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The Use of Fast Feedback Methods in Teaching Physics for Grade 7 Science

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Abstract: This study sought to determine the effects of using the Fast Feedback Methods (FFM) on the students in terms of the mastery of the content. The framework of the study was based on Ed van den Berg's (2003) Fast Feedback Methods, a whole class approach in which students work individually but at the same pace by answering a series of conceptual questions that may also be answered in the form of simulations, graphs or drawings given at the end of every lesson. During the intervention, the researcher taught selected topics in physics from Grade 7 Science using lessons with FFM embedded as formative assessment among 38 Grade 7 students from a regular public high school in Caloocan City. Aside from the Fast Feedback Methods embedded as formative assessment given at the end of the lessons, online assignments thru Facebook, Quipper and Google Forms were also given to the students as another means of getting immediate feedback. Class observations were conducted and video-taped to ensure the implementation of the FFM in class. The students' mastery of the content was measured using a mastery test together with the data gathered from the online assignments, students' fast feedback booklets and fast feedback classroom observation protocol. Furthermore, post intervention interviews were conducted among the participants to acquire more information on the students experience with the FFM. The data was statistically treated using a one sample t-test to determine if there is a significant difference between the mean scores of the students in the mastery test from the hypothetical mean and it was found that the mean score of the students is significantly higher than the test value. This suggests that the use of FFM has a positive effect on the students' mastery of the content. Student interviews and the results from the fast feedback observation protocol also support that the Fast Feedback Methods have helped the students understand the selected physics topics better. Hence, the FFM can be a useful form of formative assessment that teachers can use in their physics classes to improve students' mastery of the content.

Key Words: feedback; assessment strategy; mastery; learning; online assignments

1. INTRODUCTION

The existence of having large classes has paved way to numerous physics education researches in the past years. Several studies have actually shown that the number of students in a physics class has an impact on the teaching and learning process. One of the major factors that affects the teaching and learning of physics in the classroom is the large class size (Capistrano, 2002). Large classes make it difficult for the teacher to provide immediate and quality feedback to students because it's hard to provide individual attention to students who need it (Ives, 2000). It is important for students to know how well they are doing as they learn. This is because the knowledge that they are doing well gives students a sense of achievement which motivates them to learn more. Similarly, it is also important to let students know when they have made a mistake so that they will learn from it and take corrective measures. Hence, it is absolutely essential for teachers to monitor students' learning and give them immediate feedback.

Moreover, the Department of Education released DepEd Order No. 73 s.2012 which stipulated the guidelines on the assessment and rating of learning outcomes under the K to 12 Basic Education Curriculum. The guidelines emphasized the importance of the use of feedback in the teaching and learning process. The results of the assessment across levels should be fed back immediately to the students consistent with the principle of assessment of learning. Students need to learn from the results of the assessment so they know what to improve further and so that they can plan strategically how they can address any learning deficiency.

Lack of providing quality feedback often leads to failure in addressing student misconceptions (Black, 1998). However, the great challenge is for teachers to provide effective feedback to individual students without having the burden of spending long hours of checking student work and writing in feedback comments and extending hours to talk to every student on a regular basis.

For this reason, in 2003, Ed van den Berg, a physics teacher education professor from the University of Amsterdam, came up with a strategy that would address this dilemma with the use of Fast Feedback Methods which require no checking of student papers outside the lessons but can provide powerful formative assessment of student understanding during actual teaching. In the Fast Feedback Methods, a series of open-ended, conceptual or problem solving questions are given to the whole class at the end of each lesson. These questions may not only be answered by short responses or explanations but may also be answered in the form of simulations, graphs or sketches or drawings. The students work on it individually but at the same pace once the questions are posted.

The Fast Feedback Methods were developed to still make it possible to diagnose conceptual development of individual students and to respond to the most common problems without having to spend long hours of checking on students' individual works.

