



Research Article

FUN ACTIVITY-BASED MATHEMATICS: SOME TEACHING SITUATIONS AT LAWRENCE S.TING JUNIOR HIGH SCHOOL

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ABSTRACT

Learning Math has never brought all exciting experiences for most students in their learning process. Teaching Math therefore has never been as easy as a pie for teachers either; especially for those working in high-school settings and assigned the responsibilities for providing the core knowledge of certain concepts and formulas in a limited time frame and then making students fully understand and be able to demonstrate their application of what they learn to real-life situations. In this regard, this article focuses on the implementation of activity-based Mathematics classrooms following the theories of Project Based Learning, Learning-by-Doing theory, Service Learning, and Inquiry Based Learning to make Math lessons more engaging for the students. Throughout the article, the teaching process is illustrated through school-based examples at Lawrence S. Ting School (Dinh Thien Ly) Junior High School for students in grades 8 and 9. The activities incorporated the theories mentioned earlier with the aim of not only improving student's abilities in solving problems by completing a designed task but also creating meaningful and fun classes. The results show that they have a profound impact on student achievement for more than two years.

Keywords: daily problems, experiences, service learning, practical solutions, fun activity-based Mathematics

1. Introduction

With the desire to arouse students' interests in the subjects, apply the knowledge learned in practice, as well as create teamwork culture, from 2010, Lawrence S.Ting School (LSTS) started to apply Project Based Learning (PBL) in teaching. Since then, doing projects has become an important part of learning. However, designing a multi-task which contains key knowledge and helps students improve their skills yet brings joy to learners and also makes them experience the applications of Math in their lives seems to be a

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“Learning by Doing activity” for teachers. Besides, students need to be trained on how to think critically, logically and create connections with prior knowledges to meet new requirements. This is the reason why we have been trying to apply Inquiry Based Learning (IBL) in teaching. Furthermore, students are encouraged to make products that serve the community, thereby spreading the value of Service, one of the six core values of LSTS. In this paper, I would like to introduce some Learning-by-Doing activities incorporated the theories mentioned above which are being applied at LSTS and their values. Among various definitions of “Learning-by-Doing”, the way Reese (2011) presented in his work best fits for this article.

2. Some teaching situations

2.1. *The mysterious can*

The cylinder’s lesson plan is created in the form of a series of challenges. It is called “The cylinder’s surgery.” At the beginning, in ten minutes, students are given measurements and papers and asked to make a cylinder gift box with no further explanation. During this first task, they are required to write group’s reports that reflect their observation, comments, and conclusions drawn from the activity. When the group finish this task on time, they will get 5 points maximum for task accomplishment and 2 points for each meaningful comment. The fact that students who share the groups’ comments are randomly selected by the teacher motivates them to share their opinions and teach each other (Sharratt, & Planche, 2016). In this process, the students learn about components of a cylinder and how to construct its body and bases, from which they could then draw conclusions about the structure of a cylinder. For example, the curved surface is a rectangle or its top and bottom are two equal circles.

In the second activity, students are provided with a can without a label – the mysterious can. In groups, students brainstorm some possible questions on this can. For each question they can make, the group will get one bonus point. This stage is also a part of IBL. In the following activities, students will work on answers to the questions by themselves.

After that, they have to calculate the volume of the can and the size of the label in as many ways as they could as long as they are reasonable and practical. Ultimately, the learning outcomes students can get include:

- break down a cylinder into basic shapes;
- make a cylinder with given measurements;
- create and explain how to calculate the lateral area and the surface area;
- apply those formula to solve real life problems.

2.2. *Measure the height of the flag pole*

Trigonometry is first introduced in grade 9. Apparently, students face a lot of difficulties. However, regarding its usage and meaning, this Math concept is continuously taught in high school for its various applications in our lives. Thus, in order to make it come alive and enhance students' skills in solving problem related to trigonometry, teachers in grade 9 decide to choose an appropriate context to teach this lesson and turn it into a challenge instead. For this activity, students will get 50% of the total score from this activity and other 50% from the traditional paper tests.

