, 2006). In our modern time, the use of computers necessitates faster and efficient way of transferring information thus resulting in a more effective medium of learning.
Latest Department of Education (DepED) estimates place computer penetration at one computer for every 25,000 elementary pupils (1:25,000), one for every 111 secondary school students (1:111), one for every 728 elementary teachers (1:728), and one for every three secondary school teachers (1:3) (“National Framework,” n.d.). The figures indicate the scarcity of computer in our current public educational system. The distribution of the available of computers depends on the support of their respective local government units and officials. Aside from this, computers also lack hardware peripherals (such as scanners, digital imaging devices and projectors) that would expand the functionality of computers, networking, and Internet access.

One big obstacle in the use of computer-based programs is the absence of specific curricular standards and guidelines for integrating computers into the subject areas is another important reason for the limited use of ICTs in classroom instruction (“National Framework,” n.d.). Budgetary considerations hinder the national government from implementing a nationwide use of ICTs to make learning more interactive, interdisciplinary, collaborative and authentic. Presently, DepED is seriously taking into consideration the advancements in information-communication technology in delivering quality education in the future. Specifically, introduction of digital texts and audio visual programs will be prioritized from other forms of presentation.

The current research aims to find out whether children’s learning is shaped by the type of media through which the information is presented. In the past, researchers compared audio with audio visual presentations. A number of studies have reported that visual presentation tends to dominate over other modalities in memory tasks (Posner, Nissen, & Klein, 1976). Support for this finding was found when children were assigned to watch a videotaped segment of Sesame Street followed by a comprehension test and a recognition test. The result revealed that the video material simply appears to be more salient and more memorable than the audio material.

**Method**

**Participants**

A convenient and purposive sample of 40 Grade I pupils participated in the study. There were 10 students randomly assigned to the four conditions. ($M_{age} = 81$ months, $SD_{age} = 5.51$ months). Parental permission was obtained for each child through consultation with parents before the experiment. All the participants came from Guyong Elementary School, a public elementary institution located in the District of Santa Maria, Division of Bulacan. The site was chosen because of its location proximity to one of the researchers. In addition, the researchers conducted the experiment in a rural location since
past studies were done in urbanized areas. No child in the study had seen The Scaredy Crow interactive book before.

**Location of the Study**

The study was conducted at Guyong Elementary School, a public elementary school belonging to the District of Santa Maria in the National Capital Region of the Philippines. As of School Year 2010-2011, the school has a total student population of 1,317. Barangay Guyong has a total land area of 361.91 hectares, whose sources of income include agricultural products, livestock and industries. Rapid growth of the population is observed due to migration of workers relocated from nearby barangays.

**Experimental Design**

Children were randomly assigned to one of four story presentation conditions: audio only (N= 10), audiovisual (N=10), interactive participant (N =10) and interactive observer (N =10).

**Procedure**

Children were randomly assigned in the four conditions of the experiment: audio, audio visual, interactive and interactive observer. They were accompanied by the experimenter to the conference room of the school. The experimenter obtained permission from the school principal to use the said school facility as venue of the experiment. Laptop was utilized to present the four conditions of the experiment. The device was set up on the end of the table. A section of the conference room was used as holding area of the participants. The pupils were told to observe silence before, during and after the experiment.

At the beginning of each conditions, the researcher asked the name and age of each participants.Before the start of the interview, children were asked for verbal consent to participate in the experiment. Likewise, general instructions intended for the condition were given at the start of each experimental condition. All the participants were not familiar with The Scaredy Crow. The researchers are sure that the children are not familiar with the story since the material presented is not widely published in storybooks. Since none of the student were familiar with the story, the experimenter asked the children to tell what they thought the story might convey. Follow up questions regarding possible characters, locations and plot of the story was given before the actual experiment. The researcher asked the children to listen carefully to the story as a follow up interview would be given after the presentation.
Participants in the audio only condition were seated in front of the laptop. Headphones were assigned to them to avoid distractions from the outside environment. The participants listened carefully to the audio narration of the story. Laptop monitor was turn off so that the participant can concentrate on the assigned audio material. Children assigned in the audio visual condition also wore headphones but this time they were asked to watched the images displayed in the laptop monitor. *The Scaredy Crow* was played in the laptop as if the participants were just watching a television program. These conditions lasted around 12 minutes.

Children in the interactive condition were seated in front of the laptop. Children were encouraged to use the mouse while playing games from the laptop. This will ensure that the participants were at ease in using the mouse. The children then watched the story and were asked to click the next button displayed in every page of the electronic story book once they are ready to view the next part of the story. Meanwhile, the interactive observer participants were assigned in a separate portion of the experiment room to view the interaction of the participants assigned in the interactive condition. The interactive observer participants were not able to control the interaction. These sessions lasted for 15 to 20 minutes.

