

### **Annotated Bibliography**

Basarab H. Building collaboration through project-based theater design. *online submission*. December 1, 2012; Online submission. Retrieved from:

<http://www.eric.ed.gov/contentdelivery/servlet/ERICServletaccno=ED537210>

Basarab (2012) investigated the benefits achieved through project based learning methods in a theater arts and design class. The purpose of this research was to discover the variety of learning opportunities presented when students were given a problem and left to solve it with their own resources. The research question examined was: How is theater design specifically well suited to the development of collaborative skills? The research design was qualitative.

High school theater students in a Northern California non-magnet secondary school were evaluated over the course of one year. Data were collected from three perspectives: student self-reflection and analysis, two focus groups, as well as student journal reflections, and peer reviews. Students were regularly given a problem, specifically in regards to the design of a set piece. Students were left in small groups of three to five to discover a solution to the problem. Basarab (2012) reported that students routinely applied concepts from other classes to solve the problem presented in their theater design class. Some examples include the use of math to create a pedestal, as well as using factual representations from History class to mimic a set piece unique to a specific era (Basarab, 2012).

Self assessment methods were used at the end of the year to gauge student

success. The greatest attribute noted by students was the challenge of collaborating with other students to create a successful end result.

This research is important to educators because it shows the value of project based methods and how a class as unique as theater design can offer a creative approach to utilizing knowledge from other subject areas.

Chin, C., & Chia, L. (2004). Implementing project work in biology through problem-based learning. *Journal Of Biological Education (Society Of Biology)*, 38(2), 69-75. Retrieved from:<http://web.a.ebscohost.com.sierranev.idm.oclc.org/ehost/detail/sessionmgr4001&hid=4114&bdata=JnNpdGU9ZWhvc3QtG12Z=12696873>

Chin and Chia (2004) investigated the benefits achieved through implementing problem based learning methods in a ninth grade Biology class. The purpose of this study was to investigate (a) how self-generated problems and questions directed students in their learning, (b) how students reacted to this instructional approach, and (c) the problems that they encountered. The research question examined was: How do students respond when they are asked to formulate their own problems, pose their own questions, and design their own investigations to answer such issues? The research design was experimental.

Students were guided through a series of stages consisting of basic problem-solving methods. In stage one, students were asked to identify a problem that they

wanted to investigate from a list of case studies. Students were asked to discuss their views of the issue in small groups, create a mind map, and formulate a problem statement. In stage two students designed their own project tasks based on the problem. Three focus questions were required based on a KWL chart (what one Knows, Wants to know, and what one Learned). Students were then asked to compile all data collected from their work present their findings to their peers.

In-class observations, field notes, and video recordings were all used to compile data sources for the effectiveness of this project. From surveys completed by students, 89.7% were able to effectively answer all questions from their group-generated questions, 74.4% felt their new knowledge was applicable to their daily lives, and 74% were able to think of questions that helped to drive the progress of the project from a group perspective. Ultimately, the project proved successful because groups effectively worked together to create a design and answer all questions generated from the topic.

This research is important to educators because it shows the value of problem-based learning approaches and how vital it is for students to work together to accomplish a goal.

Demirel, T., Baydas, O., Yilmaz, R. M., & Goktas, Y. (2013). Challenges faced by project competition participants and recommended solutions. *Educational sciences: theory & practice*, 13(2), 1305-1314. Retrieved from: <http://www.web.a>

.ebshost.com.sierranev.idm.oclc.org/ehost/detailsid=5bebdd3b80a14a30891e5a0sessionmgr4001&vid=7&hid=4114&bdata=JnNpdGU9ZWwhvc3QtbGl2%3%3d#db=aph&AN=87343978

Demirel, Baydas, Yilmaz, and Goktas (2013) studied the effectiveness of project-based learning by examining how well teachers were able to implement projects. The research question examined was: What are the challenges students and teachers face during the project preparation process? The research included both qualitative and quantitative approaches.

