Print ISSN 2094-1064
Online ISSN 2244-0437

Liceo Journal of Higher Education Research
doi: http://dx.doi.org/10.7828/ljher.v15i1.1296

Evaluation of Discrepant Event using Peer Instruction of Junior High School Academic Performance and Learning Engagement in Physics

RIZIA E. RAGMAC
ORCID NO. 0000-0003-4171-0431
aizir1225@gmail.com

LESLEY C. LUBOS
ORCID NO. 0000-0002-8761-3680
lesleyclubos@buksu.edu.ph

Bukidnon State University
Malaybalay City, Bukidnon, Philippines

ABSTRACT

The study aimed to evaluate the academic performance and engagement in Physics of Grade 10 learners taught using Discrepant Event through Peer Instruction. For the test of effectiveness, the topics were delivered to one class group using discrepant events through peer instruction. The study employed the quasi-experimental-one group and pretest-posttest research design. A validated researcher-made academic performance test with 0.7547 reliability was administered as a pretest to one group before the treatment. The data were treated with the mean, standard deviation, and paired t-test at 0.05 level of significance. Generally, the results reveal that the academic performance of the learners in Electricity and Magnetism topics had improved from Highly Not Favorable to Moderately Favorable level using Discrepant Event through Peer Instruction Approach. There was a statistically significant difference between the pretest scores and the posttest scores of Grade 10 learners after using Discrepant Event through Peer Instruction Approach. The Grade 10 learners had a high level of engagement in Electricity and Magnetism topics. The evaluation of the Discrepant Event using Peer Instruction as a teaching approach favors the academic performance and engagement of the Grade 10 learners in Physics.

Keywords: discrepant event, peer instruction, academic performance, learning engagement, favorability

INTRODUCTION

Learner's performance and learning engagement are issues in every classroom. The teachers are faced with the challenge of addressing these while continuing to provide all the learners with quality instruction. These learners have diverse attention, curiosity, interest, and passion in learning, which however extends to the kind of motivation they are learning or being taught. On the one hand, teaching in the majority of today's classroom remains strikingly similar to the teaching conducted before and remains in a conventional way of teaching. Many teachers lack appropriate methods of teaching the subject in Physics to build the type of engagement environments of learners and provide accurate instruction for learners to gain the desired scientific mindset. Also, teachers face disruptive learner's performance daily and must spend time thinking about ways to approach classroom management and then attempt to evaluate its effectiveness.

Motivating learners at the beginning of a lesson is a substantial factor for classroom management because their attention, as well as their focus on the lesson, is disturbed easily by unnecessary things (Gul and Ates, 2017). So, teachers should be able to arouse the interest of their learners and focus on lessons, accordingly, on them. One of the great challenges that teachers have to face today is on how they are going to teach Science lessons. So, the Science lesson and the interest are the main factors that hinder the ideas and learnings of the learners. Longfield (2009) stated that as teachers, they must not only teach learners the concepts in a discipline-specific context, they must also uncover and attempt to overcome learners' misconceptions about teaching and learning.

Many studies (Freeman et al., 2014; Preszler et al., 2007) revealed that traditional teaching methods are not sufficiently effective on learners' problem-solving performance, conceptual understanding, self-efficacy, confidence, and motivation. The result of other studies (Gok, 2015; Shaffer & McDermott, 2005) indicated that many learners especially had difficulties in learning and understanding the fundamental concepts of Physics. Therefore, the researchers (Beatty, 2004; Bretzmann, 2013; McCreary et al., 2006; Caldwell, 2007) have been developing new teaching approaches and models based on active and interactive learning for a long time. One of these approaches is peer instruction.

This may be the reason that Discrepant Event Approach may be possible for peer instruction, so that the leaners may be comfortable in sharing their prior knowledge on specific scenarios. Some individuals do not feel comfortable participating in a group setting. Since collaborative learning generally grants the students more control over the flow of information, there is the possibility that

the focus of the instruction may veer from its intended course; problems may result if group members cannot agree or will not compromise. It can often be difficult to assemble all members of a particular group at the same time, especially in a distance-learning environment, and the abundance of information that a group generates can prove to be hard to compile individually (Bishnoi, 2017).

