The Effect of Project Based Learning on the Academic Achievement of At-Risk Advanced Placement Students.

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Abstract

The purpose of this study was to examine whether project-based learning would increase academic achievement for at risk students. The null hypothesis was at-risk students in an advanced placement psychology class will not have an increase in academic achievement through the use of the project based learning strategy.The study used a pre-experimental design method. A 10 multiple choice pre-assessment was used to determine a base line for how much students' know before each lesson started. There were six pre-assessments used in each unit of study; five multiple choice tests and one constructed response. In order to determine whether academic achievement occurred after the intervention was administered. The instrument used was a post-assessment which consisted of 50 multiple choice questions and one constructed response. The study began on February 1st, 2016 and concluded on March 11th, 2016. The results of the study were compared to data gathered from that time period also. There was a significant improvement recorded for the use of project-based learning on the academic achievement of at-risk students in an advanced placement psychology setting. Therefore the null hypothesis that at-risk students in an advanced placement psychology class will not increase academic achievement after the project-based strategy was implemented was rejected. Since the study was only over a month and a half time period. Future research on these areas could involve a much longer time period to obtain more reliable data on the effects of project-based learning increasing academic achievement.

CHAPTER I

INTRODUCTION

This study was designed to explore the effect problem-based learning would improve at-risk student achievement on unit assessments. The study took place in a 12th grade Advanced Placement Psychology classroom in a northwest Baltimore high school.

The investigator, who teaches classes in Advance Placement Psychology, observed a decrease in student scores on chapter assessments as the year progressed. Students' test scores on chapter assessments started to decline as the year progressed. Most students started to fail chapter assessments; participation, and motivation also decreased. Congruently, students' academic achievement appeared to decrease as well.

In reviewing research on ways to improve academic achievement, the researcher examined the work of Cheng, Shui-fong, and Chan (2008). Their research focused on Project-Based Learning (PBL) as an instructional approach that argues for the practical experience in learning. The PBL strategy argues for self-directed learning, by students working together on small tasks forcing students' working memory to retain information because of its active component for students to rehearse or solve problems using information. For instance, students will do well on tests because of the parallelism between the group work, class instruction and the assessments are all linked to the same cognitive level. In so doing, the investigator rationalized that students will make a connection with what they learned in groups to what is on the exam.

The research question became 'Will Project Based Learning (PBL) increase at risk Advanced Placement students to achieve an 85% or better on chapter assessments?' The investigator considered the typical learning styles, interests, and limitations of students, and intervened with resources by building those into instruction. By using the PBL strategy in class,

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it is documented that low achievers when paired with higher achievers will improve their performance by 50% (Cheng et al., 2008). For example, small project-based groups are essential to student achievement because students actively process information, create cognitive conflicts, and obtain additional information amongst their peers (Webb, 2008).

There is also research to support the use of authentic assessment increasing student achievement. According to Rawson and Dunlosky (2012), numerous practice tests is a well established strategy for improving student learning. For example, incorporating practice tests within the class, practice tests have shown to be durable and an efficient way for students to understand and learn the content because they have a means to correct what they did not know. According to Hill, Larsen & NCRVE (1992), the use authentic assessment manages, monitors and evaluates student learning.

Statement of the Problem

The purpose of the study is to explore the effects of Problem-Based Learning on increasing at-risk student academic achievement on chapter assessments.

Hypothesis

At-risk students in an Advanced Placement Psychology class will not display an increase in academic achievement on chapter assessments after the problem-based strategy is introduced.

Operational Definitions

Achievement

Achievement is defined by an approach that determines specific content domains of achievement (e.g. reading, biology, history) and of typical behaviors (socio-emotional behaviors, personality); experts decide which content must be acquired as a result of a curriculum, and other experts design instruments that measure the level of acquisition of this

knowledge and children's skills. Achievement relates specifically to what students know, and how they are able to solve problems, as a result of instruction (Alexander, 2005).