Using teachers and students whom participated in Turkey's Scientific and Technological Research Competition (TUBITAK), results were gathered to gauge how well teachers prepared their students for the project competition. The goal of the research was to pinpoint where the point of confusion occurs for educators trying to equip students to successfully complete a project and how to equip teachers for future project-based learning opportunities. 61% of the teachers that participated in this study were Science teachers. The biggest hurdle faced in trying to implement project-based learning models in the classroom as reported by the teachers was “lack of financial resources, and the length of time required for planning a project” (Demirel, Baydas, Yilmaz & Goktas, 2013, p. 1308). Students reported that their biggest obstacle was trying to effectively report the results of the project. According to Demirel, Baydas, Yilmaz, and Goktas, 2013, “lack of knowledge and skills for project preparation was the least encountered challenge

(p. 1308). The final assessment of this project was that seminars, and training resources were vital for future PBL projects.

This information is important to educators because it reveals the struggles and issues faced by teachers implementing project-based learning methods in the classroom.

Ernst, J. V., & Clark, A. C. (2012). Fundamental computer science conceptual understandings for high school students using original computer game design. *Journal Of STEM Education: Innovations & Research*, 13(5), 40-45. Retrieved from Academic Search Premier database. (Accession No. 89166317).

Clark and Ernst (2012) investigated the benefits of incorporating digital game design and computer science as a means to raise student interest in traditional math and science classrooms. The purpose of this study was to evaluate and better understand how the arts can serve as a tool to capture the attention of struggling students in core subjects. The research question examined in this study was: Can the use of gaming as an instructional tool result in attainment of computer science proficiency? The research was qualitative.

Clark and Ernst examined 30 states offering virtual public schooling in an attempt to better understand the impact that digital schools have had on student's computer science literacy. With the growing value U.S. schools are placing on STEM

education (science, technology, engineering, and mathematics), Clark and Ernst focused on computer science as the missing link within the STEM movement. Students interested in game design were asked to participate in an eight hour course that gauged their understanding in a variety of content areas by requiring students to follow a series of tasks within a gaming-centered environment. The results demonstrated that students did retain a greater understanding for computer sciences, and through a student survey, results showed conclusively that the test population gained a better understanding for the importance of how technology can be used in the real world.

This study is important to teachers because it shows the benefits of utilizing computers in non-traditional methods to expand student interest and understanding for various subjects, particularly those in which computers are not typically used.

Frank, M., & Barzilai, A. (2004). Integrating alternative assessment in a project-based learning course for pre-service science and technology teachers. *Assessment & Evaluation In Higher Education*, 29(1), 41-61. Retrieved from: <http://web.a.ebscohost.com/sierranev.idm.oclc.org/ehost/detailvid=8&sid=5bebdd3b80a14a%0sessionmgr=12511351>

Frank and Barzilai (2004) conducted a project based learning (PBL) study to gauge students' ability and understanding of PBL lessons. The research question

examined was: What implementation issues and processes do higher education students encounter in a PBL environment which involves an alternative assessment approach? The research was qualitative.

Twenty five students were asked to create their own project incorporating “scientific, technological, social and environmental principles” (Frank & Barzilai, 2004, p. 44). The same students then worked through the project and identified the positive factors and struggles encountered throughout the process. The results indicated that 90% of the participants thought that the process provided meaningful learning opportunities. Of the feedback received, some of the most powerful testimonies included students realizing the weight of their responsibility to the group. Other students noted that each person provided a unique perspective to the team based on their past and how each individual was able to teach their group members. Such success demonstrates the outcome that is possible with PBL models.

This information is useful to teachers because it provides meaningful feedback to apply when selecting groups of students for project-based instruction.

