Metacognitive Lesson Guides: Its Effect on the Chemistry Performance of Novice and Expert Learners

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Abstract

Teaching the learners in a way that their metacognitive skills are developed is essential in attaining better performance. To achieve this purpose, this study measured the effect of metacognitive lesson guides and conventional lesson plans using descriptive-comparative design. A group of novice and expert learners was taught using metacognitive lesson guides and another group using conventional lesson plans. Results showed that the metacognitive group performed better in the teacher-made test than the conventional group. Thus, the formulated lesson guides enhanced the metacognitive skills of the learners.

Keywords: *metacognitive skills, metacognitive lesson guides, conventional lesson plans, test performance, correlation analysis*

1.0 Introduction

Metacognition refers to the learners' automatic awareness of their own knowledge and their ability to understand, control, and manipulate their cognitive processes. Activities such as planning how to approach a given learning task, monitoring comprehension, and evaluating progress toward the completion of a task, are metacognitive in nature (Livingstone, 1997). Metacognitive skills are said to be important not just in school, but throughout life. Mumford (1986) said that for a person to become a successful manager, he must learn to learn. He further describes this person as one who knows the phases in the process of learning and understands his or her own preferred approaches to it. That is a person who can identify and overcome blocks to learning and can bring from off-the-job learning to on-the-job situations.

In terms of metacognitive skills, learners can be grouped into novice and expert. Expert learners are aware of their mental processes and have the ability to direct themselves toward a desired end. They have the skill to know when, where to learn and how to appropriately use learning. Expert learners feature information that is not noticed by the novices. They

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have acquired a vast pact of content knowledge and deep understanding of the subject matter as reflected in the way they organize information. Experts have varying levels of flexibility in their approaches to new situations (Bransford, *et al*., 2000). They are capable of knowing how to learn and in directing its thinking towards formulating strategy that works best (Nigam, 2009). They demonstrate an understanding of the situation and can plan a precise approach to solve a problem. They are aware when to monitor to check for errors as well as evaluate reasons for failing to comprehend and strategize to redirect their efforts (Ertmer and Newby, as cited in Nigam, 2009). These learners work from an in-depth understanding of the total situation. They demonstrate highly skilled analytical ability in problem solving. Thus performance becomes masterful. Novice learners on the other hand are those who need rules to guide performance. They do not stop to evaluate their understanding of the material and examine the quality of their work or stop to make revisions as they proceed. Satisfied with just scratching the surface, novice learners do not attempt to examine a problem in depth. They do not make connections or see the relevance of the material in their lives contrary to the expert learners (Ertmer and Newby, as cited in Nigam, 2009). Thus, it can be viewed that novice learners are low in terms of developing, monitoring and evaluating plan of action, the basic metacognitive skills.

While literature show that students' metacognitive skills are essential in effecting science learning, development of such is less emphasized in the public secondary school teaching as their conventional lesson plans reveal no activities for the enhancement of metacognitive skills such as planning, monitoring, and evaluating own performance. This study was conducted to measure the effect of formulated metacognitive lesson guides in comparison with the conventional lesson plans as shown in the students' performance in the teacher-made test. Contrary to the conventional lesson plans, these metacognitive lesson guides contain activities that would enhance or develop the planning, monitoring, and evaluating skills of the students. To achieve this purpose, students were first classified as novice and expert using an adapted questionnaire. A pre-test was also conducted to check the prior knowledge of students with regards to the topics to be discussed. Results from the two instruments served as bases in forming the metacognitive (experimental) group and the conventional (control) group. To establish homogeneity, the two groups were composed of the same number of novice and expert learners. Pre-test results served as basis in grouping the learners to ensure that the two groups' initial performances do not differ significantly. The metacognitive group was taught using the metacognitive lesson guides while the conventional group was taught using the conventional lesson plans produced by the Department of Education. Post-test Mean Percentage Score (MPS) was determined and analyzed to determine which group performed better.

2.0 Conceptual/Theoretical Framework

This research undertaking was primarily anchored on Sternberg's Triarchic Theory. This theory defines intelligence as the interaction between the potential set of mental processes that underlies behavior, the external world, and experience. This theory also emphasizes that the fundamental component of intelligence is the metacognition or executive processes that control the strategies and tactics used in intelligent behavior.