In the beginning of the study the investigator created a pre-assessment that students took before they encountered new learning. The instructor created PBL groups with high achievers and low achievers in order to allow open dialogue between students. The purpose was Vygotskian in nature, to allow high achievers to help low achievers understand lesson content by creating cognitive conflicts. The purpose of the study was to also have at-risk students' increase their scores on chapter assessments. Within the PBL groups, students had worksheets created by the investigator that had essential and scaffolding questions for students to analyze by using resources to come up with an answer. Students worked together in groups in order to discuss their findings and incorporate new knowledge onto their worksheets. Post-assessments were taken by students after the PBL strategy was implemented in order to check for an increase in academic achievement.

Assessment

Pre- and post-tests designed by the investigator were administered to obtain a snap shot of student achievement between pre and post-test; after the project-based learning strategy has been implemented.

Problem Based Learning

The problem based learning (PBL) strategy can be defined as an instructional approach that argues for the importance of practical experience in learning. The PBL strategy also works as a collaborative working environment, which challenges students on a high practical and analytical level Cheng et al., (2008).

<u>At-Risk</u>

       At-risk students for the definition of this paper are students who have a higher probability of failing academically or dropping out of a challenging class or school. The investigator has about 35 students within his Advanced Placement Psychology class that is at risk of failing the class and College Board exam.

CHAPTER II

REVIEW OF THE LITERATURE

This literature review is on Project-Based Learning, student achievement, obstacles to student achievement, and interventions for student achievement. The first section defines student achievement and Advanced Placement; it will discuss what student achievement looks like, and how it is measured in an Advanced Placement Psychology classroom. The second section discusses obstacles to student achievement for at risk students. The third section describes interventions to increase student achievement, such as project based learning and authentic assessment.

Student Achievement

When examining achievement of Advanced Placement 11th-12th grade high school students, it is important to understand what achievement and advanced placement is. According to Alexander (2005), educational assessment and educational achievement are tied together. Measuring how we think and learn cannot be directly observed like behavior, but are assessed through a series of tests or IQ scales. According to DeGoede (2004), achievement is defined by an approach that determines specific content domains of achievement (e.g. reading, biology, history) and of typical behaviors (socio-emotional behaviors, personality); experts decide which content must be acquired as a result of a curriculum, and other experts design instruments that measure the level of acquisition of this knowledge and children's skills. Since the two definitions tend to agree on how schools define achievement, there is an explanation necessary within the definitions to better define what achievement looks like within the classroom.

According to Alexander (2005), 'Achievement' relates specifically to what students know, and how they are able to solve problems, as a result of instruction. There are two types of

knowledge students are assessed upon in order to determine whether they have achieved the learning outcome. According to Alexander, the two types of knowledge students are assessed on are declarative knowledge and procedural knowledge; which is labeled as domain specific knowledge. Declarative knowledge includes our knowledge of concepts, facts, and details. Procedural knowledge is knowing how to apply declarative knowledge. For example, when we adjust the knob on a microscope to focus our view on a certain part of a cell, we use our procedural knowledge.

Since assessments are tied to defining what achievement is, the definition of assessment is given. According to DeGoede (2004), an assessment is focused on "maximum and typical performance", on the child's intelligence, aptitude, school achievements, and typical behaviors (p. 1). Assessment refers to gathering and integrating relevant diagnostic information about the child's behaviors so as to help him or her. Assessments contain deciding, problem solving, information gathering and integrating, helping, constructing a whole picture of the child's behaviors, and using teachers, parents, peers, and the child as sources of information. More information of how an assessment should be structured in order to allow students to achieve in an advanced placement class is given in the third section titled 'interventions".

In order to understand how a student should achieve in an Advanced Placement (AP) course, a description of the AP and its purpose is provided. According to Coleman (1977), the AP program is an activity of the College Entrance Examination Board. Its goal is to help meet the needs of secondary school's able, ambitious, and talented students by providing them with stimulating and demanding college-level instruction in one or more of 13 subjects. The AP Program offers high school students an opportunity to take specially designed and rigorous

courses, complete an examination based on the content of the course, and receive college credit (Miller, 2009).