Gutierrez-Perez, J., & Pirrami, F. (2011). Water as focus of problem-based learning: An integrated curricular program for environmental education in secondary school. *Online Submission*, accession No. ED528324 Retrieved from: <http://www.eric.ed.gov/contentdelivery/servlet/ERICServlet?accno=ED528324>

Gutierrez-Perez and Pirrami (2011) studied the benefits of adopting an integrated curricular program (ICP) with problem-based learning methods to “integrate environmental issues with curricular scientific topics, and at the time, to increase students' interest, motivation and awareness towards scientific and environmental matters” (Gutierrez-Perez & Pirrami, 2011, p. 270). The research question examined was: What are the benefits of using a localized environmental science issue in the classroom for a project-based learning opportunity? The study consisted of approximately 104 students between the ages of 14 and 15 years old. A real-world problem was used in the study which was affecting the students at that particular time. The town council of Montalto Italy asked students to “prepare a booklet to be given to families in order to explain why it is important to save water and how to reduce its consumption in houses” (Gutierrez-Perez & Pirrami, 2011, p. 275). Students were charged with the task of creating a chart illustrating all factors influencing water consumption. The research design was quantitative.

Surveys were produced for the students to complete at the end of the project. Results indicate that students gained a greater understanding of the water conservation process through a PBL approach. Teachers also confirmed through questionnaires that students developed life skills beyond the project which would not have been presented if a PBL method had not been implemented.

This study is important to educators because it shows the value of using real

problems in the classroom that affect all students beyond the project.

Hall. (2005). Artful biology projects. *The science teacher*, 72(1), 26-29. Retrieved from <https://share.worldcat.org/ILL/articleexchange/FileDownloadLogin/NECmeJuo8>

Hall (2005) investigated the benefits of adding art projects to biology curriculum. The test group included high school students of an alternative arts school. The research question examined was: Is it possible to bridge the gap of students' artistic reality and scientific possibilities in the classroom? The research design was experimental.

Two projects were used in a 10th grade biology class to explore the potential for students gaining a stronger understanding of the immune system. The first project incorporated the use of a flip book cartoon, challenging students to apply their knowledge in a visual representation while also telling a literal story. The second project incorporated a board game and challenged students to not only create graphic illustrations for the immune system, but to also devise a way of creating a game that centered around a particular aspect of biology. Results were measured through the use of a student survey as well as observations recorded by the teacher. The results indicated a positive improvement in student assessment scores on the material covered.

This research is important to teachers because it confirms the benefits of

integrating creative approaches to teaching traditional coursework.

Herman, D. V. (2008). Celebrating the gifts. *Reclaiming Children & Youth*, 17(2), 54-55.

Retrieved from: <http://reclaimingjournal.com/node/88> database: ERIC

Herman (2008) examined the success created through a continuation school embracing Native American teaching methods in the classroom. The school, *The Grandfather Academy* is determined to empower students to be successful through the use of visual arts, storytelling, and music. The research question examined was: Are students able to find academic success through discovering success in the arts? The research design was exploratory.

The student body examined at The Grandfather Academy was comprised of students who have experienced school failure in their past. The goal at the academy was to embrace students through small successes they can discover in the arts. Options for discovering individual success include pottery classes, offerings in the visual arts, storytelling, and music classes. Reports indicate that 68% of students in the program expressed feeling less stressed during the time they spent on art projects. "In addition, 72% reported the experience made them feel successful... one student stated that pottery helps me to think positively" (Herman, 2008, p. 55). By creating opportunities for students to find success in the arts, results were also seen to show positive improvement for academic classes.

This study is beneficial to educators because it demonstrates the possibility of troubled, unmotivated students to discover success in school by coupling their learning with creative approaches.

Herron, Magomo, & Gossard (2008). The wheel garden: Project-based learning for cross curriculum education. *International Journal Of Social Sciences*, 3(1), 44.

Retrieved from Mainfile database (Accession No. 32698901).

