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The Effect of Influence-Embedded Physics Instruction on Student Academic Performance

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Abstract: Students view physics as boring and difficult. A lot of studies has been casted on motivation and learning attitudes but the cases of underperforming and under motivated students still continues. Persuasion has always been a part of human daily interaction. It has and is used by all walks of life and has already perforated digital platforms. This action research sought to improve students' learning performance through Influence-embedded physics instruction (IEPI). The first round was carried out based on the PDSA cycle. IEPI utilizes the principles of persuasion according to Robert Cialdini and the Fogg Behavior Model (FBM), a persuasion model designed by B.J. Fogg. This was given to two intact sections of underperforming Grade 9 students of a public school in Cavite, Philippines as they cover impulse and momentum, work, power, and energy, and electricity and magnetism. The principles and model were applied to student's classroom activities, discussion, and provided learning materials. Standardized pre-test and post-test scores were used to gauge students learning for every module. Results show that IEPI helped students learn more because they were more motivated and able to accomplish their tasks that they enjoyed their activities, and that proactive use of Filipino made concepts easier to understand and discussions less daunting. Journal entries and interviews revealed that the most effective persuasion principles in improving student performance were reciprocation, liking, social proof, and scarcity.

Key Words: Cialdini, persuasion, Fogg Behavior Model, Academic Performance, Public High School Grade 9, Physics, Underperforming students

1. INTRODUCTION

Filipino students suffer from low retention of concepts, limited reasoning and analytical skills, and poor communication skills. These low performance indicators were attributed to the quality

of teachers, the teaching and learning process, the school curriculum, instructional materials, and administrative support (SEI-DOST and UP NISMED, 2011). Among the different realms of science, physics is viewed as the most challenging



area. Traditionally, physics attracts less students and has a lower success rate compared with chemistry and biology (Erdemir, 2009). According to Williams, et. al. (2003), the most apparent reason for the students' lack of interest in physics was that the students found the subject boring and perceived it as difficult. On the other hand, Johnstone (1991) suggested that the cause might lie in the transmission of knowledge, the facilities available, the learners, the nature of their learning, or the nature of the knowledge itself.

From the researcher's 3-year experience in teaching Grade 9 science, Physics and Chemistry were particularly challenging to teach because the abstract concepts in addition to the lack of required mathematical skills hinder students' learning. To make matters worse, Physics is taken during the last quarter resulting to less topics covered due to reduced number of sessions.

Resource hindrances and student negligence play a part in the non-accomplishment of students' assigned tasks. When this happens, teaching time is reduced by the commotion it causes or at worse, some individuals or groups would not perform or the activity would be skipped for the whole class.

English proficiency is also a factor obstructing science learning especially in the researcher's previous classes. Students often get stuck when they follow instructions in English and they are also intimidated when asked to recite or present activities in English.

Lastly, comparison of grades is a culture among students and they always have this idea that they deserve better than the grades they obtain. If a teacher gives the minimum passing grade to an obviously failing student, other low performing or barely passing students take this as a sign that they themselves do not have to study hard to pass, that "cruising" is enough.

Despite countless researches in motivation, attitude, and other factors that could help improve learning, these scenarios still exist in the Philippine public high school system. This made the researcher look for other avenues like persuasion to help improve students' performance.

1.1 Background

In psychology, the science of persuasion is called influence. "Persuasion is a part and parcel of human interaction". It has been in the tales of human history to the media we are exposed with now. Persuasion implies a voluntary change in behavior or attitude or both (IJsselsteijn, et. al. 2006, p. 1). According to Berdichevsky and Neunschwander, 1999, pp. 1, "Teachers are by far one of the most influential people in the community. Teachers are persuaders of an invisible yet fundamental sort, altering the attitudes of their students' day by day." Whether we like it or not, intended or not, we are all perpetrators and victims of persuasion (Cialdini, 2009) so it is high time for us to use it for the common good.

The action research used the basic persuasion principles according to Cialdini which are:

Reciprocation – people are ingrained to reciprocate the benefits they get from other people;

Liking – the more you make people feel you like them, the more they would like to have business with you;

Social Proof / Social Norm – people think it is appropriate to do the things (comparable to what) others do, feel, and believe;

Authority – the messenger is the message itself;

Scarcity – People want more of what they can have less off; and

Consistency – people always want to pursue personal alignment from previous statements, stands taken, or action made.

The action research also used the Fogg Behavior Model (FBM) shown in Figure 1. FBM states that a person's motivation and ability to do a certain behavior can trade off. For example, if a person is highly motivated, he will make a way to enhance his ability to accomplish the target behavior while a highly capable person can still do the behavior even if he is not motivated. For tasks or behaviors that we persuade others to do, we can either increase their motivation or make the task easy. It also incorporates triggers (sometimes called

prompts or cues) which facilitates a behavior chain which helps participants do a simple behavior towards a complex ones (Fogg, 2009).