It is a belief that an AP class is only for gifted students. The term "gifted students" is a social construction, an invention not a fact of nature (Borland, 2008). According to Borland, the social construction of gifted students came at the scores of IQ tests, of which psychologists deemed "intelligent" based upon IQ's above a certain cutoff. Borland, claimed that the term "giftedness" means a high general intelligence and that IQ tests measured this reliably. Coleman (1977), states that the AP program is not limited to students with the highest IQs. Rather, it is designed for, and should be available to any good student who is genuinely motivated and willing to work hard.

According to Coleman (1977), the AP examinations contain both multiple-choice and free-response questions requiring essay writing and problem solving; most exams are three hours long. The examinations are revised each year by committees of school and college teachers who are specialists in the field. The committees are assisted by test experts at the Educational Testing Service. At the end of the year, students have the opportunity to earn college credit by taking the advanced placement test; if students pass the AP test within the range of 3-5, they can receive 3 college credits and are permitted to skip courses in college.

Although the AP Program was developed in the 1950s, African American students did not benefit until the 1980s (Miller, 2009). African American students accounted for 14% of the overall high school student population in 2007; over 7% (7.4%) of those taking AP examinations were African American in 2007. Over 3% (3.3%) of those who made a score of 3 or higher were African American. By comparison, the 4th Annual College Board Report to the Nation indicates

that Latino students are 14.6% of the high school student population, and 13.6% of the Latino students scored 3 or higher.

Obstacles to Student Achievement

The obstacles to student achievement can be numerous, however for this study it would be impossible to assess and evaluate them all. There are a few obstacles that may prevent students from achieving in an AP classroom. AP classrooms can range from all across the cognitive and socio-economic spectrum. As noted before, any student can take an AP class, as long as they are committed to work hard (Coleman, 1977). Again, students come into the classroom with different cognitive, learning, and motivational abilities. Students come into the classroom with different studying, strategic skills, and learning habits that are not on a college level. A major obstacle to student achievement within an AP classroom can also be cultural and low socioeconomic status (Carter, 2008).

Students within the low socio-economic spectrum tend to be minorities within the United States; these minority students are labeled at-risk. Projections indicate that by 2020, these racial and ethnic minority groups will represent 39% of the total population, though some predict that they will constitute almost half of the population. Thus, minority students are disproportionately represented in public schools (Carter, 2008). Poverty status is an indicator of being "at-risk" in school, because poverty is known to influence a child's mental, behavioral, and educational development. About 16% of all families with children under 18 residing in the United States live in poverty. Furthermore, poverty intersects race and ethnicity; certain racial and ethnic minority groups are more likely to live below the poverty line. Overall, the percentage of children living in poverty was higher for Blacks, Native Americans/Alaskan Natives, Latinos, and Native Hawaiian or other Pacific Islanders. According to Carter, at-risk students have a probability of

scoring lower on standardized tests. Carter states, at-risk students' social and educational behaviors are attributed to contextual factors such as their families' economic background. Further, certain family structures are at risk for having less availability to economic resources than others and thus are at risk for providing a home environment believed to be less conducive to strong student achievement.

According to Gardiner (2004), culture plays a huge role in academic achievement. Pedagogical models and practices tend to be culturally embedded. Within the United States, Gardiner claims that curriculum, testing and assessments are Eurocentric. Gardiner uses the Cultural Difference Theory to argue her point; the theory maintains that schools in the United States are based on the majority (European American) culture, which differs in many ways from the minority cultures; these cultural differences interfere with the learning of these students and affect their motivations to do well. Culture has been found to play a critical role in educational achievement in cross-cultural and cross-ethnic studies. Significant differences in educational achievement have been reported among students from different countries as well as among different ethnic groups within the United States. Gardiner, claims that compared with many other countries, the United States has a wide range of ethnic groups that share within-group backgrounds, languages, values, beliefs, thinking, and norms of behavior. Gardiner further argues that research has shown that some ethnic minority groups of students (e.g., African Americans, Hispanic Americans) achieve below the national average of all students. One exception is the high educational achievements demonstrated by Asian American student. Gardiner, claims that minorities and students of low-socio economic background suffers the most as she provides evidence by referring to the documentation data in standardized achievement test scores, grades, high school graduation rates, dropout rates, and other measures of educational

achievement. Gardiner does cite despite the reported patterns, there are high achievers within minority groups.