Herron, Magomo, and Gossard (2008) discuss the intrinsic benefits created in students through the construction and maintenance of a wheel garden in an urban southeastern high school. The purpose of this study was to demonstrate the lasting effects that a public, student-focused project can have on a school community.

The research question posed in this study was: Would students gain a positive appreciation for project-based learning through the planning, constructing, and planting of a wheel garden? The research design was experimental.

A southeastern high school principal recruited students to voluntarily participate in the construction of a wheel garden on campus. The participants were required to research local, sustainable resources and plants to use in the garden. While teachers of history, biology, art, and math all participated in the construction of the wheel garden, the focus was on creating bonding opportunities for students to discover and work together to accomplish the project.

The result of the project created learning opportunities in history, biology, art, and math, successfully weaving a creative component into each respective classroom. This study concluded that the project was successful because such engagement with the arts created positive changes in student attitude, motivation, cognitive skills and academic achievement, particularly in the areas of reading, writing, and math. Participating students of the garden wheel took it upon themselves to maintain the living art piece on campus throughout their high school career.

This research is important to administrators and principals alike because it demonstrates the lasting benefits that project-based learning can have on a high school. It also provides positive evidence of high school students investing a sense of pride for their school by contributing to creating lasting, artistic creations on campus.

Hobbs, L. (2012). Teaching out-of-field: Factors shaping identities of secondary science and mathematics. *Teaching Science: The Journal Of The Australian Science Teachers Association*, 58(1), 21-29. Retrieved from:  
<http://web.b.ebscohost.com.sierranev h.idm.oclc.org/ehost/pdfviewer/pdfviewer?vid=19&sid=f42b2de6-48a6-4901-bf5ace18159%40sessionmgr1114&hid=1189>

Hobbs (2009) conducted a study based on teachers' past experience and how that effected their teaching role at the time of the study. The research question

examined was: How does a teacher's background and qualifications effect their in-field and out-of-field teaching subjects? The research was quantitative.

Hobbs interviewed a variety of teachers, lab technicians, administrators, and Career Technical Education (CTE) instructors from primary through secondary schools to better understand how their past has shaped their teaching roles at the time of the study. The results revealed a surprising number of science teachers who either had a background in the arts, or who had taught an art class while simultaneously teaching their normal science class. Hobbs, 2009 reported that these factors indicate a stronger correlation that the arts have to science than originally thought.

This information is useful to teachers and administrators alike because it demonstrates the link that many science teachers have to the arts.

Kariuki, P., & Hopkins, B. (2010). The effects of an interdisciplinary program on secondary art students participating in an interdisciplinary chemistry-art program and in an art only rogram. Online submission. Retrieved from: <http://www.eric.ed.gov/contentdelivery/servlet/ERICServlet?accno=ED513644>

Kariuki and Hopkins (2010) study the benefits of secondary school students participating in an interdisciplinary program of photography coupled with chemistry. The purpose of this study was to determine the value of introducing

team-taught interdisciplinary programs on the secondary level between academic and career technical teachers. The research question posed in this study was: Would students gain a deeper understanding for chemistry and photography if the classes were taught concurrently? The research design was experimental.

Participants from the advanced art/photography class of varying science background were chosen to take part in this study. Students were divided by their years of chemistry experience and randomly selected to create groups that mirrored the experience of the whole class. Seven students were chosen as part of the experimental group and ten composed the control group. Students participated in lectures that involved the chemical process for developing photo's. The class commenced with a lab in which students applied their knowledge from the lecture to the process of making prints.

The result of the experiment demonstrated that the photography students gained a deeper understanding for the chemical reactions occurring when developing a photo in the darkroom. Test scores from the experimental and control groups confirm that interdisciplinary teaching approaches can be beneficial when administered in a relative, meaningful manner.

This research is important to teachers and administrators alike because it reveals the power of creating engaging, relevant learning opportunities in the chemistry classroom.