After the sessions, children were asked to respond to 20 specific questions about the story. The set of questions included 13 fact questions and 7 inference questions. Questions like where did the story take place? and what color were the birds? are example of narration-based fact questions. On the other hand, questions like why did Spike get scared? and what happened when the wind stop are examples of inference questions. The specific questions are included in the Appendix.

The experiment concluded by asking the child to name a favorite book, computer program and television show. Vague answers were clarified to specifically classify whether the information given was intended as a show, book or computer program. The said procedure was done since some children’s stories had a book, television show and computer-based program versions. Only the first answers to the specific categories were considered in cases that the participants mentioned related or similar information. The said task aims to ensure that the child will finish the experiment with a positive feelings.

**Results**

Children’s total correct-response scores were collated and analyzed. The means and standard deviation were computed. The scores in response to the specific memory questions (scores ranged from 0·60).
Table 1
Mean Number of Four Story Presentation Conditions

<table>
<thead>
<tr>
<th>Condition</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Audio</td>
<td>2.01</td>
<td>.48</td>
</tr>
<tr>
<td>Audio-visual</td>
<td>2.64</td>
<td>.09</td>
</tr>
<tr>
<td>Interactive P</td>
<td>2.18</td>
<td>.33</td>
</tr>
<tr>
<td>Interactive O</td>
<td>2.04</td>
<td>.33</td>
</tr>
</tbody>
</table>

A t-test for significant differences between groups was used for the four conditions namely: audio, audio-visual, interactive and interactive observer. Participants in the Audio-visual condition (M = 2.65, SD = .03) performed better than those in the Audio condition (M = 2.02, SD = .15); t(9) = -3.720, p = .005. Likewise, participants in the Audio-visual condition (M = 2.65, SD = .03) performed better than those in the interactive (M = 2.19, SD = .11); t(9) = 3.743, p = .005. Lastly, Audio-visual participants performed better than those in the interactive observer (M = 2.04, SD = .11); t(9) = 4.788, p = .001.

A second media condition by gender ANOVA (two-way ANOVA) was conducted on children’s summed correct questions that could answer narration facts questions. There was a main effect of media condition F(3,32) = 3.86, p < .02. Participants in the audio-only (M = 13.30, SD = 2.71) scored lower than the rest of the participant in the audio-visual (M = 17.90, SD = 2.33), interactive participant (M = 14.40, SD = 3.66) and interactive observer (M = 12.80, SD = 3.75) conditions.

Table 2
Mean Number of Correct Responses to Narrated Fact and Inference Questions

<table>
<thead>
<tr>
<th>Condition</th>
<th>Narrated fact questions</th>
<th>Inference questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Audio</td>
<td>13.30 (2.71)</td>
<td>13.30 (5.12)</td>
</tr>
<tr>
<td>Audio-visual</td>
<td>17.90 (2.33)</td>
<td>19.40 (1.57)</td>
</tr>
<tr>
<td>Interactive P</td>
<td>14.40 (3.65)</td>
<td>14.50 (1.75)</td>
</tr>
<tr>
<td>Interactive O</td>
<td>12.80 (3.63)</td>
<td>15.60 (3.77)</td>
</tr>
</tbody>
</table>

Scores ranged from 0-21 for each question type (narrated fact and inference). These scores were analyzed in a gender (boy and girl), media condition (audio only, audio-visual, interactive participant, interactive observer) using two-way ANOVA, the main effect was on media condition F(6,62) = 2.55, p < .03.

Participants in the audio only (Facts: M = 13.30, SD = 2.71 Inference: M = 13.30 SD = 5.12) scored lower (FACTS and INFERENCE) among other conditions such as the audio-visual (Facts: M = 17.90, SD = 2.33 Inference: M = 19.40, SD = 1.57), interactive participant (Facts: M = 14.40, SD = 3.65 Inference: M = 14.50, SD = 1.75) and interactive observer (Facts: M = 12.80, SD = 3.63 Inference: M = 15.60, SD = 3.77).
There are 40 responses for television shows, 37 responses for favorite books, 13 for radio programs and 2 for computer programs. Based on the results, it can be said that most participants were more exposed in TV shows followed by books, radio and computer. This may be due to the fact that participants can access television readily as compared to the other materials.

The results suggest that Filipino is the most favorite book (45.95%) followed by Matapat (24.32%) and English (13.51%). All the books mentioned were textbooks that the participants were using in their classrooms. On the other hand, Ben 10 emerged as the most favorite television shows of the participants (35%) followed by Dora (20%), SpongeBob Square pants (10%) and Bantatay (10%). All except Bantatay are cartoon shows considered as the participants’ favorite television shows. It can be noted that the television shows considered by the participants are all within the range of television programs classified as fit for children viewing.