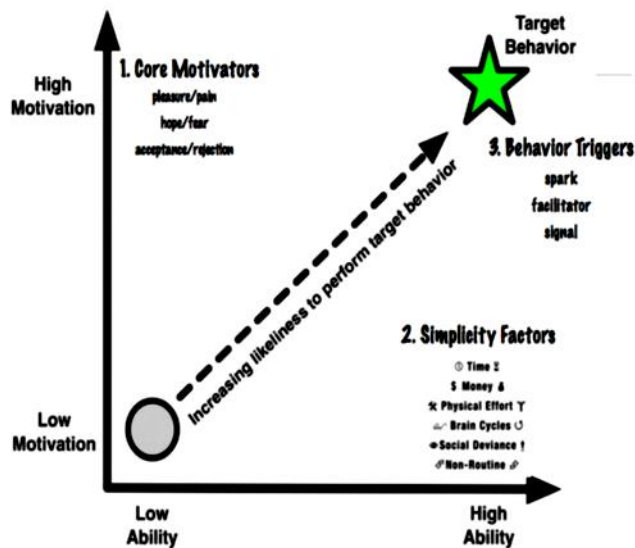


Fig. 1. Graphical representation of the Fogg Behavior Model

2. METHODOLOGY

2.1 Participants

There were 119 participants for this study. They belonged to two intact classes of Grade 9 in a public school located in Cavite, Philippines. The school is classified as a mega school with a total enrolment of 4, 097 students and 161 teachers for school year 2017-2018. The average class size of Grade 9 students is 60. The participants belonged to the lowest two classes in their batch. There were 12 classes in this batch. Past teachers would share that the students from these sections appeared to lack the motivation to learn; that absenteeism is common; and that students could not care any less about their own poor performance.

2.2 Instruments

To investigate the impact of IEPI on student academic performance, several instruments were used and prepared. These includes the influence-embedded learning materials, the evaluation tool for the learning materials, the pre-tests and post-tests, the student journals, and observation forms.

Influence-embedded learning materials. These are the combination of group boxes, hand-outs, exams, activities, presentations, incentives, and rewards that were utilized in the study.

Evaluation tool for the learning materials. The prepared materials were evaluated in terms of how evident the principles of persuasion are and how visible the core factors of Fogg Behavior Model are in the physics learning instructions prepared. The congruency and appropriateness of the prepared materials to the content standards and learning competencies of the Department of Education were also evaluated. The evaluation tool was a Likert scale with a range of 1-5 with verbal interpretations of “strongly agree” for a score of 5 down to “strongly disagree” for a score of one. Three education experts were consulted to accomplish the evaluation.

Pre-test and Post-test (per module). The pre-test and post-test for each of the three modules were obtained from DepEd’s Science - Grade 9 Learner’s Module (2014). These were standard tests consisted of multiple choice items. Each item was scored one point for every correct answer. These were translated in Filipino to eliminate the threat of language factor in the result ensuring that students’ scores were reflective of their knowledge. The pre-tests were administered prior the first lesson of every module and post-tests were given at the end of each module.

Journals. Each student was asked and encouraged to write his/ her reflection about the sessions focusing on their thoughts and feelings about what happened in their physics class. There was no strict guideline given to students with regards to how they accomplished their journals. This was done in order to let students write what they think was remarkable and to remove any bias or limit about what they can write. It was also done to



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elicit *commitment* statements out of their own volition.

Observation Forms. The researcher used the Instructional Supervision Form 1, a standard supervision form used by head teachers in observing teachers in public schools. The observers were asked to focus on the content and pedagogy used, the way the classes were planned, how the students were assessed, the motivation of students, and the teacher-learner interaction during the IEPI.

Interviews. Focus group discussions were conducted among selected students to verify their insights in their journals. An interview was also given to the teacher-implementer to provide a different perspective aside from the obtained class observations.

2.3 Procedure

For the duration of the intervention, the researcher prepared and corresponded all the learning materials that were used to the teacher implementer. This was done to ensure that there would be no teacher factor that could affect the results of the study.

The researcher utilized the physics modules in the Learner's Manual provided by DepEd for public high schools. Modifications were made while keeping the learning competencies/objectives and delivery times unchanged. During the intervention, all the needed learning materials by the students were provided by the researcher through the teacher implementer. All material contents are in Filipino but the scientific terms remained in English. These were all provided to cater *ability and reciprocity*. The researcher would like to note that the provision of teachers to all the needs by the students is rarely observed in the Philippine public high school system.

Researcher-prepared pre-lesson activities were evident in IEPI. The activities were based on references familiar to students' interests and humor like popular games and characters and "hugot" lines. These were done to improve *liking* and *reciprocity* among the students.