Lee, H., & Breitenberg, M. (2010). Education in the new millennium: the case for design-based learning. *International Journal Of Art & Design Education*, 29(1), 54-60. doi:10.1111/j.1476-8070.2010.01631.x

Lee and Breitenberg (2010) investigated the current practices and benefits of a design-based learning approach at the secondary level. The purpose of the study was to measure the effectiveness of encouraging creativity and innovative thinking in curriculum. The research question posed in this study was: Do students retain more knowledge from a lesson when teachers emphasize holistic thinking, active learning, visual media and problem-solving? The research was quantitative.

A workshop known as *A City of Neighborhoods* was created to gauge the success of various activities implemented in the classroom. Some examples include walking tours of the local community to integrate in a History class and then follow-up activities to tie in with the tour, such as: sensory collages, visually observing change over time, and a historic layering activity that challenges students to think how their impact has changed the environment for the better and worse. Photographs were used to illustrate the stark contrast of the changes in the environment utilized for the study.

The results indicate that students had a greater understanding and appreciation for the lesson because of the diverse learning engagement that took place in the

projects.

This study is important to educators because it demonstrates the effectiveness of incorporating diverse learning exercises in the History classroom.

Martí, E. E., Gil, D. D., & Julià, C. C. (2006). A PBL experience in the teaching of computer graphics. *Computer Graphics Forum*, 25(1), 95-103.  
doi:10.1111/j.1467-8659.2006.00920.x

Marti, Gil, and Julia (2006) examined the benefits of using a PBL approach to a computer graphics course for students pursuing a Computer Science degree at the Engineering School of the Autonomous University of Barcelona. The research question examined was: How does the implementation of a Project-Based Learning model effect student's content retention? Paired in groups of four to six, students are presented with an issue and charged with the task of discovering a solution. The class was arranged in such a way that allowed groups to work during lab time on their project resolution, while also providing one day per week, theoretical discussion sessions to seek the council of tutors in the class.

Requirements for each group included creating KWL charts (Know, Want to know, what was Learned) and regularly referring back to the charts throughout the course. The research design was experimental.

An end of course exam was administered to gauge student feedback and document

success. The exam results indicated that student attendance was significantly lower than classes that did not implement PBL's. A large number of students also demonstrated a higher level of interest in pursuing Computer Graphics jobs after graduation; a result that was not evident in traditional classroom teaching styles. An inevitable downside to the implementation of PBL models for teachers is the added time commitment required for creating a successful project-based learning program.

This research is beneficial to educators because it demonstrates the effectiveness of students taking an active role in their education in the Computer Science field when creative methods are utilized.

McCoy, L. P. (2012). *Studies in teaching: 2012 research digest. action research projects presented at annual research forum (Winston-Salem, North Carolina, June 29, 2012)*. Online submission. Retrieved from:  
<http://www.eric.ed.gov/contentdelivery/servlet/ERICServlet?accno=ED533608>

McCoy (2012) investigated the benefits of a project-based learning approach to an Honors United States History class in a suburban high school. The purpose of the study was to measure the effectiveness of incorporating art elements into the History curriculum. The research question posed in this study was: Do students retain more knowledge from a lesson when the arts are incorporated? The research was quantitative. The initial assignment for the class was to read multiple essays

on a single topic and develop alternative thinking approaches. Some of the assignments included journal writing, and political cartoon creation. Students responded to various artistic exercises by writing paragraphs for each assignment and noting whether or not they enjoyed the exercise. McCoy (2012) administered a pretest on all topics covered in study and followed the unit with another test once elements of art were implemented.

The results indicate that students retained more knowledge of the information because content was introduced in a non-traditional manner. In a peer review discussion at the end of the study, students shared their appreciation for the journal exercises stating that it gave them a new perspective on the material when placed in a character's position of the time period being studied.

This study is important to educators because it demonstrates the power of history lessons when fun, non-traditional approaches are made in the classroom.

