THE IMPACT OF COGNITIVE AND METACOGNITIVE LEARNING STRATEGIES IN DESKTOP TEACHING

Dr. Romiro G. Bautista

Natural Sciences and Mathematics Department

AMA International University – Bahrain

E-mail: bautista.romer@yahoo.com

Abstract

This study was designed to examine the learning impact of cognitive and metacognitive learning strategies when used in desktop teaching. Controlled by their learning abilities in Communication Arts English, the students' mastery of concepts, as bases for the development of a central schema towards the development of a working definition and explanations, was evaluated using their cognitive and metacognitive learning strategies in desktop teaching. Twenty-eight (28) students enrolled in Methods of Research were the respondents of the study. A questionnaire was adopted in determining their cognitive and metacognitive learning strategies while their GPA in Communication Arts English was used in determining their learning abilities. Using Pearson-r correlation, a highly significant positive relationship was found between their learning abilities and their cognitive and metacognitive learning strategies; a significant positive relationship between their cognitive and metacognitive learning strategies and their success in desktop teaching; and a significant positive relationship between their performance in formative and summative evaluations and their cognitive and metacognitive learning strategies and success in desktop teaching were also found.

Keywords: Desktop Teaching, Cognitive and Metacognitive Strategies, Learning Outcomes, Learning Abilities, Academic Performance

1. Introduction

Institutions of higher learning undergo great transformation as the transition of the learning environment is observed towards the realization of digital years in response to the World Declaration on Higher Education for the Twenty-first Century (1998). This is a call to a great diversification in Higher Education through innovative educational approaches and one of these strategies is the efficacy of desktop teaching using the cognitive and metacognitive strategies of student-learners. Desktop teaching is a strategy that provides the student-learners the opportunities to take the lead in mastering learning outcomes the way they wanted it to experience. Mastering concepts are the bases for the development of a central schema towards the establishment of a working definition and explanation to various learning topic. This creates an active students' participation in both group and individual exploration creating a sustained community of inquiry at their choice and pace. Aside from an active learning strategy, desktop teaching is also a review activity where the student-learners take an active role in their learning experiences in a resembled classroom-fair environment (Rubenecia, 2012). It involves the students by assigning individual topics which they will develop and later share to the entire class. This fully engages the student-learners to the learning environment by applying varied cognitive and metacognitive learning strategies. Draper (1997) in Rubenecia (2012) emphasized that desktop teaching helps students by engaging themselves in discussing and learning specific topic as they become responsible to their learning and success in mastering learning outcomes.

Hobbs (2009) mentioned that desktop teaching strategy is best used for vocabulary acquisition towards concept formation and development. He believed that this strategy works well in enhancing the comprehension ability of the student-learners when used as a pre-reading or post-reading strategy. This strategy provides the students the opportunity to do etymological and linguistic research and share their findings with their classmates in a relaxed learning environment. He further concluded that the desktop teacher and listener benefit from the strategy as it allows them to analyze and breakdown words which are familiar to their experiences. Hence, it becomes more effective when employed with the students' cognitive and metacognitive learning strategies.

The Cognitive Processes in Multimedia Learning

Student-learners are engaged in three important cognitive processes – selecting, organizing and integrating (Mayer and Moreno, 1998 & 2001). At first, the student-learners select incoming verbal information to yield a text base and are applied to incoming visual information to yield an image base. These text based and image based information are organized to create a verbally-based model of the to-be explained system and is applied to the image base to create a visually-based model of the to-be-explained system. As a final point, integration occurs when the learner builds connections between corresponding events (or states or parts) in the verbally-based model and the visually-based model (Ellis, 2009).

Metacognitive Theory of Learning

Flavell (1971) postulated that metacognition consisted of both monitoring and regulation aspects that can be regarded to the learner's ability to manage the input, storage, search and retrieval of the contents of his own memory. He further said that metacognition leads to selection, evaluation, revision or deletion of cognitive tasks, goals, and strategies. It helps the individual make meaning and discovers behavioral implications to one's metacognitive experiences. The theory was composed of four classes. This includes (a) metacognitive knowledge, (b) metacognitive experiences, (c) tasks and goals, and (d) strategies or actions.