The main point is that directly challenging learners' naïve ideas will lead to more quality science learning in the classroom. With the statements stated above, there is a possible positive outcome to the use of the discrepant event, especially in science lessons. An effective way to use such kind of strategy is to motivate the learners and to ask what could happen before the demonstration, emphasizing that the right answer is what it seeks in the lesson but asking the learners to think broadly. Thinking broadly together with peers makes meaningful inquiry learning. Such strategy might be useful to the set of inquiry skilled learners in Marcelino C. Regis Integrated School for their Electricity and Magnetism subjects.

FRAMEWORK

Discrepant Event is considered to anchor on Festinger's (1957) theory called Theory of Cognitive Dissonance. According to this theory, the existence of cognitive dissonance or inconsistency creates a psychological discomfort that will motivate a person to reduce the dissonance and actively seek consonance or mental equilibrium. Discrepant event is likewise anchored on the theory of Constructivism by John Dewey (1938). This theory advances that learning occurs through experience. The peer instruction is anchored on Social Learning Theory theorized by Albert Bandura (1977), which posits that people learn from one another via observation, imitation, and modeling. The theory has often been called a bridge between behaviorist and cognitive learning theories because it encompasses attention, memory, and motivation.

Inquiry-based learning also serves as the umbrella of the study for this learning and teaching method prioritizes learner's questions, ideas, and analyses (Guido, 2017; Pappas, 2014). To highlight the pedagogy's distinction on this matter, it is important to define inquiry-based learning from both learners' and teachers' perspective. From a learner's point-of-view, inquiry-based learning focuses on investigating an open question or problem. There must this evidence-based reasoning and creative problem-solving to reach a goal and conclusion, which they must defend or present. From a teacher point-of-view, this inquiry-based teaching focuses on moving and bringing learners beyond general curiosity into

the realms of critical thinking and understanding. The teacher encourages the learners to ask questions and support them through the investigation process, understanding when to begin and how to structure an inquiry activity.

Discrepant Event using Peer Instruction is in line with the methods as guided research, document analysis, and question-and-answer sessions. The teacher can run inquiry activities in the form of case studies, group projects, research projects, field work, especially for science lessons, and unique exercises tailored to students. Whichever kind of activity is used, it should allow learners to develop unique strategies for solving open questions. Thus, this building skill can help learners reach a high level of thinking, inquiry-based learning that will help improve the performance of the learners (Guido, 2017).

Peer instruction is an interactive teaching strategy based on constructivist learning theory and social constructivism. Yaoyuneyong & Thornton (2011) pointed out that constructivist environments are designed to both challenge and support learners' thinking process and to facilitate active learning, whereby learners can discover from themselves rather than easily receive the facts, concepts, and principles in the question.

Figure 1 shows the schematic diagram showing the parameter of the study. It presents the visual presentation of the relationship among variables and how they interact with each other, and this includes teaching using discrepant event approach through peer instruction. The first box on the left contains variables of the problems. It indicates the strategy used, a Discrepant Event approach developed by Alfred Friedl with discrepant event approach for Electricity and Magnetism as used in the study and the use of conventional method (using K to 12 Science Modules); while the second box on the right side contains the variables that show the approach measured in the implementation of the teaching strategy which includes the academic performance and learning engagement in Science.