In terms of metacognitive skills, students can be generally classified as novice and expert. Expert learners are presumed to possess high metacognitive skills in terms of planning, monitoring and evaluating a plan of action. Novice learners, on the other hand, are those who possess low metacognitive skills in terms of planning, monitoring and evaluating their own learning processes. They are the type of students who are not aware of the progress of their own learning. These types of learners are present in both metacognitive and conventional

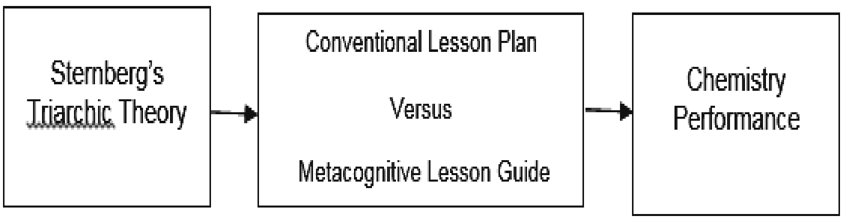

Figure 1. Conceptual framework of the study.

groups. Metacognitive group was taught using the metacognitive lesson guides which integrate exercises that would enhance the planning, monitoring and evaluating skills of the students. Conventional group was taught using the conventional lesson plans provided by the Department of Education. Chemistry performance of the two groups as determined through the Post-test Mean Percentage Scores (MPS) was statistically analysed to determine which group performed better.

3.0 Methodology

A total of thirty-two (32) students of Limasawa National High School selected through cluster sampling composed the Metacognitive Group and the Conventional Group. An adopted questionnaire was used to classify these 32 students into novice and expert learners that provided the basis for clustering. Then, two sub-groups for each type of learners (novice and expert) were formed. Each of the novice learners was randomly selected to compose a certain novice sub-group. The same procedure was applied to the identified expert learners. Then, one sub-group from each type of learners was randomly assigned to compose the Metacognitive Group while the remaining sub-groups composed the Conventional Group. Thus, the resulting Metacognitive Group and Conventional Group have one novice and expert sub-group. On the other hand, to compare the chemistry performance of the Metacognitive Group and Conventional Group, Pre- and Post-test design was utilized.

The following texts described the instruments used by the researcher in gathering the data needed for this study.

Novice-Expert Questionnaire is a 15-item instrument excerpted from Strategic Teaching and Reading Project Guidebook as cited by Nigam (2009). This questionnaire is divided into three sections, namely: planning, monitoring and evaluating a plan of action. Each of the sections is composed of items that would assess the student's meta-level skills in reading, understanding, analysis and exploration. Results gathered through this instrument showed who among the respondents were novice and expert learners.

Achievement Test in Chemistry is a 30-item pilot-tested test that revealed the performance of students in chemistry.

Aside from these questionnaires, the researcher also used the Conventional Lesson Plan supplied by the Department of

Education to teach the Conventional Group. To teach the Metacognitive Group, the researcher used the formulated metacognitive lesson guide. Unlike the conventional lesson plan, this lesson guide emphasized the enhancement or development of the metacognitve skills of the students by providing activities that would let the students plan a strategy to learn a particular lesson, monitor if that strategy works and evaluate the outcome of the strategy.

4.0 Results and Discussions

Pre- and Post-test Mean Percentage Scores of Metacognitive Group

Table 1 shows the Mean Percentage Scores of the novice and expert metacognitive groups. From the data presented, it can be discerned that there was a remarkable increase in the performance of the expert metacognitive group as reflected in the pre-test and post-test Mean Percentage Scores. The expert metacognitive group posted a post-test MPS of 77.33 percent which is remarkably higher compared to the pre-test MPS of 46.67 percent. Likewise, the novice metacognitive group had doubled their performance when the group posted a post-test MPS of 70.91 percent which is 50 percent higher than the pre-test. Subsequently, the whole metacognitive group marked an overall post-test MPS of 72.92 percent which was higher than the pre-test MPS of 38.96 percent.

