A Project-Based Approach to Enhance Skills in Science Investigatory Projects among Secondary School Students in Northern Mindanao

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Abstract

This paper investigated the use of a Project-Based Approach as a pedagogical tool to enhance students' skills in conducting science investigatory projects. Two hundred fifty (250) students and ninety eight (98) science teachers in public secondary schools in Northern Mindanao, Philippines had accomplished questionnaires. Students' engagement in Project-Based Approach significantly increased their self-efficacy in conducting science investigatory projects and developed skills in collaborating, problem-solving, and critical thinking.

In the conduct of the investigatory projects, the students exhibited a greater understanding of science concepts and skills in quantitative analysis. The quality of the student researches was improved resulting in the increased number of participation in Science fair competitions. Exploratory multiple regression analysis addressed the importance of this teaching tool at the level of the students'

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performances in Science. Results showed that the students' skills in conducting investigatory projects generally improved with increased exposure to this collaborative teaching tool. This study concluded with pedagogic implications for teachers to enhance their skills in the use of a Project-Based Approach and was recommended to sustain its use as an effective strategy in teaching.

Keywords: pedagogical practices, Project-Based Approach, science fair, science investigatory projects

Introduction

In today's standards-based schools, teachers are faced with constant pressure to balance innovative and meaningful curriculum and teaching with the demands of mandated curriculum. In Article XXV of the Philippine Constitution, the major thrust of Philippine Science Education is to supply society with scientifically-literate citizens and promote scientific researches and inventions. Cognizant to this is a provision for greater time allotment in Science for laboratory work and to conduct simple investigatory projects outside the structured laboratory settings. The investigatory aspect of science research projects fits well with current reform efforts in science education. Science is steadily being transformed into a process-driven, inquiry-based area of study, and Science Fair projects provide additional opportunities for students to become personally and directly involved in scientific investigation.

Science investigatory projects provide students practical experience in using the scientific method and help stimulate their interest in scientific inquiry. Given these benefits, society can realize from professional scientific inquiry and such goals have significant importance. The outcome of a professional science investigatory project often involves a discovery that can improve the lives of people and protect the environment. The conduct of science investigatory project appears to be an increasingly popular and widely practiced teaching and learning method. It is an effective strategy that makes the student develop an analytical mind to discover for himself a scientific truth that develops his creativity and integrity. It provides students a broad picture of science as a way to ponder, to discover, and to investigate a problem (Meg, 2004). A science investigatory project keeps the student active, both in terms of manual skills and intellectual activities. However, it requires proper planning and management in order to yield the optimum results in terms of student learning

To provide students with a well-rounded classroom experience is to use the Project-Based Approach (PBA) in teaching. In the PBA, students are exposed to a reality based situation which is the starting point of scientific inquiry; the students formulate problems, identify learning needs, search for knowledge, study and apply their knowledge thus, students are engaged in relevant, meaningful, and inquiry-based science learning and apply what they have learned to real-life experiences.

The goal of a project-based learning is to investigate real-world, standards-based problems that are of interest, relevance, value and worth to the student (Toolin, 2004). In PBA, the student's analytical learning is aimed at self-directedness and life-long learning. The existing view of the relationship between the learning process and knowledge flows are well articulated by Scarbrough, H., Bresnen, M. and Edelman, S. (2004). 'Learning and knowledge are intertwined in an iterative, mutually reinforcing process. While learning (process) produces new knowledge (content), knowledge impacts future learning. In short, there is widespread recognition that learning is usefully viewed as a process that is both a source of new knowledge and yet is shaped by prior knowledge. Conversely, the iterative, mutually reinforcing' nature of this interaction makes it difficult to disentangle its constituent parts.

In the analytical framework of Scarbrough, Bresnen, and Edelman, S. (2004), the learning potential in the conduct of investigatory project is influenced not only by the dynamics of the project itself, but also by the relationship between the project and different organizational contexts. Through the PBA teachers employ a variety of assessment methods even before the start of the project. After the project is finished, students are guided to present information about the progress of their project according to their learning style and creativity. Students also delve deeper into the subject area and begin to ask analytical and thought-provoking questions about its content.