Metacognitive Knowledge is regarded as a self-knowledge and belief about the factors that affect the learner's cognitive activities as it facilitates or impedes his learning performances to various conditions of learning. Cognitive and metacognitive knowledge are regarded as mutually dependent and interrelated to each other as they are related to one's interests, abilities and goals (Cornford, 2000). This includes the (a) person variables, (b) tasks variables, and (3) strategy variables. These activities are geared towards an individual's knowledge and beliefs as thinkers or learners and to his beliefs about other learner's thinking processes. Weinstein and Meyer (1991) in Cornford (2000) stated that *'A cognitive learning strategy is a plan for orchestrating cognitive resources, such as attention and long-term memory to help reach a learning goal'.* This calls for skill, will, and self-regulation (Weinstein and Meyer (1994) in Cornford (2000).

Metacognitive Experiences are regarded as a "stream of consciousness" as the learner recalls and integrates his information, memories, or earlier experiences in the process of solving a current-moment cognitive problem. This encompasses affective responses to various learning tasks and other activities. It includes the learner's successes or failures, satisfaction or frustrations, among others. These overlap the nature of his metacognitive knowledge and experiences in pursuing various learning tasks. It can be said that becoming aware of one's inconsistencies, paradigm differences, and counterexamples are likely to generate strong affective responses (Cornford, 2000).

Metacognitive Goals and Tasks are the desired aims or results of any cognitive scheme. These include comprehension, committing facts to memory, or producing something, to any mental activity – both written and oral, or of simply improving one's knowledge about a topic or a problem. The achievement of these goals and objectives is expected to draw a great impact to the learner's metacognitive knowledge and metacognitive experience. These schemes are believed to precede learning (Weinstein and Meyer, 1994).

Metacognitive Strategies are the learner's ordered processes to ensure the attainment of his cognitive goal and objectives towards any learning activity. These are believed to oversee his learning pace and processes in planning and monitoring his cognitive activities. These make the learner compare his own cognitive outcomes to internal and external standards towards his goals (both cognitive and metacognitive domains). This is regarded as the look-back portion of the theory as it monitors the efficacy of the strategies done in the entire process through self-assessment and evaluation.

In Anderson's model (2002) cited in Coskun (2010), metacognitive strategy training is divided into five primary components: (1) preparing and planning, (2) deciding when to use particular strategies, (3) monitoring strategy use, (4) learning how to orchestrate various strategies, and (5) evaluating strategy use. In the *preparing and planning* component, students are prepared in relation to their learning goal and start thinking about what their goals are and how they will go about accomplishing them. In the process of *deciding* when to use *particular strategies*, learners think and make conscious decisions about the learning process and choose the best and most appropriate strategy in a given situation. In the *monitoring strategy use* component, they need to ask themselves periodically whether or not they are still using those strategies as intended. While *learning how to* orchestrate *various strategies*; students coordinate, organize, and make associations among the various strategies available. In the last component, *evaluating strategy use*, students attempt to evaluate whether what they are doing is effective by means of self-questioning, debriefing discussions after strategies practice and checklists of strategies used can be used to allow the student to reflect through the cycle of learning. At this stage, all the previous stages are evaluated. Cognitive and metacognitive strategies as used in this study are limited to rehearsal, elaboration, organization, critical thinking and self-regulation (Pintrich et al., 1991).

Rehearsal Phase includes simple tasks used in learning to activate bits of information that serves as the students' central schema, e.g., items familiarization like enumeration, recitation, memorization of key words and context clues, and listing. These strategies are assumed to switch the encoding processes but do not construct internal connections in integrating the information with their prior knowledge and experiences.

Elaboration Phase includes strategies that will lead learners to store information into long-term memory building as it constructs internal connections in integrating the information with their prior knowledge and experiences, e.g. summarizing, paraphrasing, creating analogies, and note-taking.

Organization Phase is characterized as a dynamic endeavor that involves the learners to a particular learning task resulting to better performance. This includes organizing bits of information like concept-mapping, diagramming, clustering and outlining. It further employs charts and table to further organize the presentation of thoughts for a more vivid analysis.