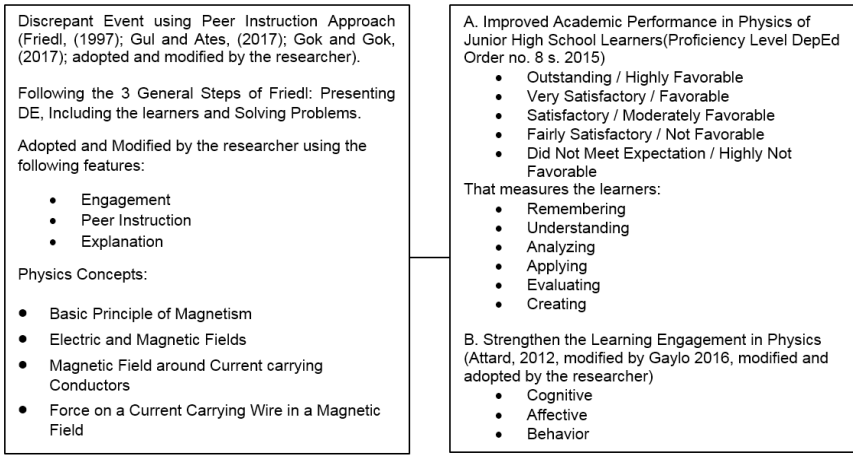

Figure 1. Schematic Diagram Showing the Parameter of the Study

OBJECTIVES OF THE STUDY

This study assessed the effects of the discrepant event using peer instruction approach to academic performance and learning engagement of Junior High School learners in Physics. This study was being conducted at Marcelino C. Regis Integrated School of Ozamiz City Division for the school year 2018-2019. Specifically, these are the objectives of the study: (1) Identify the significant difference between the pretest scores and the posttest scores in Academic Performance in Physics of Junior High School learners using a discrepant event approach through peer instruction; (2) Determine extent of favorability of the discrepant event using peer instruction application to Physics lessons of Junior High School learners; and (3) Give the academic performance and learning engagement level in Physics of Junior High School learners using Discrepant Event through peer instruction approach.

METHODS

This study used one group pre-test - post-test quasi-experimental research design to evaluate the effectiveness of discrepant events using peer instruction in teaching Physics to the academic performance and learning engagement of Junior High School learners. The three motivated stages of the instructional development of the ADDIE model (Simbulan, 2011) were the process used

in the conduct of this study. The stages are the following (a) Pre-Development Stage; (b) Development Stage; and (c) Post Development Stage.

The design utilized one intact or whole class. This class was taught a discrepant event approach using peer instruction with the instructional materials and classroom instructions. This group was given a pre-test before the conduct of the study and post-test after the implementation of the developed lessons. The answers of the learners in the pre-test assessed the previous or current knowledge of the students in Physics. The pre-test served as the covariate of the study for this group. This result was necessary to determine the difference in the learners' examination performance of the lessons.

The researcher developed the lesson that contained the learning competencies, objectives, concepts, and references. The lessons were basically based on the K to 12 Curriculum. The four lessons that were made, developed, and validated are on the 'Basic Principles of Magnetism'; 'Electric and Magnetic Fields'; 'Magnetic Field around Current carrying Conductors'; and 'Force on Current carrying wire in a Magnetic Field' which were used and structured in accordance to the treatment necessary in the study. Furthermore, the development of the lessons involves three stages of development adopted from Seels and Glasgow (2000) with modification from Simbulan (2011).

RESULTS AND DISCUSSION

This study evaluates the effectiveness of Discrepant Event using peer instruction on learner's academic performance and engagement in Physics from the data gathered. To determine the favorability result of the discrepant event using peer instruction to physics lessons, paired t-test was used at 0.05 level of significance. Table 1 shows the summary in the learners' pretest scores and posttest scores.

Table 1

T-test analysis on the difference in the learner's academic performance in Physics

Academic Performance	N	Mean	Standard Deviation	P
Pretest	32	9.750	2.615	0.000
Posttest	32	22.781	4.612	p<0.000
Difference	32	-13.031	4.987	

95% CI for mean difference: (-14.829, -11.233)
t-Test of mean difference = 0 (vs not = 0): T-Value = -14.78 P-Value = 0.000

The increase of scores in the posttest show that the learners performed better after they were taught using discrepant event through peer instruction approach. The p-value means lower than the alpha level which was set at 0.05 level of significance. This indicates a significant difference in the mean scores between the pretest and posttest. Based from the findings, there is a significant difference in the pretest and posttest in the academic performance in Physics of Junior High School learners and the favorability result of the posttest mean score signifies moderately favorable of the teaching-learning process using discrepant event through peer instruction approach.

As revealed, the learners' scores increased in the posttest. The mean shows that the learners performed better after using the designed materials. Though its result presented moderately favorable, favorability on the increase of the mean from pretest to posttest favors the materials. The standard deviation shows a slight dispersion of learners' scores. The greater standard deviation result shows that posttest scores are spread out. This means that the learners understanding in the lesson vary after the implementation of the intervention of the lesson. The pretest low standard deviation results indicate that the learners have the same level of understanding prior to the lesson proper.