Theoretical Framework

The history of doing "projects" can be traced to Dewey and other progressive educators. In the PBA the students are engaged in self-directed learning (Sile´n 1996, 2000, 2001, 2003) the view of learning and the theoretical underpinning of the PBA have their roots in Dewey's pragmatism (Dewey 1911, 1916), meaningful learning (Marton et al. 1997; Marton and Booth 1997; Ramsden 1992) and social constructivism (Boud 1988; Sa¨ ljo¨ 2000). Constructivist approaches aim at skills development and performance improvement centered on goal-oriented inquiry, authentic learning contexts and supporting personal perspectives. Honebein (1996) has identified goals for the design of constructivist learning environments to provide students with the knowledge construction experiences, provide experiences in the use and appreciation of several perspectives, encourage participation and ownership in the learning process focusing on realistic and relevant contexts, embed learning in social experience and encourage self-awareness of the knowledge construction.

Statement of the Problem

This research is intended to document the use of PBA as a pedagogical tool to enhance the skills in the generation of science investigatory projects among the public secondary schools of Region 10. In particular, this study sought to determine the profile of the public secondary schools of Region 10 in relation to the generation of science investigatory projects as to their quantity generated each school year; the quality of science investigatory projects won by the school during science fair competition; and the adequacy of science laboratory facilities and equipment. Aside from the level of students' engagement to the PBA is determined as well as the student's research skills in conducting investigatory projects. Finally, in examination of the significant relationship in the use of the PBA and the profile of public secondary schools are looked into and its significant impact in the use of PBA in determining the competency skills of students when conducting science investigatory projects.

Review of Literature

Existing literature relevant to the PBA highlights the multiplicity of perspectives that span a range of epistemological positions providing different emphases on the generation and transfer of knowledge and learning. As stressed by Thomas (2000), the PBA is a model that organizes learning around projects which are complex tasks based on challenging questions or problems that involve students' design, problem-solving, decision making, or investigative activities. It give students the opportunity to work autonomously over extended periods of time that culminate in realistic products or presentations.

PBA has been proven to be a dynamic approach to teaching in which students explore real-world problems and challenges, simultaneously developing cross-curriculum skills while working in small collaborative groups. The study of Sense (2007) indicates that students are more likely to retain the knowledge gained through the PBA far more readily than through traditional textbook-centered learning. In addition, students develop confidence and self-direction as they move through both team-based and independent work. The success of project-based learning requires involvement that includes cognitive, metacognitive, and collaborative factors. These factors define self-regulated learning. Students develop and utilize self-regulatory skills and become autonomous managers of their own learning as they accomplish their project goals (Gerlach, 2008). The study of Holiday (2006) study also shows that the use of the PBA in instruction enhances their skills in conducting investigatory projects.

Objectives

With the various literature reviews and findings, it is at this premise that this study is conducted to determine the use of the PBA with emphasis on how it affects the competency skills of students in conducting investigatory projects and its impact to the development of research skills of students its relationship to the quantity and quality of the science projects generated.

Methodology

This study was conducted in Region 10, Northern Mindanao which is composed of 211 public secondary schools. Among these schools, only 41 schools actively participated in the Intel Philippine Science Fair Competitions from school years 2008-2009, 2009-2010 and 2010-2011. The study employed a random sampling procedure with two groups of respondents. One group of respondents consisted of 250 high school students who actively participated in the science fair competition. The other group consisted of 98 public high school science teachers who were advisers and coaches to students' science investigatory projects. They rated the level of students' competency in conducting science investigatory projects.

This study used the descriptive research design to describe the use of the PBA to enhance skills of students in conducting science investigatory projects. Data gathered were from two sources. Primary data were taken from the respondents through questionnaires. Likewise, secondary data on the master list of science investigatory projects were taken from the files at the Regional office of the Department of Education and the Department of Science and Technology, Region 10.

The questionnaires underwent validation using high school students not included as respondents. Reliability of the instrument was determined through Cronbach of scaled items. Descriptive statistics, such as the mean, standard deviation, frequency counts and percentage distribution were used to describe the profile of public secondary schools in terms of the quantity and quality of the science projects as well as the adequacy of science facilities and equipment. It is also used to describe the level of students' engagement of the PBA and the competency of their skills in conducting research. Pearson *r* correlation was used to test the relationship in the use of the PBA when grouped according to the student's competency level and the quantity and quality of the science projects generated. Multiple regression was used to determine if there is a significant impact in the use of the PBA in the competency skills of students in conducting science investigatory projects.