**Discussion**

The current study replicated earlier findings that audio only children participants remembered a story poorly, including the story facts and ability to make inferences. There is a need to replicate similar studies in our Philippine setting. There are instances that the results and findings conducted abroad may not yield similar result when compared with the conditions present in our current settings. The researchers felt that it will be of best interest if the research be replicated using participants from our country. The study supported the hypothesis that visual stimuli tend to
dominate over other modalities in both perceptual and memory tasks (Posner, Nissen, & Klein, 1976). In addition, video comprehension was significantly higher in the A/V match condition than in either the A/V mismatch or video-only conditions, which did not differ from each other (Pezdek, & Stevens, 1984). The results clearly indicates that children tend to remember and comprehend visual or audio visual materials rather than audio materials.

Contrary to the expectations, interactive observer participants performed as well as the other participants assigned in other conditions. This may be linked to the personal motivation of the child in any given condition. It is probable that if the child is not properly motivated, the ability to remember facts in a story may not be enhanced. Motivation factor is important to investigate in future research. In fact, children in the present study were observed to be highly motivated with the task involved in the current study.

The effect of interactive media seems not evident in the experiment conducted. Instead of facilitating memory retrieval, it hindered the participant to retrieve story facts and in making inferences. The interactive book format offers many potential detours and distractions away from the main story than other forms of media (Ricci, & Beal, 2002). Since interactive condition requires longer time with the material, it is expected that it will yielded higher memory retrieval. Contrary to expectations, longer time allotted with material did not lead to better memory of the story.

It was apparent in the study that participants in the study had higher exposure to television based media. This may provide evidence for the significant higher memory retrieval in audio visual condition than the other three conditions. The similarity between television programs and the audio visual presentation of The Scaredy Crow facilitated better memory of the story among the participants in audio visual condition.

The results of the study may be totally different with a more difficult and elaborated story or with other types of interactive media, let’s say computer games. Future researchers may study possible effect of story type, story difficulty and motivation of students. Future researchers might also be interested in possible effect of other socio economic status variables such as age, grade level and location.

The effect of interactivity is similar with audio visual presentation in terms of memory retrieval. This finding should be noted by the different children’s program being produced in the country. Producers of these shows must utilized interactivity to harness the memory retrieval of their children audience. Shows like Batibot and Art angel are currently employing interactivity by asking their audience to respond to questions related to the show’s theme and story.

The use of interactivity using computer-based programs could play a vital role at each stage in the process of information comprehension and
remembering. In addition to the competency of the teacher, technological instruments specifically computer-based programs can be utilized to convey story content and ensure that the required competencies at a given grade level are achieved by all pupils. In order to facilitate the introduction of computer-based programs in schools, administrators and teachers need to be oriented to what extent they will utilize such medium. A workshop must be convened in order to address the specific guidelines and processes needed to be accomplished before the formal integration of computer-based programs in the learning process. Likewise, resource speakers may be invited in workshops to explain the possible advantages and disadvantages of the said learning media. This kind of activities prior to the implementation may prove worthwhile since all stakeholders are well informed and part of the decision making.

If stakeholders decided to implement a computer-based learning may it be in specific or all the subjects, the computer-based programs to be used must be compatible with the learning objectives of a specific lesson per subject. For many lesson objectives, computer-based programs could be the ideal medium for initial explanation. But in succeeding class sessions, computer-based programs can be supplemented by other audio visual or learning methods and strategies. Well-designed computer-based programs can present compelling images, graphics, skits, demonstrations that will reinforce the learning process. Such application of learning media can actively motivate pupils to exert additional effort in order to achieve expected learning goals.

Teaching using different learning media must be done cautiously to avoid diverting the attention away from the learning objectives. The use of audio-visual devices greatly depend not only to its content but also on how the teacher uses the media to make the learning process understandable, memorable, and motivating.

The task of a teacher does not end with the presentation of a computer-based program. A careful review of key ideas and a series of questions to pupils are necessary to facilitate learning. Innovations such as showing questions pre-loaded on the computer can catch the attention of pupils rather than simply calling pupils randomly. Based on the answers of the pupils, the teacher easily detects whether there is a need to reteach a difficult idea or to skip forward if the content appears too basic.

Innovation such as the use of computer-based learning materials provides an alternative from the traditional and passive learning process. Its application will depend on the content of each lesson and to the expected learning competencies of pupils under a specified grade level. Furthermore, its integration can be done on selected topics and lessons or to the whole subject. The length of the lessons using computer-based materials also may be quite different, depending on whether the content lends itself to many short lessons or few lengthy lessons.
Lastly, there are unlimited ways by which a teacher can integrate computer-based programs and other technology to meet the desired learning objectives and to meet the competencies expected from pupils. However, the point is that to achieve information comprehension and retrieval in the learning process, one must not solely rely on the possible effect of interactivity. The success of any learning process appears to be best achieved using an integrated collaboration between the teacher, learning media and the unlimited ways and methods a teacher may utilize to teach a lesson.

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