Furthermore, Fast Feedback Methods have been used as exercises to supplement a complete set of lesson materials for teaching several topics in physics to highly academic high school students aged 17-18 in different schools in the Netherlands. Also, the said approach has already been tested in the Central Philippines in 2003 among pre-service physics education students; however, it has not been used to supplement instruction among high school students taking physics under the new K to 12 curriculum. Hence, the purpose of this study is to use the Fast Feedback Methods in teaching selected topics in physics for Grade 7 Science and see the effects of using the said approach on students' learning.

Specifically, this study intends to see the effects of using the Fast Feedback Methods as embedded formative assessment on the students' mastery of the content.

2. METHODOLOGY

This study involves a classroom-based action research wherein the teacher-researcher conducted an undertaking to solve an existing problem in the class where the teacher teaches. This research also made use of the descriptive research design with both quantitative and qualitative approaches used in the analysis of data gathered to answer the research problems in this study.

The participants of this study are 38 Grade 7 students of a regular public high school in Caloocan

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City during the Fourth Quarter of S.Y. 2014-2015. The set of participants was purposively selected on the basis of intellectual capability and trainability of the students which were deemed necessary for the conduct of this research.

There were four stages of development employed in this study namely *Preparation, Implementation, Data Gathering and Data Analysis.* To establish the validity and reliability of the data, the researcher used multiple approaches of data collection through triangulation in the form of structured questionnaire or test, interviews and classroom observations.

2.1 Preparation Stage

In this stage, the researcher developed all the lesson plans needed for the intervention and prepared all the research instruments used in this study such as the 50-item Mastery Test, Online Assignments, Fast Feedback Observation Protocol and the interview protocol for the participants. The 50-item Mastery Test, online assignments thru Facebook and Google Forms and the interview protocol were developed by the researcher while the online assignments thru Quipper and the Fast Feedback Observation Protocol were adapted from previous researches and were modified to fit the needs of this research. All the materials and instruments used in this study went through the phases of construction, face and content validation from experts and revision prior to implementation.

For the preparation of the lesson plans, the researcher chose the first three modules in physics from the Grade 7 Science Learner's Materials prescribed by the Department of Education. These modules cover 14 topics under motion, waves and sound. Each lesson plan constructed by the researcher is embedded with the three Fast Feedback questions to be given at the end of the lesson. All the lesson plans went through content validation by three experts in the field of physics education. The lesson plans were then revised based on the experts' validation prior to implementation.

2.2 Implementation Stage

The lesson plans incorporated with Fast Feedback Methods were used in teaching the selected topics in physics for Grade 7 Science. The intervention has a total time allotment of 4 weeks which is equivalent to 16 hours of instruction. The implementation happened on the 2nd week of February up to the 2nd week of March 2015 during the 4th Quarter of S.Y. 2014-2015.

The manner in which the Fast Feedback Methods by Ed van den Berg (2003) was used was adapted in the intervention. Instead of having the prescribed activities on the learners' materials, the students were taught using the lessons with embedded Fast Feedback Methods prepared for each topic. Formative assessment in the form of short quizzes given at the end of the lesson were replaced by Fast Feedback Methods in the form of open-ended, conceptual or problem solving questions and physics simulations with guide questions which may also be answered with sketches, graphs and diagrams. The Fast Feedback session at the end of each lesson takes a total of 15 minutes. The teacher begins by posting the question on the board/screen. The students are then given a minute to silently read and analyze the question and another minute to write their answers, responses, solution or drawings on their booklets. *Peer discussion* follows wherein the students are arranged into a small group of 3-4 members where they share and exchange ideas as they try to convince one another and reason out why their answers are correct. While the students discuss with their peers, the teacher roams around, checks on students' responses to get a feel of how the students understand the concept and sometimes tries to have mini discussions to some students as they try to give explanations to their answers. As the teacher listens to the students' ideas during the peer discussion, she can come up with an explanation that would address the students' misconceptions which emerged during the peer discussion. The last part is the *Plenary discussion* wherein the teacher summarizes the students' answers, explains the concepts for the correct answers and addresses any students' misconceptions.