Results and Discussions:

Table 1. Distribution of Public Secondary Schools in Terms of the Quantity of Science Investigatory Projects Generated Per School Year

Quantity of Projects Generated	2008-2009		2009-2010		2010-2011	
	Freq.	Percentage	Freq.	Percentage	Freq.	Percentage
Very Good (More than 6)	2	4.88	1	2.44	8	19.51
Good (5-6)	4	9.76	2	4.88	10	24.39
Fair (3-4)	14	34.15	13	31.71	15	36.59
Poor (1-2)	16	39.02	17	41.46	8	19.51
Very Poor (None)	5	12.20	8	19.51	0	0
TOTAL	41	100%	41	100%	41	100%

Table 1 shows the distribution of public secondary schools in the quantity of science investigatory projects generated per school year. The quantity of science investigatory projects generated by students is shown to be generally fair. Majority of the schools could generate at least 1 to 4 projects a year as official entries to the Intel Philippine Science Fair (IPSF) competition. The Intel Philippine Science Fair (IPSF) is an annual national competition among high school students with the mission of promoting science and technology to the youth through research or investigatory projects.

Most of these projects were coming from Science and Technology oriented schools implementing the Engineering and Science Education Program (ESEP). Data revealed that there was a tremendous increase in the number of science investigatory projects generated in school year 2010-2011. Aside from the fact that the conduct of investigatory projects has been institutionalized in the public secondary schools in the country, the increase may be attributed to the intensive trainings of teachers in the Intel Teach curriculum which gives emphasis to the use of the PBA as a teaching tool to prepare students in a 21st century classroom. This was the year that the Science and Technology oriented high schools was expanded increasing the number of special science classes in the Region

(DepEd Order No. 40, s. 2010). At the earlier part of the school year there was also additional subsidy for the Regional Science High Schools to include the procurement of supplies and materials to support student's researches and in the conduct of science investigatory projects (DepEd Order No. 9, s. 2010). Furthermore, at the later part of this school year, the DepEd issued an order to update the technical specifications of Information Communication Technology (ICT) Equipment and Internet Access Services in Public schools giving priority to ICT Equipment and Internet Access Services for classroom instruction (DepEd Order No.121, s. 2010) coupled with its extension in the implementation of the DepEd Internet Connectivity Project (DICP).

It is to be taken into account that the use of the PBA as a teaching tool required the integration of ICT in instruction. The PBA is the first course in the Intel Teach Elements series which has e-learning component that facilitated the students' engagement in various activities where the exercises enabled them to explore concepts. Moreover, the use of ICT could increase the versatility and value of project-based learning making it possible for individual students or teams to carry out in-depth projects and scientific researches that could be drawn from various media and multiple sources of information through online databases.

The increase in the number of science project entries in a school could be traced also to the students' interest in conducting science projects. According to Luck (2004), a student's interest is a critical factor in conducting a science project. A student has to spend months researching, developing, its and presenting a project. Hence, creating a commitment to the project, its success depending on enduring interest and engagement of the student (Abernathy, 2005). The study of Bruce and Bruce (2000) reported that one of the common reasons that students become interested in conducting science projects is their personal experience in participating in a science fair.

Table 2. Distribution of Public Secondary Schools Terms of the Quality of Science Investigatory Projects Won Per School Year

Quality of Projects Won	2008-2009		2009-2010		2010-2011	
	Freq.	Percentage	Freq.	Percentage	Freq.	Percentage
Very Good (National level)	1	2.44	3	7.32	7	17.07
Good (Regional Level)	3	7.32	8	19.51	10	24.39
Fair (Division level)	8	19.51	16	39.02	19	46.34
Poor (School Level)	16	39.02	14	34.15	5	12.20
Very Poor (Classroom level)	13	31.71	0	0	0	0
TOTAL	41	100%	41	100%	41	100%

Table 2 shows the distribution of public secondary schools in terms of the quality of a science investigatory projects won per school year. The quality of a science investigatory project was generally at a fair level though it can be gleaned from the table that there is an increase in the number of projects won in each years' in Intel Philippine Science Fair (IPSF) competition. The quality of the project was based on the level of its winning. For the projects to be of good quality, they had to be subjected to a series of evaluation from the school to national levels by an institutional review board or Scientific Review Committee (SRC). The level of sophistication of a candidate's project was quite high. The students received guidance from professional scientists as well as the use of selected datasets and facilities from the nearest institutions and universities. The judging team determined how much the students participated in the design of the experiment and in the data analysis. The final critical step in the judging process was the student interviews, which gave the individual judges the opportunity to determine the degree of every student's knowledge, technical skill, and creative ability Charles (2008). This result could be explained further by the inadequacy of laboratory facilities and equipment among public secondary schools in Region 10 Gomez (2007). Experiments required a laboratory with some basic equipment and consumables on a recurring basis.