Apart from the cultural difference theory in the United States, Gardiner (2004) notes that values and beliefs do take a hold within certain ethnic groups in the United States. According to the author it is the pragmatic belief in high achieving students that education will better their chances at getting a good paying job and increasing social conditions. In a study conducted by Gardiner (2004), it was found that African American and Hispanic American students did not believe that doing poorly in school would hurt their chances for future success. Asian American and European American students, on the other hand, were more likely to believe that academic success would have a significant payoff. These different beliefs among various ethnic groups affect their behaviors related to education.

Besides cultural, race, and low economic status being obstacles to student achievement, there is also the obstacle of higher order cognitive process. According to Alexander (2005), cognitive process contains three sub-sections domain specific knowledge, procedural knowledge and strategic knowledge. The obstacle to overcome is the different levels of information processing students are on. There is an important concept in the cognitive process that deals with dual channels (auditory and visual). Each channel has a limited capacity, and that learning is an active process of filtering, selecting, organizing and interpreting information (Mayer, 2008). According to the information/cognitive process, there are specific strategies to make sure students are retaining content in all three types of memory stores: sensory, working and long-term memory. The instructor must find strategies to target different learning channels, in order for students to be able to select, organize and interpret information.

Interventions

Interventions to overcome obstacles to student achievement are using the strategies to target different ways of processing information, Project-Based Learning (PBL), and practice with standardized tests. In order for students to retain domain specific knowledge, and have the ability to recall specific information; strategies such as concept mapping and think-aloud procedures should be implemented (Alexander, 2005). Concept mapping allows students to organize factual knowledge, and shows understanding and relation between many different concepts- declarative to procedural knowledge. Alexander claims that novice learners must make connections to see how they got to a specific conclusion.

Project-Based Learning (PBL) is an instructional approach that argues for the importance of practical experience in learning (Cheng et al., 2008). PBL is a powerful strategy that promotes self-directed learning. PBL is an active learning strategy. Active learning is an effective way for students to cognitively process their thinking. Active learning causes the student to be engaged, self-reflect, and attains the knowledge by participating and contributing to the group (Yow, 2012). In PBL students work on academic tasks in small groups; the task can be in form of an investigation or research on a specific topic (Cheng et al., 2008). Group members collaborate with one another to produce a collective outcome over a designated period of time. In Project-Based Learning, knowledge is constructed through social interactions. Again, PBL is an active learning, constructivist and collaborative type of learning. Therefore, PBL forces students working memory to retain the information because of its active component for students to rehearse or research or solve a problem using the information (Kamp, Dolmans, Berkel & Schmidt, 2012). PBL allows students to grasp a practical sense of the information after learning

new information. This leads students to find answers to real world problems through the use of PBL (Barber, King, & Buchanan, 2015).

By using the Project-Based Learning strategy in class, it is documented that low achievers when paired with high achievers will improve their performance by 50% (Cheng et. al. 2008). In order to assimilate new values and beliefs with minorities about trusting their peers, it is important to create a sense of community. Students tend to do better with peer support for academic achievement. In some cases, peer influence is even greater than parent influence. In a 1992 study with adolescents, Gardiner (2004), found that European American and Asian American adolescents were more likely to have friends who place a great deal of emphasis on academic achievement and, as a result, worked hard to keep up with their friends. According to Gardiner, Hispanic and African American adolescents were less likely to receive peer support for academic achievement. Small project based groups are essential to student achievement because students actively process information amongst their peers. PBL groups are best in creating cognitive conflicts which can lead students to reexamine and question their own ideas and beliefs with other students. Students can obtain additional information in order to reconcile conflicting viewpoints, and to try new ideas obtained in their groups (Webb, 2008).