Critical Thinking Phase is the development of skeptic evaluations towards the attainment of higher order of thinking in leveraging knowledge and understanding. This includes the ability of the learners to integrate their past

experiences to their current situations in order to solve the problem, draw conclusion and make recommendations vis-à-vis with critical judgment.

Self-Regulation Phase is referred to the ability of the students to practice goal setting and do task analysis relative to their self-control and self-regulating capacity (planning). This further includes self-testing and questioning (monitoring), checking and correcting learning behaviors (regulating) in improving their learning performance (Stolp and Zabrucky, 2009).

2. Objectives of the Study

This study was designed to discern the learning impact of cognitive and metacognitive strategies learning in desktop teaching in the development of select topics of the course materials in Methods of Research.

Specifically, it sought to find explanations of the following:

2.1 What are the cognitive and metacognitive strategies used by the students in desktop teaching?

2.2 Are the learning abilities of the students in Communication Arts English control their cognitive and metacognitive strategies in desktop teaching?

2.3 What is the learning impact of the students' cognitive and metacognitive strategies learning and their success in participating desktop teaching?

2.4 What is the impact of the students' cognitive and metacognitive strategies in desktop teaching to their success on achieving the course learning goals and objectives?

3. Methodology

The Descriptive-Correlation Research Design was used in this study. The result provided bases for the causal relationship of the independent variables to the dependent variables. The impact of the desktop teaching to the academic achievement of the students in Methods of Research was also elucidated when grouped according to their learning abilities in English. The final grades of the students in Communication Arts (English) were the basis in determining their learning abilities. Conducted in a constructive learning environment, concepts of metacognition were incorporated in the development of select topics in Methods of Research using desktop teaching. The respondents of this study were the two sections of twenty eight (28) students enrolled in Methods of Research, first semester, AY 2008, of the Cagayan Valley Computer and Information Technology College, Inc., Santiago City, Isabela, Philippines. Data for this study were gathered through examination. Data were tabulated for analysis and interpretation. Analysis of transcripts, direct observation and rubric assessment in portfolio assessment were also employed aside from the customary paper-pencil test strategy of generating data. This study made use of formative and summative teacher-made tests conducted during the Midterm Period. Using a two-way table of specification, the manuscripts were self-checked by the author for internal and face validity. It was further checked and evaluated by the test-committee of the college to ensure its validity. Suggestions were incorporated in the final manuscript. Also, a questionnaire developed by Pintrich, Smith, Garcia and McKeachie (1991) was adopted in determining the cognitive and metacognitive strategies used by the students in learning. This study made use of frequency counts, mean, percentage and Pearson-r in treating the data gathered. It made use of SPSS in processing the data gathered for this study.

Results and Discussion
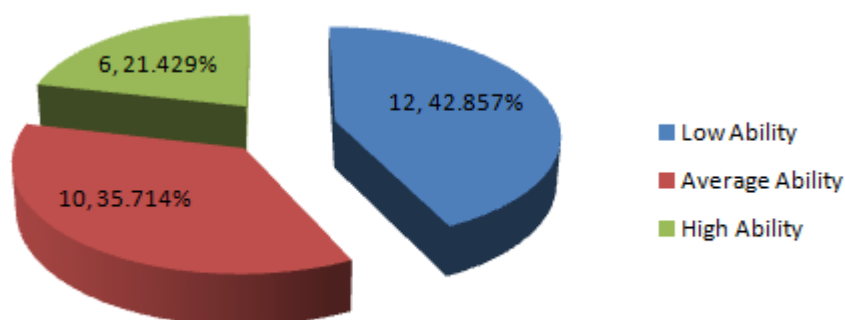
Figure 1. Learning Abilities of the Student-respondents in English

Presented in figure 1 are the learning abilities of the student-respondents in English in the development of select topics of the course in Methods of Research through desktop teaching. It shows that 12 or 42.857 % belong to the low ability group, 10 or 35.714 % belong to the average ability group and 6 or 21.429 % to the high ability group. This means that the group is heterogeneous in terms of their learning abilities in English. However, it can be said that majority of the respondents belong to the upper group in terms of their performance in English. Presented in figure 1 are the learning abilities of the student-respondents in English in the development of select topics of the course in Methods of Research through desktop teaching. It shows that 12 or 42.857 % belong to the low ability group, 10 or 35.714 % belong to the average ability group and 6 or 21.429 % to the high ability group. This means that the group is heterogeneous in terms of their learning abilities in English. However, it can be said that majority of the respondents belong to the upper group in terms of their performance in English.