Table 3. Distribution of Public Secondary Schools Terms of the Adequacy of Science Laboratory Facilities and Equipment

Range	Description	Frequency	Percent
4.50 – 5.00	Very Good	0	0.00
3.50 – 4.49	Good	9	21.75
2.50- 3.49	Fair	27	65.85
1.50 – 2.49	Poor	5	12.20
1.00 – 1.49	Very Poor	1	0
Sum		41	100.00

Mean: 2.53
Description: Fair
Standard Deviation: 0.46

Other Information:

Indicators	Mean	Description
Provision for Science laboratory Facilities	2.31	Fair
Adequacy of Science Laboratory equipment	2.74	Less Adequate

Table 3 shows the distribution of public secondary schools in terms of the adequacy of science laboratory facilities and equipment. The adequacy for science laboratory facilities and equipment was generally found to be fair. There has been an increasing number of students in the public secondary schools resulting in the inadequacy of science laboratory despite the Department of Education's efforts improving science education, the school environment, the adequacy of science laboratory facilities and equipment was still far from ideal. Despite these limitations, some public secondary schools were still able to generate science projects and won in the science fair competitions.

There were schools with well-equipped laboratory rooms because the science teachers themselves put up their own facilities with the help of parents, the local government and support from the administration. Other schools had a well-equipped laboratory rooms because they were recipients of projects funded by the Department of Science and Technology (DOST) under the Engineering Science Education Program (ESEP). Some of these schools were also recipients of projects launched by the Educational Development Projects Implementing Task Force (EDFITAF) with Japan-assisted Educational Facility Improvement Program (EFIP).

Table 4. Students' Level of Engagement to Project-based Approach

Indicators	Mean Rating	Description
Project Basics	4.83	Highly Engaged
Project Planning and Design	3.98	Engaged
Project Assessment	3.87	Engaged
Project Management	3.17	Fairly Engaged
Computer-Based Instruction	3.69	Engaged
Use of Web 2.0 Tools	2.31	Less Engaged
Use of Web-Enhanced Learning	2.37	Less Engaged
Overall Mean	**3.46**	**Engaged**

Table 4 shows the students' level of engagement to the PBA. Students were found to be generally engaged to project-based approach . A closer look at the data reveals that students were highly engaged to project basics. This means students were exposed to a variety of projects and learned about the characteristics of projects. Results further reveal the students' engagement to project planning and design.

In designing projects, teachers spend significant time developing a driving question, the backbone of the project and facilitate students' learning process. Students were also found to have been engaged in project management. This means that at the start of each project, students received a detailed assessment rubric that outlined the standards the project covered and provided explanations on how performance would be assessed.

The rubric often includes time lines and information on essential elements of their successful products. After receiving the assignment, the teachers ask the students to determine what content they know and needed to know. The need-to-know lists were reviewed in the class, and every question clarified. Students were prone to ask questions about project logistics but by adding a content section to the list of knows and need-to-knows, students were more likely to ask questions about content. According to Barron and Darling-Hammon (2008), providing a rubric for assessment can promote students' time-on-task and content-related discussions.

Students were also found to be fairly engaged in project management. This means that the students still needed more exposure on how to manage their project in terms of sustainability facilitated by teachers. Once a project is underway, teacher's roles should shift as adviser, coach, and evaluator. This means the teacher undertakes scaffolding of the students' success with ongoing and diverse assessments and give benchmark ratings until the project is completed. Hence, it is important for a teacher to response accordingly to the student's inputs.

Results shown that the students' engagement in Computer-Based Instruction (CBI) reveal their competence in technology. They could easily follow instructions using computers. Computer-Based Instruction programs have been used increasingly in schools to supplement or replace more conventional teaching methods.