All the sessions all throughout the implementation were video recorded through a smart phone and a digital camera hidden in the classroom. The teacher-researcher also kept a daily log/ journal for every session ensuring that all-important details and observations on the implementation were recorded.

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During the intervention, the students used Fast Feedback Booklets, binder filler notebooks, where they wrote all their answers, responses, drawings and explanations to all the Fast Feedback questions given in the class.

Aside from the Fast Feedback questions given at the end of the lesson, another method was used to get immediate feedback on students' learning and that was in the form of online assignments. These assignments posted online were announced at the end of the class and were accomplished by the students at home. Online assignments were given to the students using three (3) platforms namely Facebook, Quipper and Google Forms. Each platform was used in each of the modules covered in the selected topics. All online responses were cast overnight and were evaluated in class the next morning.

However, since not all the respondents have internet connection at home, adjustments were done by the teacher-researcher in such case where in some of the students made their online assignments in the computer laboratory in the school.

2.3 Data Gathering Stage

To ensure that the Fast Feedback Methods were implemented, all the classes throughout the implementation were observed by the school principal, department head, master teacher or science teachers from the same school. During the classroom observation the observers utilized the Fast Feedback Observation Protocol which consists of the Fast Feedback Observation Rubric and the Fast Feedback Observation Sheet. The Fast Feedback Observation Rubric covers the following domains: Fast Feedback Questions, Fast Feedback Instructions, Students' Participation, Students' Intellectual Engagement, Students' Motivation, Students' Misconceptions, Peer Teaching, Time Allotment and Use of Technology. Each observer gave his/her rating on each domain based on the appropriateness of the implementation of the Fast Feedback Methods with the rating 3 as "Very Evident" and 1 as "Not Observed".

Student interviews were also conducted after the implementation. Likewise, the 50-item Mastery Test was also administered after the intervention. All the Fast Feedback Booklets and online assignments were submitted to the teacher-researcher and at the same time, the entire teacher's daily log/journal was kept as supplementary source of data.

2.4 Data Analysis Stage

The effect of the use of Fast Feedback Methods on the students in terms of the mastery of the content was determined through the proficiency of the students in the mastery test administered after the intervention. Moreover, data gathered through the post-intervention student interviews and the Fast Feedback Observation Protocol were also analyzed.

3. RESULTS AND DISCUSSION

The effects of the use of Fast Feedback Methods as embedded formative assessment on the students' mastery of the content were determined in terms of the following:

3.1 Mastery Test

Table 1. One-sample t-test of Mastery Test

	Test Value = 30					
	t	df	Sig. (2-tailed)	Mean Diff.	95% Confidence Interval of the Difference	
					Lower	Upper
MT	13.12	37	.000	9.579	8.10	11.06

After the completion of the mastery test, the researcher used one sample t-test as a statistical tool to compare the mean of the scores of the students in the mastery test with the hypothetical mean of 30 based from the passing rate set by the Department of Education which is 60 percent of the highest possible score as a standard for achievement (DepEd Order no.8 s.2015).

The results show that the mean score of the students exceeded the test value of 30 points by 9.579 as seen in Table 1. The p-value which is greater than

the threshold of 0.05 implies that there is a significant difference between the mean score of the students and the test value. This shows that the mean score of the students is significantly higher than the test value as indicated by the positive t-value of 13.122 which strongly suggests that the use of Fast Feedback Methods has a positive effect on the students in terms of their mastery of the content in the selected physics topics in Grade 7 Science.

Table 2. Measures of Central Tendency in the Mastery Test

	N	Mean	Std. Dev.	Std. Error Mean
MT	38	39.58	4.500	.730

Table 2 shows one-sample test statistics of the students' scores in the mastery test. The table provides the standard deviation with a value of 4.500 which means that the scores have low deviation from mean score. The computed value for the standard deviation suggests that there is a narrower range between the lowest and highest scores or, more generally, that the scores cluster closely to the mean score of 39.58.