Table 1. The Cognitive and Metacognitive Strategies Used by the Students in Desktop Teaching

	Cognitive and Metacognitive Strategies	Mean	Descriptive Interpretation
1	Rehearsal	3.821	True to Me
2	Elaboration	4.107	True to Me
3	Organization	4.143	True to Me
4	Critical Thinking	4.179	True to Me
5	Self-regulation	4.000	True to Me

Table 1 presents the general usage of the cognitive and metacognitive learning strategies by the students in desktop teaching. It shows that the student-respondents employ progressive cognitive and metacognitive strategies in learning. As perceived by the student-respondents, the aforementioned criteria of the 5 indicators manifest in their learning activities geared towards the attainment of the learning goals and objectives. This means that the student-learners employ a variety of strategies and mechanisms to a specific learning topic.

The determinant of these cognitive and metacognitive strategies in learning is under the regulation of the student-learner through a wanton skill and will (Weinstein and Meyer (1994) in Cornford (2000), Ellis (1999).

Table 2. Relationship of the Students' Learning Abilities in English and their Cognitive and Metacognitive Strategies in Desktop Teaching

| | | Cognitive and Metacognitive Strategies | | | | |
		Rehearsal	Elaboration	Organization	Critical Thinking	Self-regulation
Learning Abilities in English	Pearson Correlation	.595**	.594**	.656**	.418*	.401*
	Sig. (2-tailed)	.001	.001	.000	.027	.035
	N	28	28	28	28	28

* Correlation is significant at the 0.05 level (2-tailed)
** Correlation is significant at the 0.01 level (2-tailed)

Presented in table is the test of relationship of the students' learning abilities in English and their cognitive and metacognitive strategies in desktop teaching. It shows that the learning abilities of the students in English are significantly related to their cognitive and metacognitive strategies in critical thinking and self-regulation: r-values of .418 and .401, and p-values of .027 and .035, respectively, at 0.05 level of significance.

On the other hand, their learning abilities are also significantly related to their strategies in rehearsal, elaboration and organization: r-values of .595, .594 and .656, and p-values of .001, .001 and <.001, respectively, at 0.01 level of significance. This means that the learning abilities of the student-respondents in English control the determinants of their cognitive and metacognitive learning strategies.

Hence, the null hypothesis of no significant relationship is hereby rejected. This phenomenon can be attributed to the skill and will under the self-regulation of the student-learner (Weinstein and Meyer (1994) in Cornford (2000), Anderson (2002) and Coskun (2010). Weinstein and Meyer stated further that *'A cognitive learning strategy is a plan for orchestrating cognitive resources, such as attention and long-term memory to help reach a learning goal'.*

Astutely, Ellis (1999) in reference to Flavell (1989) concluded that the learning abilities of the student-learners and competencies in English control the determinant and selection of the cognitive and metacognitive learning strategies, thus, students develop a greater understanding of themselves as language learners. They become more actively and personally involved in the learning process, more confident, more curious and ask more questions, and develop strong motivation and positive attitudes towards learning. He further suggested four metacognitive awareness in the context of language learning. It includes (a) languages awareness, cognitive awareness, social awareness and cultural awareness.

These conclusions are in conformity with Chomsky, Crystal, Aitchison and Piaget's Language Acquisition Theory. They stipulated that every learner has a 'language acquisition device' or LAD which encodes the major principles of a language and its grammatical structures into the learner's brain. Student-learners have then only to learn new vocabulary and apply the syntactic structures from the LAD to form sentences. They then accumulate these formed

sentences in the development of a central schema establishing a valid explanation to a certain topic for an inquiry. The input hypothesis of Krashen (1985) also explains that student-learners form syntactic structures by understanding messages or by receiving comprehensible inputs that lead into a distinctive way of developing competencies on written communication.