Students however, were found to have less engagement in the use of Web 2.0 tools and Web Enhanced Learning Activities (WELA). These findings could be attributed to the lack of training among science teachers and the inadequacy of resources in the public schools particularly in terms of internet connectivity devote efforts by DepEd to improve the school's infrastructure relevant to the integration of ICT for classroom instruction. Web 2.0 is the use of interactive technology that aims to enhance creativity, information-sharing, and collaboration among users. In a Web 2.0 environment, users can work together and share responsibilities; collaborate with peers, experts, and community members; monitor and keep track of contributions; use varied kinds of technology to conduct research, to communicate, and to create knowledge (Buan, 2008).

Table 5. The Student's Research Skills in Conducting Investigatory Projects as Rated by Science Teachers

Indicators	Mean Rating	Description
Manipulative skills	4.34	Skilled
Information and Communication Skills	3.17	Moderately skilled
Creativity and Innovation skills	2.67	Moderately skilled
Critical Thinking Skills	3.62	Skilled
Initiative and Self-Direction	2.91	Less Skilled
Problem-Solving Skills	3.67	Skilled
Teaming and Collaboration	4.34	Skilled
Numeracy Skills	4.40	Skilled
Individual Accountability	3.89	Skilled
Technological Literacy	4.16	Skilled
Overall Mean	**3.67**	**Skilled**

Table 5 shows the student's research skills in conducting investigatory projects as rated by science teachers. Students were generally found to demonstrate research skills and were rated by their science teachers as "skilled" (mean of 3.67). Data reveal that the students were skillful in terms of manipulative skills on their ability to carry out practical work involved in conducting the science project particularly in the handling of science equipment. However, they were found to be moderately skilled in terms of information and communication skills. This means that the students were not efficient enough to access and effectively use accurate information and to be creative in solving the problem at hand. There was a need for them to understand the fundamentals of the ethical/legal issues surrounding the access and use of information. There was a tendency for students to merely copy and paste information without permission or acknowledging the author. Results further reveal a moderate level of their skills in creativity and innovation. This refers to their deficiency in demonstrating originality and inventiveness in work. They lacked the competence to develop, implement and communicate new ideas to others and could not act on creative ideas to make a tangible and useful contribution to the domain in which an innovation may occur.

The students however, also exhibit critical thinking skills in gathering data, analyzing and synthesizing information in a variety of contexts, thus science teachers rate them as "skilled". This is a skill most students enjoy learning because they see immediately that it gives them more control of their science projects. Furthermore, data showed that students have less skills it terms of initiative and self-direction. This refers to their ability to set goals related to learning, their plan for the achievement of these goals and how they manage time and workload. But, this is deened normal for high school students as they are under the guidance of their science teachers and follow the instruction from their respective coaches. Students have developed their skills in quantitative analysis as shown in their rating for numeracy skills in computation, measurement, estimation and data evaluation in various settings particularly in the conduct of their science projects.

Data further reveal that the students had developed the skills in problem solving, teaming and collaboration, individual accountability and technological literacy. Problem solving skills refers to their ability to identify and ask significant questions that clarify various points of view and lead to better solutions. This also includes their ability to frame, analyze and synthesize information in order to solve problems, the essence in scientific investigations. Students were a given a problem or challenged to identify a problem then they followed the guidelines of problem based learning (PBL) to solve the problem. As they followed the investigative process, they employed the science process skills which were the methods and procedures of scientific investigation (Wetzel, 2008).

The PBA requires the students to work in groups thus, in this study it was found out that students had developed the skills in working as teams, coupled with an awareness at individual accountability. Various studies supported the impact of collaborative learning on improving student achievement and promoting positive peer relationships across group lines (Johnson and Johnson, 2009). The way the teachers supported successful collaborations was an important ingredient in the success of conducting investigatory projects. Students were assigned to groups of three or four. The first group meeting began with groups creating contracts that established shared norms or behavior expectations. Building individual accountability into the project process helped in promoting successful student collaborations (Vega, 2007). If a student was not fulfilling his/her part of the project was the responsibility of team members to bring this to the teacher's attention, specifying what responsibility was not completed. Team members could be removed from the group which means the individual must complete the project on his/her own. Moreover, data also revealed students' skills in technological literacy how it works, what purposes it could serve and how they select and utilize appropriate technology to effectively perform a variety of tasks.