The findings are parallel to the earlier results of the research conducted by Gul and Ates (2017) and Gok and Gok (2017). The researchers also sought to evaluate the favorability of the discrepant event through peer instruction approach. The statistics analysis and findings suggest that the used of this teaching-learning approach lessons moderately favors to the study. Learners taught using discrepant event through peer instruction are strongly motivated, conditions are favorable for learning (Matthews, 2016; Gonzales-Spada et al., 2010; Wiebe, 2009).

The results support the previous research conducted by Mancuso (2010) and Longfield (2009) on the positive effects of using discrepant event demonstrations in science instruction as a way to strengthen student-led scientific investigation and increase students interest and engagement in learning science. Michinov et al. (2015) indicated that peer instruction is based on a social constructivist approach to learning, in which social interaction plays a crucial role in the construction of knowledge, and where discussion and collaboration between peers have a positive impact on learning. Thus, these lead to increase the posttest mean score result of the academic performance of the learners.

On the other hand, on the result of the posttest, most of the learners were not able to reach the highest level of the academic performance. This supports the study of Taylor (2014) and Abbot (2016) that stated that if the learner has a

low understanding of the terms used in the Physics lesson, then it will be difficult for him to comprehend and answer the achievement test. Their study proposed to develop district implementation of alternative, locally-developed assessment designed as an intervention to enhance and measure teaching and learning.

Table 2

Learner's Academic Performance in Physics

Score Range	Level of Proficiency	Frequency Scores Pretest		Posttest	
		F	%	F	%
28-30	Outstanding/Highly Favorable	0	0%	2	6.25%
25-27	Very Satisfactory/Favorable	0	0%	10	31.25%
22-24	Satisfactory/Moderately Favorable	0	0%	14	43.75%
19-21	Fairly Satisfactory/Not Favorable	0	0%	0	0%
0-18	Did Not Meet Expectation/Highly not Favorable	32	100%	6	18.75%
	$\bar{x}$	9.750		22.781	
	sd	2.615		4.612	
Favorability Level		Highly Not Favorable		Moderately Favorable	

Table 2 shows the result of the pretest and posttest scores of the Grade 10 learners. Based on the achievement description, the pretest mean scores of the Grade 10 learners got 'Did Not Meet Expectation' or 'Highly Not Favorable' to the teaching process of the lesson. It means that the learners have less understanding; prerequisite and fundamental knowledge and skills have not been acquired or developed adequately to aid understanding. However, as in their posttest mean scores, they obtained high scores and attained the moderately favorable performance level. The standard deviation indicated that the pretest score of the learners in this group are closer to the average scores with that of the posttest score. A high result in standard deviation in posttest means that the scores are spread out.

The frequency and percentage of pretest scores show that before the conduct of the study, the participants in Grade 10 learners had least mastered the concepts behind Electricity and Magnetism. Pretest results indicate that the learners have poor favorability in the level of proficiency scores. The result suggest for the approach that will aid the improvement of the leaners' academic performance. It

can be implied that when the teachers may not incorporate effective approach in teaching and learning process, learners' academic performance would be on the same level, which is low.

Result signify that the use of discrepant event through peer instruction in teaching Electricity and Magnetism increases the learner's academic performance significantly higher than the pretest result. Though the approach has no comparison on the way of teaching, but the results show that there is increases of their pretest mean score to their posttest mean score. The result corroborates with the study conducted by Alcid (2014) wherein the researcher found that discrepant event through peer instruction increases the learners engagement in the lesson as well as their performance in the lesson. These results are also in conformity with the findings of Huitt et al. (2009) who disclosed that the factors improving the learners' performance is affected by the teaching learning process such as discrepant event using peer instruction more specially in teaching science.

The study examined the engagement of learners in Physics when taught with discrepant event through peer instruction approach. To determine the engagement in Physics of Grade 10 Junior High School Leaners, pretest and posttest means and standard deviations of the engagement scaled were obtained, analyzed and compared.