Table 3. Relatipnship of the Students' Cognitive and Metacognitive Strategies and their Success in Participating Desktop Teaching

		Success in Participating Desktop Teaching
Cognitive and Metacognitive Strategies	Pearson Correlation	.506**
	Sig. (2-tailed)	.006
	N	28

** Correlation is significant at the 0.01 level (2-tailed)

The foregoing table presents the relationship of the students' cognitive and metacognitive strategies and their success in desktop teaching. Using Pearson-r correlation at 0.01 level of significance, it was found out that there is significant relationship between their cognitive and metacognitive learning strategies and their success in desktop teaching: r-value of .506 and p-value of .006. This means that the better the manifestation of the cognitive and metacognitive learning strategies of the students, the better is their success in their participation to desktop teaching.

Table 4. Impact of the Cognitive and Metacognitive Strategies and Desktop Teaching on the Students' Success on the Course Learning Goals and Objectives

Students' Performance on the Course Learning Goals and Objectives		Cognitive and Metacognitive Strategies					Students' Success in Desktop Teaching
		Rehearsal	Elaboration	Organization	Critical Thinking	Self-regulation	
Formative Evaluation	Pearson Correlation	.582**	.570**	.570**	.408*	.385*	.808*
	Sig. (2-tailed)	.001	.002	.002	.031	.043	.031
	N	28	28	28	28	28	28
Summative Evaluation	Pearson Correlation	.533**	.552**	.606**	.405*	.427*	.429*
	Sig. (2-tailed)	.003	.002	.001	.032	.023	.023
	N	28	28	28	28	28	28
Written Output	Pearson Correlation	.410*	.562**	.526**	.396*	.311	.347
	Sig. (2-tailed)	.030	.002	.004	.037	.107	.070
	N	28	28	28	28	28	28

* Correlation is significant at the 0.05 level (2-tailed)
** Correlation is significant at the 0.01 level (2-tailed)

Table 4 shows the impact of the cognitive and metacognitive strategies of the student-respondents and their success in desktop teaching to their performance on the course learning goals and objectives. It presents that the attainment of the course learning goals and objectives measured in the formative evaluations is generally affected by the employment of the students' cognitive and metacognitive strategies. The impact of the employment of critical thinking and self-regulation was traced at 0.05 level of significance with r-values of .408 and .385 and p-values of .031 and .043 respectively. On the other hand, the impact of rehearsal, elaboration and organization was traced significantly at 0.01 level of significance: p-values of .582, .570 and .570, and p-values of .001, .002 and .002,

respectively. The same phenomenon was observed on the employment of said strategies to the attainment of course learning goals and objectives in the summative evaluation as critical thinking and self-regulation were traced to affect the dependent variable at 0.05 level of significance: r-values of .405 and .427 and p-values of .032 and .023, respectively, while rehearsal, elaboration and organization were traced significantly at 0.01 level of significance: r-values of .533, .552 and .606, and p-values of .003, .002 and .001, respectively. The performance of the student-respondents to the course learning goals and objectives as observed in their written output is observed to be related to the students employment of rehearsal and critical thinking at 0.05 level of significance: r-values of .410 and .396, and p-values of .030 and .037, respectively, while elaboration and organization affected their performance at .01 level of significance: r-values of .562 and .526, and p-values of .002 and .004, respectively. It can be pointed out that self-regulation did not manifest to be a significant factor in determining their success in their written output as its p-value exceeded the critical value at .05: r-value of .311 and p-value of .107. The table also presents the impact of the students' success in the desktop teaching to their success in the attainment of the course learning goals and objectives. It was found out that success is correlated to their performance in the formative and summative evaluation but not in their written output at .05 level of significance: r-values of .808, .429 and .347, and p-values of .031, .023 and .070, respectively. The aforementioned findings are in conformity with the findings of Draper (1997) Hobbs (2009) and Rubenecia (2012) when they emphasized that desktop teaching helps students to engage in discussing and mastering specific learning outcomes. This mental cognition, on the other hand, is controlled by the experiences, skills and self-regulation of the student-learners as they employ their distinct cognitive and metacognitive strategies in learning (Weinstein and Meyer (1994) in Cornford (2000); Segedy, Kinnebrew and Biswas (2011). Coupled with their abilities and competencies of the English language, the students employ this mental cognition through select strategies that involve their experiences and skills (Ellis (1999) in reference to Flavell (1989). These abilities together with their metacognitive learning strategies are strong predictor of academic success and problem solving ability Everson and Tobias (1998) Theide, Anderson and Therriault (2003). Students who are able to effectively discriminate between information they have learned and information they have not learned are more likely to comprehend and learn new information better in forming new learning schema and framework (Ibe, 2009; Stolp and Zabrucky, 2009). Veenman, Wolters and Afflerbach (2006) also concluded that cognitive and metacognitive instruction appears to enhance metacognition and learning in a broad range of students (Veenman, Elshout & Busato, 1994); however, Pressley (2000) concluded that it is obviously of particular relevance to poor students. They further cited three fundamental principles that are known from the literature for successful cognitive and metacognitive instruction: a) embedding metacognitive instruction in the content matter to ensure connectivity, b) informing learners about the usefulness of metacognitive activities to make them exert the initial extra effort, and c) prolonged training to guarantee the smooth and maintained application of metacognitive activity.