The present study showed that the quantity and quality of science projects were found to be significantly related to students' science research skills (Table 6). This means that the number of science projects they had generated and won in the science competition had contributed to the enhancement of their skills in conducting science investigatory projects. A closer look at the data revealed that their engagement to the PBA was significantly related to the enhancement of their research skills. The p value of 0.006 was highly significant at 0.05 level of confidence.

Table 6. The Relationship between the Respondent's Exposure to PBA and Student's Research Skills in Conducting Science Investigatory Project.

Indicators	Correlation	P-value	Decision	Conclusion
Quantity of Science Project	0.147	0.042	Reject the Ho	Significant
Quality of Science Project	0.125	0.038	Reject the Ho	Significant
Students' Engagement to PBA	0.041	0.006	Reject the Ho	Highly Significant
Adequacy of Science Laboratory Facilities and Equipment	0.150	0.071	Fail to reject Ho	Not Significant

Table 6 shows the relationship between the respondent's exposure to the PBA and the student's research skills in conducting the science investigatory project. The PBA is a kind of project-based teaching and learning which involves the use of in-depth and rigorous classroom projects to facilitate learning that exposes them with complex tasks based on challenging questions or problems that involved the students' problem solving, decision making, exploratory skills, and reflection that included teacher facilitation, thus allowing them to develop valuable research skills as they engage in various investigative activities. These skills are vital for everyone's success in a changing society where there is an increased access to technology, digital information and tools in global competition. This result implies that engaging the students in projects allowed them to acquire the necessary skills that would prepare them for success in the 21st century.

Table 7 Results of Multiple Linear Regression Analysis between the Use of Project-based Approach and the Research Skills in Conducting Science Investigatory Projects.

Independent Variable	Regression Coefficient	P Value
Quantity of Science Projects	0.072*	0.049
Quality of Science Projects	0.168*	0.053
Engagement to PBA	0.026*	0.027
Adequacy of Science Laboratory Facilities and Equipment	0.039	0.605

Adjusted R^2 : 0.582
F Value : 1.867
Sig. Level: 0.042
Legend: * significant at $\alpha = 0.05$

MLR Result Using The Significant Independent Variables:

Independent Variables	Regression Coefficient	*P* Value
Quantity of Science Projects	0.070*	0.036
Quality of Science Projects	0.065*	0.043
Engagement to Project based approach	0.092*	0.021

Adjusted R^2 : 0.80
F value : 20.53
Sig. Level : 0.02

Table 7 shows the result of the regression test between the use of the PBA and the Student's Research skills in conducting investigatory projects. The F value of 1.867 indicates that the model is significant at 99.95% confidence level. In fact the whole set of variables explain 58.2 % of the variation of the students' skills in research. Results reveal that the quantity and quality of science projects and engagement of students in the project based approach influence the student's research skills in conducting science investigatory projects.

For the purpose of evaluating the impact of these variables are treated separately as significant independent variables. Regression results reveal that these variables explain the 8% of the total variation in the student's skills in research borne out of their regression coefficient, which showed that for every unit increase in the quantity of projects there was a corresponding increase in students' research skills by 7 percent. This implies that requiring the students to generate science projects would generally improve the students' skills in research. Regression analysis also reveal that for every increase in the quality of the students' science projects there would be a corresponding increase in their research skills by 6%. This result implies that there was a need to scrutinize the projects of students before submitting it as an entry for science competition. Furthermore, regression analysis has shown that for every unit increase of the students' engagement in the PBA tended to increase the students research skills 9.2 %, implying that the use of the PBA could enhance the students' skills in conducting science investigatory projects.

Conclusion

The adoption of the Project Based Approach (PBA) in teaching significantly enhanced the skills in conducting science investigatory projects among High School students. Students learned best when working in teams, engaging in cooperative, self-directed learning as they worked through the challenges of their projects. Teachers, for their part enhanced their pedagogical skills in the use of the PBA. It is recommended that the PBA be used for an effective strategy in teaching.

When implemented well, the PBA would develop the students' critical thinking skills, improve long-term retention of content learned, and increase students' and teachers' satisfaction through learning experiences. Adopting a project-based learning approach likewise could invigorate the learning environment, energize the curriculum with real-world relevance and spark students' desire to explore, investigate, and understand their own world.

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