In order to create a successful PBL group, high achievers in the class must be mixed with low achievers in order to help each other fix their misunderstandings and explain concepts in familiar terms they can understand (Cheng et al., 2008). In order for PBL to be successful, the teacher must incorporate and teach four elements of a group process, which are positive interdependence, individual accountability, equal participation and social skills.

Apart from the PBL strategy, students must also have practice with standardized tests in order to increase their achievement within an advanced placement class. Standardized tests are

those in which the conditions and content are equal for all examinees (Olson & Sabers, 2008). Standardized test is "one in which the procedure, apparatus, and scoring have been fixed so that precisely the same test can be given at different times and places" (p. 1). According to Rawson and Dunlosky (2012), numerous practice tests is a well-established strategy for improving student learning. By incorporating practice tests within the class, practice tests have shown to be durable and an efficient way of students understanding and learning the content because they have a means to correct what they did not know. According to Hill et al. (1992), the use of authentic assessment manages, monitors and evaluates student learning. Authentic assessments cause students to construct responses according to learning gained in class. Authentic assessments should be structured to incorporate higher order thinking and basic skills, integrate tests with class instruction, and are closely related to classroom teaching.

Summary

This review of the literature has discussed the indicators of student achievement, obstacles to student achievement, and the interventions to increase student achievement. This review also discussed strategies to increase student achievement.

CHAPTER III

METHODS

Design

This study used a pre-experimental design to examine whether the Project-Based Learning strategy increases at-risk Advanced Placement Psychology students to achieve an 85% or better on chapter assessments. A null hypothesis was used to test the design.

Participants

Participants represents a sample of 55 students enrolled in an Advanced Placement Psychology course in a northwest public high school. The treatment group, representing at-risk Advanced Placement psychology students taught by the investigator, included 35 students. Within this group there were 34 African Americans/Black and one Hispanic/Latino students. The demographics of the school that receives free and reduced lunch is at 59.4% of the students. Within this northwest school, the average AP scores for social studies for the past five years ranges between 1.1-1.6 out of a score of 5. This northwest high school also has a high absentee rating. Access to individual student records on scores or FARMS was kept private. Due to the nature of not exposing the school, the school name was kept private.

Instrument

Two instruments were used in the study. The first instrument used was a pre-assessment about class content, which was adapted from the class text Myers' Psychology for AP (2011). The textbook is written by Myers (2011). Each of the three units had six pre-assessments. Five pre-assessments were multiple choice, and one pre-assessment was a constructed response item. The pre-assessments included 10 multiple choice questions, or one constructed response item graded on a five-point rubric scale about class content.

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The second instrument included, three chapter post-assessments, each test was adapted from the principal textbook for the class. The post-assessment included most of the pre-assessments questions to measure if learning took place after the project-based learning strategy was implemented. Each item on the chapter test is a cumulative test of each lesson they have learned in the unit only. The test addressed content taught in that chapter and included 50 multiple choice questions with an answer choice of A-E, and 1 extended constructed response. Each chapter tests were given every two weeks. All tests were paralleled to the objectives of the lesson, teacher instruction, group discussions, and AP Psychology College Board standards.

Procedure

The study began for the experimental group on February 1st, 2016. The group met for 90-minute periods on alternate days until three units of instruction concluded on March 23rd, 2016. All students completed the pre-test every day for five minutes before the start of each lesson. The pre-assessment scores were tallied up at the end of the two week unit to get the overall pre-assessment score. The investigator assigned groups keeping at-risk students together with high level students and implemented the project based learning strategy. After each lesson was over, both the high level and at-risk students took an evaluation or assessment at the end of the lesson-note this was not the post-assessment. The post-assessment came at the end of unit- which ended every two weeks. The post-assessment contained a unit test of 50 multiple choice items and a writing response, which had to be completed in 90 minutes. Instruction for the next two units followed the same format as the first unit.

CHAPTER IV

RESULTS

There was no support for the hypothesis that problem-based learning will not increase academic achievement for at-risk students. Table 1 describes the means and standard deviations of student scores on three chapter assessments.