Table 3

Learner's Over All Engagement in Physics

Engagement	Pretest			Posttest		
	Mean	Standard Deviation	Qualitative Description	Mean	Standard Deviation	Qualitative Description
Cognitive Engagement	2.20	0.446	Rarely	3.73	0.370	Sometimes
Affective Engagement	3.37	0.644	Sometimes	4.39	0.321	Often
Behavioral Engagement	2.85	0.601	Rarely	4.61	0.384	Often
Over-all Engagement	2.81	0.444	Rarely	4.24	0.290	Often

Legend: A = Always, O = Often, S = Sometimes, R = Rarely, N = Never

Table 3 presents the over-all engagement in Physics of Grade 10 leaners before and after the conduct of the study. Results indicate that before the conduct of the study, the learners had an average engagement or almost satisfied engagement based from the mean pretest scale. The standard deviation in the pretest shows that the answers of the learners were more dispersed. It means that they have

different engagement involvement prior to the lesson conducted.

On the contrary, posttest results reveal that after the conduct of the study engagement of this group were high or satisfied very adequately. The posttest mean of the learners' responses were high as compared to the pretest response. There is a significant increase in every level of engagement (cognitive, affective, and behavioral). It could be inferred that with the use of discrepant event through peer instruction, there is an increase in the learners' engagement in Physics.

The result substantiate the notable findings of Kuh (2007), Coates (2009), and Coleman (2001) that learners who are engaged obtain higher score because they participate in the learning process with connection on how the teacher facilitate the lesson. The learners are engaging more in the activities and learning process, which leads to a range of measurable outcomes. Results in the engagement substantiate the findings that the more engaged the learners in the lessons, the better they will achieve. Furthermore, the engagement results imply that the leaners taught with discrepant event through peer instruction got higher mean posttest achievement scores compared to their pretest mean scores because they are more engaged.

The results are evident also to the studies of Durik & Harackiewicz (2007) and Corso et al. (2013), that learners are more likely to become engaged in an activity if they have a personal interest in the subject. They are motivated when they "are moved to do something." Discrepant event somehow motivated the learners which increased their engagement to science lessons. Having observed the learners' eagerness to leap into the answers of their confusions on how an event happen as it did, the teacher researcher established a time-out step midway through the problem solving process. This modification allows learners to reflect on prior knowledge after they've had a chance to manipulate the materials. Thus, engagement is built on this process, leading to the increase in learning.

In addition, the majority of the learner's engagement is concerned directly or indirectly with improving learners' learning. Learning engagement is critical to examination performance and providing learners with understanding, knowledge, skills, and confidence to move on into next learning process. Engagement of the leaners can make a difference to performance and foster in learners a sense of inclusion and self-respect. With these indicators of the effectiveness of the study, it is highly recommended that implementation of the strategies be sustained in the school.

CONCLUSIONS

The use of Discrepant Event through Peer Instruction Approach is sufficiently adequate. It makes the learners more interactive to engage in the lessons and address difficulty aspects of the materials in peers to foster individual construction of their understanding. The use of Discrepant Event through Peer Instruction in teaching Electricity and Magnetism is favorable to the academic performance of the Grade 10 Junior High School learners. The learners develop their fundamental knowledge and understanding of the Electricity and Magnetism concepts. The use of Discrepant Event through Peer Instruction in teaching Electricity and Magnetism improved the academic performance of the Grade 10 Junior High School learners and made the learners more engaged, inspired, arouse curiosity, motivated, interested, and stimulated intellectual development in learning Physics concepts in terms of cognitive, affective, and behavioral aspects.

RECOMMENDATIONS

Based on the findings and conclusions of the study, the following recommendations were derived and drawn:

1. A similar study may be developed using Discrepant Event through Peer Instruction Approach in teaching Science with two groups to further provide a sound basis for the effectiveness of Discrepant Event through Peer Instruction Approach in the teaching and learning process;

2. The School Administrators and the Department of Education officials may encourage the Science Teachers to use Discrepant Event through Peer Instruction in teaching Science in the K to 12 Curriculum, by conducting in-service training. Training involves the development of the instructional materials using the discrepant event through the peer instruction approach; and

3. Teachers are encouraged to use Discrepant Event through Peer Instruction Approach as a supplementary tool in teaching Science Lessons to help improve the Learners Performance.