3.1 Online Assignments

The data gathered from the online assignments thru Facebook, Quipper and Google Forms also manifested the students' mastery of the lessons on Motion, Waves and Sound. In general, students obtained scores ranging from 60-90% for each of the online assignments. Using Facebook, the students were able to solve problems on motion online at home and were given real-time feedback as to whether their answers and solutions are correct. The students also obtained high scores in their completed assignments about waves and sound given thru Quipper and Google Forms.

3.1 Fast Feedback Observation Protocol

Furthermore, the Fast Feedback Observation Rubric results obtained from the classroom observers (science teachers, master teacher, department head and school principal) yielded a mean rating of 2.90 out of 3.0 being the highest rating from all the observers. This shows that the Fast Feedback Methods were appropriately implemented in the class in terms of the following domains: Fast Feedback instructions and questions, students' participation, motivation, misconceptions and intellectual engagement, peer teaching, time allotment and use of technology.

3.1 Student Interviews

In addition, the post intervention interviews also revealed that the students find it easier to understand the physics lessons taught with Fast Feedback Methods as formative assessment and that it also helped them learn physics better. Misconceptions which emerged during the peer discussion were also immediately addressed by the teacher giving the students the opportunity to correct any misconceptions that they have in mind so that they would have a clearer understanding of the concepts.

The students also claimed that the online assignments have given them the immediate feedback that further facilitated their learning and have improved their study habits as well. Below are excerpts from the interview:

"Dun sa Fast Feedback, parang mas nahihimay-himay po yung mga ideas at mas naiintindihan namin kung bakit nagkamali sa sagot. (In Fast Feedback, the ideas are scrutinized and we are able to realize why our answers are wrong.)"

"May times na tama yung sagot mo pero mali naman pala yung explanation, sa Fast Feedback mas nalilinawan yung pagkakaintindi mo sa concept ng physics. (There were times that you got the correct answer but the explanation is wrong. In Fast Feedback, you get a clearer understanding of the physics concepts.)"

"Sa peer discussion, mas naiintindihan mo yung lesson kapag pinapaliwanag mo sa kaklase mo. Kapag mali yung pagkaintindi naitatama naman ng classmate mo pag nag-share kayo ng mga ideas. (In peer discussion, you get to understand the lesson better when you explain it to your classmates. Any misconception is also addressed when we share ideas with our classmates.)"

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"Nare-refresh po yung mga ideas namin kapag nagbabasa kami at nagsasagot ng mga tanong tsaka mas humahaba pa yung pagkaka-alala naming sa mga concept. (Our ideas were refreshed whenever we read and answer questions and the concepts were retained longer.)"

"Mahalaga siya (Fast Feedback) sakin kasi sa tingin ko kung hindi man siguro namin ito nagawa mas mahihirapan kami na maintindihan yung topic. (Fast Feedback is important to me because if we're not able to do it, it would be harder for us to understand the topic.)"

4. CONCLUSIONS

This study sought to determine the effects of the use of Fast Feedback Methods as embedded formative assessment on the students' mastery of the content. An intervention was conducted among 38 Grade 7 students to teach selected physics topics wherein each lesson was incorporated with Fast Feedback Methods in the form of conceptual questions, simulations, drawing graphs and diagrams. A researcher-made mastery test along with online assignments was used to determine the effect of using the Fast Feedback Methods on the students' mastery of the content. Results revealed that the students manifested mastery of the physics lessons taught with a mean score of 39.58 out of the 50-item test. The mean score of the students is significantly higher than the test value of 30 which is based from the passing rate set by the Department of Education which is 60 percent of the highest possible score as a standard of achievement.

In addition, classroom observers shared their insights about the intervention thru the Fast Feedback Observation protocol and confirmed that the students' motivation was apparent in the class and that the students were intellectually engaged during the Fast Feedback session at the end of each lesson.

The results of the study imply that the use of Fast Feedback Methods as embedded formative assessment in teaching physics for Grade 7 Science have a positive effect on the students' mastery of the content.

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