Table 1. Means and Standard Deviations of Achievement Measures for the Group

Measure	Pre-test Mean (Standard Deviation)	Post-test Mean (Standard Deviation)
Personality	33.32 (25.42)	52.76 (31.93)
Development	44.63 (23.83)	60.94 (25.05)
Psychological Disorders	33.50 (21.48)	62.03 (31.05)

The null hypothesis that at-risk students who received project based learning will not demonstrate greater academic achievement on chapter assessments was rejected. As Table 1 illustrates, the means and standard deviations of the achievement measures for the intervention group had a significant difference. A series of dependent t-tests were run to examine if there was a significant difference in achievement before and after the intervention. A dependent t-test was run because the investigator had one group and two measures; the pre- and post- assessment. Meaning, the same group of students were measured twice.

Results showed a significant difference in personality achievement [$t(33) = -7.477$, $p < .001$]. Results showed a significant difference in development achievement [$t(34) = -8.992$, $p < .001$]. Lastly, results showed a significant difference in psychological disorders [$t(33) = -11.174$, $p < .001$]. Students performed significantly better at post-test on all measures than prior to the intervention. These results and implications will be discussed in chapter 5.

CHAPTER V

DISCUSSION

The null hypothesis that at-risk students who are exposed to project based learning will not have an increase in their academic achievement was rejected. There was a significant change in academic achievement of at-risk students since taking the pre-assessment to taking the post assessment. Student performance significantly improved when students were taught through the use of problem based learning groups. As Table 1 in Chapter 4 shows, the pre-assessment scores were low. Prior to the implementation of the post-assessments, students were exposed to the Project-Based Learning Strategy. As Table 1 indicates, students had a significant increase in their achievement on chapter assessments. Since the implementation of this experiment, the very first unit on personality saw a 16 percent increase in academic achievement after the implementation of the PBL strategy. The final unit saw an increase of 28 percent increase in academic achievement after the PBL strategy was implemented. It is important to note that the investigator only had a month and a half to teach a brand new strategy to the class. Within this month, the students have shown a significant gain in academic achievement through the use of PBL. According to the dependent t-tests that were run on the pre and post tests; there was less than a 1,000 percent chance of the PBL strategy not working. Since there is less than a one percent chance of the intervention not working, the null hypothesis has to be false.

Implications of Results

In this experiment, there was an effect on academic achievement through the use of PBL. When students were taught via project based learning, the results reflected a significant increase between pre-and post-assessments. Therefore, the hypothesis was rejected in this experiment.

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The investigator had a parallel component which helped contribute to the increase in academic achievement of at-risk students by connecting the learning objectives, the use of scaffolding questions, teacher instruction, project based learning, and practice with authentic assessments. The investigator purposefully created a relationship between the objectives, and the teaching techniques to a high level of complexity using Bloom's Taxonomy. According to Hovey and Ferguson (2014), they argued that strength of the PBL instructional method is the focus on 21st century skills such as problem solving, creativity, and group collaboration. Since project based learning uses a high practical level of complexity, the strategy forced students to analyze, justify and synthesize content. The investigator created this high level of complexity to mimic the high practical and analytical nature of their chapter assessments.

Barber et al. (2015) claimed in their research that an instructional strategy like project-based learning, allows for many of the parameters in authentic learning environments to exist. Students learn in authentic contexts, do tasks of their choosing, collaborate with others, and have access to peers who share expertise. In the investigator's experiment, the use of PBL affected the students to have an increase on chapter assessments. Since students were allowed to work in groups of their peers; students were more motivated to learn new material because they had the opportunity to bounce ideas off of each other in a collaborative effort. This intervention allowed students to become motivated because PBL uses authentic problems to solve. Authentic problems are problems that relate to students' lives, require the use of the tools of the discipline in manners similar to professionals in the discipline, and require immersion in the culture of the discipline (Belland, Kim, & Hannafin 2013).