This result suggests that the metacognitive lesson guide played a significant role in making the students understand the lesson and in consequently developing the metacognitive skills of the students. It is likewise observed that the disparity between the performance of the novice and expert metacognitive groups decreases from the pre-test to the post-test

Table 1. Mean percentage score of metacognitive group.

Respondents	MPS (Pre-test)	MPS (Post-test)
Novice Metacognitive Group	35.45 %	70.91%
Expert Metacognitive Group	46.67%	77.33%
Overall	**38.96%**	**72.92%**

MPS. This implies that the metacognitive lesson guide can somehow make novice learners post higher performance closer to that of the experts if they are exposed to learning situations where there is a greater chance for them to develop their planning, monitoring and evaluating skills.

Pre- and Post-test Mean Percentage Scores of Conventional Group

Table 2 shows the performance of the conventional group in the pre-test and post-test. As expected, it can be observed that the expert conventional group marked a better performance in the pos-test than in the pre-test. The post -test MPS of 62.67 percent over the pre-test which is only 48.67 percent suggested the expert students still learn through conventional method of teaching. This is also true to the novice conventional group wherein the said group revealed a 61.82 percent post-test MPS which is observably higher than 35.76 percent pre-test MPS.

If we compare the post-test of the two subgroups, it can be viewed that 61.82 percent is very close 62.67 percent. Considering that there was a wider difference in their pre-test MPS, these post-test results imply that although the conventional method of teaching provided similar learning opportunities to both novice and expert learners, it was so limiting on the part of the expert learners considering that there was only a minimal leap of the post-test of the expert conventional group. Such restriction hindered the experts to perform far better than the novices. As a consequence, the two subgroups posted a close post-test MPS.

Difference in Pre- and Post-test Scores between Metacognitive and Conventional Groups

Table 3 shows the computed p-value for the pre-test and post-test MPS of the metacognitive and

Table 2. Mean percentage score of conventional group.

Respondents	MPS (Pre-test)	MPS (Post-test)
Novice Conventional Group	35.76%	61.82%
Expert Conventional Group	48.67%	62.67%
Overall	**39.79%**	**62.08%**

Table 3. Difference in pre- and post-test scores between metacognitive and conventional groups.

Variables	Overall Mean	Levene's Test	t-test	p-value
Metacognitive Group Pre-test	11.69	.848	.132	.896
vs				
Conventional Group Pre-test	11.94			
Metacognitive Group Post-test	21.88	.559	2.043	.049
vs				
Conventional Group Post-test	18.63			
Metacognitive Group Pre-Post Difference	10.19	.129	2.819	.008
vs				
Conventional Group Pre-Post Difference	6.69			

* If p-value < 0.05, then the test is significant.

conventional groups. From the revealed 0.896 computed p-value of the pre-tests with equal variances assumed, it can be discerned that there was no significant difference between the pre-test performance of the metacognitive and conventional groups. It can be inferred from the pre-test results that although the conventional group posted a higher pre-test mean, the two groups possessed equal information on the selected topics before the administration of the prepared metacognitive lesson guides and the conventional lesson plans. On the side of the post-test, the computed p-value of 0.049 revealed that there was a significant difference between the post-test performance of the metacognitive group and the conventional group. This observation was further strengthened by a higher pre-post difference of the metacognitive group and the .008 computed p-value which revealed that there was a significant difference between the Pre-Post Differences of the two groups.

Considering that the metacognitive group posted a higher post-test MPS than the conventional group, it can be said that the former performed better than the latter. This relatively high post-test performance of the metacognitive group can be attributed to their high metacognitive skills which are essential to achieve a better performance as posited by Mumford (1986). Hence, it can be inferred that the metacognitive lesson guide helped significantly in drawing out the metacognitive skills of those exposed to it. This further implies that helping the students develop their metacognitive skills would make the learners perform well in a task expected of them. Thus, it is proper to structure our lessons in a way that learners are given a wide chance to develop their planning, monitoring, and evaluating skills.

5.0 Conclusion

Based on the findings of the study, it can be concluded that the formulated metacognitive lesson guides significantly enhanced the chemistry performance of novice and expert learners.

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