LITERATURE CITED

Alcid, L. (2014). *The Use of Discrepant Events for Conceptual Development*. 41 Mabait St., Teachers' Village, Quezon City. Retrieved on May 15, 2018 from National Conference on Best Practices in Teaching & Learning Science and Mathematics, UP NISMED, Diliman Quezon City.

Bandura, A. (1977). *Social Learning Theory. New York: General Learning Press*. Retrieved on March 13, 2019, from https://www.learning-theories.com/social-learning-theory-bandura.html.

Beatty, I. (2004). *Transforming student learning with classroom communication systems*. EDUCAUSE Center for Applied Research (ECAR) Research Bulletin, 3, 1-13. Retrieved on September 14, 2018 from https://library.educause.edu/resources/2004/2/transforming-student-learning-with-classroom-communication-systems.

Bretzmann, J. (2013). *Flipping 2.0 practical strategies for flipping your class*. New Berlin, WI: The Bretzmann Group. Retrieved on September 14, 2018 from https://scholar.google.com.ph/.

Caldwell, J. E. (2007). *Clickers in the large classroom: Current research and best-practice tips*.CBE-Life Sciences Education, 6, 9-20. Retrieved on September 14, 2018 from https://www.lifescied.org/doi/abs/10.1187/cbe.06-12-0205.

Corso, M. J., P.H.D., Bundick, M. J., P.H.D., Quaglia, R. J., E.D.D., & Haywood, D. E. (2013). Where student, teacher, and content meet: Student engagement in the secondary school classroom. *American Secondary Education, 41*(3), 50-61. Retrieved on September 19, 2018 from https://search.proquest.com/docview/1431533440?accountid=149218.

Dewey, J. (1938). *Logic the Theory of Inquiry*. New York Henry Holt & Comapany, Inc. Retrieved on March 13, 2019, from https://archive.org/stream/JohnDeweyLogicTheTheoryOfInquiry/%5BJohn-Dewey%5D-Logic-The-Theory-of-Inquiry-djvu.txt.

Durik, A. M., & Harackiewicz, J. (2007). Different strokes for different folks: How individual interest moderates the effects of situational factors on task interest. *Journal of Educational Psychology*, 597-610. Retrieved on May 17, 2018 from https://scholar.google.com.ph.

Freeman, S., Eddy, S. L., McDonough, M., Smith, M. K., Okoroafor, N., Jordt, H., & Wenderoth, M. P. (2014). Active learning increases student performance in science, engineering, and mathematics. *PNAS, 111*(23), 8410-8415. Retrieved on September 1, 2018 from https://scholar.google.com.ph.

Friedl, Alfred E. (1997). *Teaching science to children: An integrated approach (4th ed)*. New York: McGraw-Hill. Retrieved on April 27, 2018 from https://trove.nla.gov.au/work/7395979.

Gok, T. (2015). An investigation of students' performance after peer instruction with stepwise problem-solving strategies. *International Journal of Science and Mathematics Education, 13*, 561-582. Retrieved on September 2, 2018 from https://scholar.google.com.ph.

Gok, T. and Gok, O. (2017). Peer Instruction: An evaluation of its theory, application, and contribution. *Asia-Pacific Forum on Science and Teaching*, *18*(2), Article 9, p1-2. Retrieved on July 23, 2018 from https://www.eduhk.hk/apfslt/v18_issue2/gok/page2.htm.

González-Espada, W. J., Birriel, J. & Birriel, I. (2010). Discrepant Events: A Challenge to Students' Intuition. *The Physics Teacher, 48*. 507-511. Retrieved on September 15, 2018 from https://aapt.scitation.org/doi/abs/10.1119/1.3502499.

Guido, M. (2017). *All About Inquiry-Based Learning: Definition, Benefits and Strategies*. Prodigy Blog Updates. Retrieved on February 19, 2019 from https://www.prodigygame.com/blog/inquiry-based-learning-definition-benefits-strategies/.

Gül, K. S., & Ateş, H. (2017). Science teachers' perceptions toward discrepant events applied in science education. A*sia - Pacific Forum on Science Learning and Teaching, 18*(2), 1-28. Retrieved on July 17, 2018 from https://search.proquest.com/docview/2055193792?accountid=149218.