With regard to the actual activities, revamps and/or alternatives were devised. This was done by either introducing game mechanics or by providing procedure twists in the activity. The researcher used elements like race, point system, and voting for the best actors/actresses to make the suggested activities in the Grade 9 Learner's Manual more interesting. As for evaluation, students were given different "sets" or "type" of exams to choose from. Awards were given to activity winners and best scorers. These were given every after a group activity and every module accomplished through the posted score summaries. These were all done to elicit *liking, social proof, and scarcity*.

The pre-test and post-test provided were originally from the Grade 9 Teacher's Manual, it was translated in Filipino and the scores were analyzed using t-test for paired samples and effect size. The topics covered were impulse and momentum (module 1), work, power, and energy (module 2), and electricity and magnetism (module 3).

Lastly, journals and "Target Score" in the answer sheets' name grid allow avenues for *consistency* to take place.

3. RESULTS AND DISCUSSION

3.1 Impact of IEPI on Student Academic Performance

The mean scores of the pre-test and post-test for every module was compared. Table 1 shows the number of items per module, the mean scores for pre-test and post-test as well as their standard deviations. T-test for paired samples was used for the means and Cohen's d values were calculated, too. Results show that all post-test scores for each module were significantly higher than the pre-test scores ($p=0.00$). A moderate effect size was observed in the Impulse and Momentum and Electricity and Magnetism modules with Cohen's d values of 0.60 and 0.76 respectively. This means that approximately, one in every five students taught in Module 1 had shown improvement while two in every seven students improved for Module 3. Module 2 got



the highest Cohen's d value of 0.96 categorized as a large effect size. This means that for every three students taught in Electricity and magnetism, there is one who improved in terms of the knowledge gained.

materials and language are important ability factors (simplifiers) that should be taken into consideration when we want to empower the desired behaviors of our students.

TABLE 1. TEST OF DIFFERENCES OF PRE-TEST AND POST-TEST SCORES

Module	No. of items	Pre-Test Mean	Pre- test SD	Post-test Mean	Post-test SD	t Stat	p	t Critical (2-tail)	Cohen's d
M1: Impulse and Momentum	10	3.85	1.44	4.80	1.74	-4.20	0.00	1.99	0.60
M2: Work, Power, Energy	15	4.23	2.06	6.28	2.20	-5.89	0.00	1.99	0.96
M3: Electricity and Magnetism	10	3.90	1.76	5.17	1.57	-4.97	0.00	1.99	0.76

3.2 Student Reflections and Experiences on IEPI

Among the most prominent feedback during the interviews and journal entries of the participants is their appreciation and somehow "guilt" for performing poorly despite the efforts done by their teacher. They felt "special" because the intervention was done for them and not the top section of their batch. Some students noticed the efforts needed to think, type, and print the materials they receive on almost a daily basis. The participants find the games and gimmicks funny and the candies and prizes worth their effort. These show that *reciprocation, liking, and scarcity* could affect how students perform in class. It also shows that even the simplest treat like candy can make a difference in a class especially for underperforming students.

One of the most appreciated changes during the IEPI was the proactive use of Filipino in the classroom discussion as well as with all the learning materials provided to the students. Many participants were thankful and agree that they learn better with Filipino. Participants also agree that the hand-outs prepared for them helped them understand concepts better because aside from having a reference, they can focus more on listening in the discussion because their attention is not divided with writing which they normally do in their normal classes. This shows that provision of

Lastly, some students became a little conscious about their performance and happy at the same time because they observed some good changes with their underperforming friends. Some participants even feel "pressured" and surprised whenever their friends receive prizes. They credit these changes to the candies and prizes and to the provision of materials whenever they do individual and group tasks. This shows that social proof is evident and that making tasks look easy can help underperforming students engage more in Physics.

3.3 Teacher Implementer's Reflections and Experiences on IEPI

From the interview with the teacher-implementer, it was revealed that the class noise became more academic and that more students were engaged with the group activities. He noticed an increase of quantity of outputs and that somehow, there was an improvement in its quality. He also mentions that the lesson schedule was properly adhered, too. Lastly, he says that there was nothing much to say about the high scorers but the number of low scorers decreased.



4. CONCLUSIONS AND RECOMMENDATIONS

Despite the negative connotation associated with persuasion, there are avenues where it can be applied positively like education. IEPI showed to have a significant positive effect on students' pre-test and post-test scores. The study also reveals that motivators like candies and rewards, no matter how simple, are effective in helping students do behaviors they are asked or expected to do. Also, the provision of all learning materials and the proactive use of Filipino really help underperforming students learn, accomplish, and participate in tasks. Lastly, it was revealed that the most effective persuasion principles in improving student performance were reciprocation, liking, social proof, and scarcity.

This study serves as a good takeoff to further look into the following:

- The persuasion principle that has the immediate and/or lasting effect;
- The extent of assistance teachers are willing to provide unmotivated students without turning them complacent or too dependent on outside help; and
- Other avenues that teachers can explore to encourage commitment among students.

5. ACKNOWLEDGMENTS

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