Medina-Jerez, W., Dambekalns, L., & Middleton, K. V. (2012). Art and science education collaboration in a secondary teacher preparation program. *Research In Science & Technological Education*, 30(2), 209-224. doi:10.1080/02635143.2012.698603

Medina-Jerez, Dambekalns, and Middleton (2012) explored the notion of merging silk painting with a middle school science class studying organelles in an effort to gauge student interest when the visual arts were integrated. The research question

examined was: How can curiosity be generated amongst students through the use of visual arts? The research design was experimental.

Using the work of artist Alex Grey as a reference, middle school science students were guided on the process of creating elaborate silk paintings. The focus was to first understand the chemical process that occurs when silk is used as a medium for the arts, while also creating a visually stunning painting. Using McTigue and Croix (2010) as a guide for the study due to their research on student's perception of interpreting graphic information, the researchers were able to create an experiment that appealed to the target population. The results indicated a positive outcome demonstrating student's interest and curiosity in learning about the human body through the use of art.

This information is important to educators because it reveals the creative diversity of art that can be used within science classrooms to increase student engagement.

Oluk, S., & Ozalp, I. (2007). The teaching of global environmental problems according to the constructivist approach: as a focal point of the problem and the availability of concept cartoons. *Educational Sciences: Theory And Practice*, 7(2), 881-896. Accession No. EJ796227 Retrieved from: [http://www.edam.com.tr/kuyeb/en/oneki\\_sayilar.asp?act=detay&ID=31](http://www.edam.com.tr/kuyeb/en/oneki_sayilar.asp?act=detay&ID=31)

Oluk and Ozalp (2007) studied the benefits of a problem-based learning project with a group of rural 7<sup>th</sup> graders, ages 13 – 14. The research question examined

was: Do students take an active role in helping to change the problems of global warming and ozone depletion when a PBL approach is used? Two groups were utilized in this study: a control group in which traditional teaching methods were utilized, as well as an experimental group in which a PBL approach was implemented. The research design was experimental.

Students were given environmental issues as a basis for their projects and charged with the task of creating a viable solution to problems that they contribute to. In interviews conducted after the project, the “experimental group [of] students show that experimental method[s] leads to an increase in attention towards science lessons, facilitates learning, and makes the lesson more enjoyable” ( Oluk & Ozalp, p 887, 2007).

This research is beneficial to educators because it reveals the power of giving students an active role in the research and results.

Syafii, W., & Yasin, R. (2013). Problem solving skills and learning achievements through problem-based module in teaching and learning biology in high school. *Asian Social Science*, 9(12), 220-228. doi:10.5539/ass.v9n12p220

Syafii and Yasin (2013) studied the benefits of using a problem-based module (PBM) in a secondary Biology classroom. The purpose of this study was to determine student's problem solving abilities and achievements gained through the

use of PBM's. The research question posed in this study was: Are problem-based modules an effective tool for increasing student's problem-solving skills, achievement, and product of learning after the teaching and learning session are completed? The research design was experimental.

This study was conducted at a high school in Indonesia in which two groups were chosen; one was assigned to be a control group, while the other was an experiment group. The design of the quasi-experiment study measured whether or not the experiment group learned problem solving skills using PBM, the effectiveness of conventional learning with the control group, and a pre and post-test on each group. The teacher used a PBM module as a guide in the lesson which included activity sheets with problem solving prompts, as well as steps for outlining proper problem solving steps. The controlled group learned the same lesson but through a conventional method of teaching in which the teacher used a standard lesson plan, textbook, lecture, and drills. Students of the control group were not exposed to the PBM model.

The results were presented in both qualitative and quantitative forms. Qualitative data was obtained from an observation sheet. Quantitative data was obtained from the pre and post tests. Results demonstrate that the problem-solving skill understanding of the experimental group was 95.47%, whereas that of the control group was 25.12%, validating the effectiveness of utilizing a PBM in this high school Biology class.