Huitt, W., Huitt, M., Monetti, D., & Hummel, J. (2009). *A systems-based synthesis of research related to improving students' academic performance*. In 3rd International City Break Conference sponsored by the Athens Institute for Education and Research (ATINER), October (pp. 16-19). Retrieved on May 15, 2018 from https://scholar.google.com.ph.

Kuh, G. (2007). *How to Help Student?* Retrieved May 16, 2018, from http://www.heacademy.ac.uk/sites/default/files/studentengagement_1.pdf.

Longfield, J. 2009. "Discrepant Teaching Events: Using an Inquiry Stance to Address Students' Misconceptions." *International Journal of Teaching and Learning in Higher Education, 21*(2): 266-271. Retrieved on September 14, 2018 from http://www.isetl.org/ijtlhe/pdf/IJTLHE732.pdf;https://digitalcommons.georgiasouthern.edu/ct2-facpubs/3.

Mancuso, V. J. (2010). *Using discrepant events in science demonstrations to promote student engagement in scientific investigations: An Action Research Study*, PhD thesis, Warner School of Education and Human Development University of Rochester, Rochester, New York. Retrieved on May 15, 2018 from https://search.proquest.com/docview/756263944?accountid=149218.

Matthews, M. (2016). *Discrepant Event Science in the Classroom*. Educational Innovations Inc.. Retrieved on April 28, 2018 from http://blog.teachersource.com/2016/09/09/discrepant-event-science/.

McCreary, C. L., Golde, M. F., & Koeske, R. (2006). Peer instruction in the general chemistry laboratory: Assessment of student learning. *Journal of Chemical Education, 83*(5), 804- 810. Retrieved on September 14, 2018 from https://pubs.acs.org/doi/abs/10.1021/ed083p804.

Michinov, N., Morice, J., & Ferriéres, V. (2015). *A step further in peer instruction: Using the stepladder technique to improve learning*. Computers & Education, 91, 1-13. Retrieved on August 26, 2018 from https://www.researchgate.net/publication/312304124_A_step_further_in_Peer_Instruction_Using_the_Stepladder_technique_to_improve_learning.

Pappas, C. (2014). *Instructional Design Models and Theories: Inquiry-based Learning Model*. eLearning Industry. Retrieved on February 25, 2019 from https://elearningindustry.com/inquiry-based-learning-model.

Preszler, R. W., Dawe, A., Shuster, C. B., & Shuster, M. (2007). Assessment of the effects of student response systems on student learning and attitudes over a broad range of biology courses. *CBE-Life Science Education, 6*, 29-41. Retrieved on September 2, 2018 from https://scholar.google.com.ph.

Shaffer, P. S., & McDermott, L. C. (2005). A research-based approach to improving student understanding of the vector nature of kinematical concepts. *American Journal of Physics, 73*(10), 921-931. Retrieved on September 2, 2018 from https://scholar.google.com.ph.

Simbulan, S.A. (2011). *Resource Material on Creative Communication Techniques*. Malaybalay City.

Taylor, S. (2014). *Reviewing the language compensation policy in the national senior certificate*. Perspectives in Education, 32(1), 120-137. Retrieved on September 5, 2018 from https://search.proquest.com/docview/1566313163?accountid=149218.

Wiebe, G. (2009). *Tip of the Week – Visual Discrepant Event Inquiry*. History Tech. Retrieved on April 28, 2018 from https://historytech.wordpress.com/2009/02/27/tip-of-the-week-visual-discrepant-event-inquiry/.

Yaoyuneyong, G., & Thornton, A. (2011). Combining peer instruction and audience response systems to enhance academic performance, facilitate active learning and promote peer- assisted learning communalities. *International Journal of Fashion Design, Technology and Education, 4*(2), 127-139. Retrieved on September 4, 2018 from https://scholar.google.com.ph.

ACKNOWLEDGMENTS

The completion of this undertaking could not have been possible without the participation and assistance of so many people whose names may not be enumerated. Their contributions are sincerely appreciated and gratefully acknowledge. However, the researchers would like to express their deep appreciation and indebtedness particularly to Bukidnon State University and the School Division of Ozamiz City.