References

1. Cornford, Ian R. (2005). Cognitive and Metacognitive Strategies as a Basis for Effective Lifelong Learning: How Far have we Progressed? University of Technology, Sydney.

2. Dawson, Theo L. (2008). Metacognition and Learning in Adulthood. Massachusetts: Developmental testing Service, LLC.

3. Draper, Roni (1997). Active Learning in Mathematics: Desktop Teaching. Mathematics Teacher. http://www.academia.edu/617512/Active_Learning_in_Mathematics_Desktop_Teaching

4. Ellis, Gail (1999). Developing Metacognitive Awareness: The Missing Dimension. School of Education, University of Nottingham.

5. Flavell, John H. (1979). Metacognition and Cognitive Monitoring: A New Area of Cognitive Development. Stanford University

6. Louca, Eleonora Papaleontiou (2008). Metacognition and Theory of Mind. Newcastle: Cambridge Scholars Publishing.

7. Ibe, Helen Ngozi (2009). Metacognitive Strategies on Classroom Participation and Student Achievement in Senior Secondary School Science Classrooms. Science Education Journal.

8. Mayer, Richard E and Rozan Moreno (1998). A Cognitive Theory of Multimedia Learning: Implications for Design Principles. University of California, Santa Barbara. www.unm.edu/~moreno/PDFS/chi.pdf

9. ---- ibid (2001). Cognitive principles of multimedia learning: The role of modality and contiguity". Journal of Educational Psychology 91: 358–368. Multimedia Learning. New York: Cambridge University Press.

10. Pintrich, P. R., & De Groot, E. V. (1990). Motivational and self-regulated leaning components of classroom academic performance. Journal of Educational Psychology, 82, 33– 40.

11. Pressley, M. (2000). Development of grounded theories of complex cognitive processing: Exhaustive within- and between study analyses of thinking-aloud data. In G. Schraw, & J. C. Impara (Eds.), Issues in the measurement of metacognition (pp. 262–296). Lincoln, NE: Buros Institute of Mental Measurements

12. Rubenecia, Marliza E. (2012). Desktop Teaching. A Paper Presented at International Journal for Arts and Sciences Conference at University of Nevada - Las Vegas.

13. Sternberg, Robert J. and Li-Fang Zhang (2001). Perspective on Thinking, Learning and Cognitive Styles. New Jersey: Lawrence Erlbaum Associates.

14. Stolp, Stephanie and Karen Zabrucky (2009). Contribution of Metacognitive and Self-Regulated Learning Theories to Investigation of Calibration of Comprehension. International Electronic Journal of Elementary Education.

15. Veenman, Marcel V.J., Bernadette Van Hout-Wolters, and Peter Afflerbach (2006). The Netherlands: Springer.

16. Waters, Harriet Salatas and Wolfgang Schneider (2009). Metacognition, Strategy Use and Instruction. New York: The Guildford Press.