This research is important to teachers and administrators alike because it reveals the power of practical, interactive learning opportunities in science classrooms.

Toolin, R., & Watson, A. (2010). Conducting sustainable energy projects in secondary science classrooms. *Science Activities*, 47(2), 47-53. doi: 10.1080/003681209903383158

Toolin and Watson (2010) studied the empowering benefits of student-created PBL tasks in regards to environmental science. The project focused on sixth through twelfth graders by providing students with the tools and resources needed to design, research, create, and present a project that demonstrates effective, practical ways of conserving energy. The research question examined was: How can teachers effectively create long-term, standards based projects that engage students in real-world problem solving issues? The research design was qualitative.

A sustainable energy project was proposed to an environmental science class and the students were asked to choose an issue or sub-topic that solves a problem related to wasted energy. Sample projects with goals were given as a means to starting the process. The premise of the project was to demonstrate the effectiveness of project based learning opportunities when students show a vested interest in the issue.

Self, and peer-assessment tools were used to gauge the effectiveness of the project and the results confirm that students were more apt to create higher quality products when they felt like they were genuinely a part of the solution process. One of the greatest by-products produced through this study was the confirmation of intrinsic success on the student's side.

This study is beneficial to educators and administrators because it demonstrates the power of student-led projects.

Turk, J. (2012). Collaboration, inclusion, and empowerment: a life skills mural. *Art Education*, 65(6), 50-53. Retrieved from Teacher Reference Center (Accession No. 82750725).

Turk (2012) investigated the benefits achieved through 6th-8th grade students creating a mural. The purpose of this research was to discover the variety of learning opportunities presented when a group of students work together to create an art piece. The research question examined was: Can art education be more authentic and meaningful when students take on the role of researchers in the classroom through a project-based assignment? The research design was qualitative.

Middle school students were paired with a group of art students from the

University of Pittsburgh at Bradford. Participants included 26 Art Club Students, and 8 Life Skills Students. Students were faced with the challenge of working together to create a design, create a list of how much material and paint would be required, as well as the unique challenges through group collaboration. The mural project was based on authentic instructional practices by engaging students in higher-level thinking, active inquiry, and real-life problem solving. Students involved in the process acted as full participants in the study and reported their immediate reactions to the experience during each session. Information was collected directly with interviews on a session-by-session basis while the study was underway with observation and note taking. A final interview was held and the participatory action research study data showed that students successfully bridged the gap between art club and life skills students, while also discovering a successful way to collaborate on a group project. Several participants came from economically disadvantaged homes, and many of the life skills students had been diagnosed with various disabilities including Autism and Multiple Sclerosis.

This research is important to educators because it shows the positive benefits of a diverse group of students working together to achieve a beautiful piece of artwork, while creating opportunities for students to learn crucial life skills from one another.

Verma, A. (2011). Engaging students in STEM careers with project-based learning -- Marine tech project. *Technology & Engineering Teacher*, 71(1), 25. Retrieved

from ERIC database (Accession No. EJ941852 ).

Verma, Dickerson, and McKinney (2011) investigated the links that a project-based ship building program has on students interested in STEM courses. The purpose of this research was to conclude whether or not students benefit in STEM classes by participating in a project-based learning approach to a ship building project. The research was qualitative.

Small groups of middle school and high school students participated in a 144 hour course that covered shipyard activities, the construction of ships including hull design, a stability activity, ship disaster investigation, ship operations, as well as history and terminology related to ship building. Throughout the instruction model, students were required to demonstrate their understanding for various elements from the curriculum by creating a physical model from K'NEX parts. Student surveys and individual interviews concluded that students gained a greater understanding for ship design and construction when a hands-on element was coupled with the instruction. Higher level workshops were offered to students and 95% of students showed an interest to continue with the advanced curriculum.

This research is important to teachers because it shows that students retain an understanding for STEM coursework when they are able to apply that knowledge to physical results, such as the ship building creations.