Student achievement improved also through the mutual understanding of personal responsibility to themselves and to the group. Under heterogeneous grouping, low achievers can

get assistance, encouragement and stimulation from high achievers; while high achievers can improve their cognitive abilities and presentation skills through explaining and elaborating concepts to low achievers (Cheng et al. 2008). Since communication was vital in the success of each student, the instructor also had the burden of making sure that all directions are clear and parallel to the curriculum, standards and assessments. Students had the vital piece of preparing themselves for chapter assessments.

In a recent study, students taught through traditional lecture methods while some taught through PBL. The control group were students taught in the traditional method while, the experimental group was taught through PBL. Both groups took a pre- and a post-assessment after the instruction was given. Students in the PBL group had significantly higher scores on post-assessments than the control group (Sungur, Tekkaya & Geban, 2006). In order for the investigator and students to modify their behavior, and keep track of their academic success, the use of pre and post assessments offered a way to effectively communicate with one another. Meaning, once students obtained their tests scores on pre and post assessments, their behavior changed according to the information they received causing them to increase their scores on chapter assessments. After trial and error, the students were more committed to the PBL strategy because their academic achievement had a significant increase.

Threats to Validity

The pre-experimental design does not do a great job controlling for threats to validity. Due to the reason pre-experimental is a huge threat to validity, is the lack of a control group. Therefore, the investigator had minimal control over the experimental outcome.

The first threat to validity is history, since schools were closed for seven snow days, the inclement weather affected students' responses to the post-assessment. During the snow storm

students may have forgotten information in the time between the pre- and post-assessments. The second threat to validity would be maturation. Students became tired as the year progressed and fatigue settled in as the year was wrapping up. Therefore, fatigue from taking too many assessments changed the way students reacted to taking both the pre- and post-assessments.

A third threat to validity would be testing itself. Since the investigator gave a pre-assessment, students may remember some of the correct answers for the post-assessment, making the scores bias. Taking similar tests resulted in an increase score on the post-assessments, therefore the investigator did not know if the increase of the scores were due to the intervention. A fourth threat to validity is regression. Regression occurred because students were chosen from extreme scores on the Bell curve. At-risk students were low achievers in the class, placing them farther from the average. When studies are investigated on extreme outliers of the bell curve, the outliers tend to gravitate more towards the mean. Since the study focused on at-risk students, they shifted up towards the mean. Keeping along the same lines of regression, students may do poorly on the pre-test by having poor luck. In the case of this experiment, students may have guessed badly on the pre-test, and improved on the post-test because this score is more expected. The last threat to validity would be the pre-test interaction. Students would have acted differently to the intervention than they would have if they had not taken the pre-test.

Similar Research

Part of this research is very similar to the study performed in 2015 by Barber, et al. The authors also used the Problem Based Learning strategy, and paralleled their teaching strategy to their assessments and curriculum. Just like the investigator's experiment, the authors used the PBL concept to empower students to choose real world tasks to demonstrate their knowledge. Just like in the investigator's experiment, the author's experiment saw an increase in student

autonomy, engagement, shared development of collective knowledge, and an increase on authentic assessments.

Another part of this research is similar to a study performed in 2008 by Cheng, et al. Within their PBL groups, the researchers fostered a more heterogeneous community to see if high achievers will bring up low achievers. The researchers found that when the quality of the class work was low quality, the collective efficacy was low; therefore the high achievers suffered. However, when the quality of the group work was high, the collective efficacy and self-efficacy of both high and low achievers rose. The researchers concluded that the determinant factor wasn't the quality of the group, but the process they had to engage in.

Implications for Future Research

Results from this study showed that at-risk high school Advanced Placement psychology students through the use of PBL may help improve academic achievement on chapter assessments. According to research similar to the investigators experiment, PBL research has an overall positive effect on student academic achievement.

The results for this experiment showed that academic achievement was affected by the PBL strategy. The investigator observed an increase in engagement and motivation after the first unit, once students saw an increase on the chapter assessments. Students had to buy into the strategy that it will work for them. It can be argued that PBLwould improve motivation and academic achievement, however since this was only one month and a half- a longer time frame will be much more reliable.

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