The main task of this exercise is to measure the height of the taller flag pole in the school yard. In two weeks, each group of six students have to select at least three solutions to get the result. They can first introduce as many ways as they can imagine but are just allowed to choose one main solution to present. The students then give their explanations and the final result in a presentation in the form of a poster, a video clip or an infographic. Finally, the teacher and students evaluate group's score based on given rubrics (Table 1 in the appendix).

2.3. *Living values in Math*

Living values in Math was first created by Ms. Nguyen Ngoc Uyen Phuong, a Math teacher at LSTS. This is an interdisciplinary project of Math and English for students in grade 8. In the project, students will play roles of writers, character designers, artists, directors, and social activists to complete particular missions. (Nguyen, Tran, & Dang, 2017)

The project goes through four stages:

- Stage 1: complete the living value challenge in three to five days which can be not using plastic bags, cooking a meal for the family, living a life of a vegetarian, and such. The challenge will provide students with initial experiences to write reflections on a social media platform of the project to spread the meaningful messages and prepare the ideas to write a story.

- Stage 2: students learn how to draw by ruler and compass, starting from basics such as parallel lines, perpendicular lines, equilateral triangle, square, and so on to much more complex shapes, like pentagon, hexagon, how to make the template of the pyramid, equilateral apex, and vertical prism on paper. They are also given instructions on connections between real-life objects and geometric shapes learned in the class as well as how to sketch out the objects using the shapes to make the first drafts of the characters of the story created in the first stage.

- Stage 3.1: students design a poster to describe the story and the underlying messages.

- Stage 3.2: students calculate the surface area of the characters to optimize the area of the paper when they are mass produced.

- Stage 4: students make comic strips in stop motion style based on the story about living values. The purpose of this activity is to give them a sense of community service.

Teachers in grade 8 keep students informed of the requirements and description of each stage with specific rubrics, external resources and deadlines on the first day of the project implementation. Accordingly, students can generate ideas and plan ahead work schedules (see all the rubrics in Table 2 and Table 3 in the appendix)

3. Results and Discussion

3.1. From *The mysterious can*

After the continuous challenges, students generally realize that the circumference of the top or bottom must also be the length of the rectangle if they want to make each part of the cylinder fits perfectly with others. Those discoveries have laid the important steps to compute the lateral area, the surface area, and the volume of the cylinder, all of which are the key knowledge of the lesson.

Moreover, students have a chance to “meet” some problems related to cylinder objects in real life and solve those problems together. They are also allowed to try many realistic solutions such as pouring water into the can or buying the same can to get the volume of the can, which may not be accepted in formal classes. This activity has brought Math closer to students’ lives, sparked joyful moments, and developed their creativity during the discussion and presentation.

3.2. From *Measure the height of the flag pole*

As a result, each year, we are amazed by more and more unique, creative, and funny ways that students have shown us. Here are some of them:

- Trigonometry: measure the base angle in the right triangle formed by the ground, the pole and the rope when it is untied, then calculate its tan, and finally figure out the height of the pole.
- Photoshop: take a picture of a student standing next to the pole and use his height as a standard measurement.
- Approximate measurement: add up the height of two floors and the approximate height of the extra part from the highest floor to the top of the point, then subtract the height of the base.
- Congruent triangles: construct a smaller right triangle which is congruent with the right triangle formed by the ground, the pole, and the rope when it is untied. Using congruent ratio, students can get the answer.
- Drone: fly a drone until it gets to the same height of the pole.
- Yarn strategy: tie the yarn with the mark to the rope which holds the flag, next pull the rope until it reaches the top of the pole, then mark on the yarn and lower the rope to

untie the yarn. All they do in the end is to measure the distance between two marks.

- Measure apps on smart phones

- Gravity: choose a point where it could be the half or one third of the pole, one student drops a yarn and then measures the falling length. From the ratio between the position they drop it with the tallest point of the pole, they can calculate the distance.

- Ask the maintenance staff

Students apply what they have learnt in different subjects to calculate the height of a tall object. They also create their own solutions, make decisions by choosing the best option, and practice communication skills (Laal, & Laal, 2012). Even in the end, although the students used to be curious about the answer, they just remember how they accomplish the challenge, not about the number. Experiences students get from the process of thinking, measuring, calculating, negotiating... become meaningful memories. The flag pole will remind them about the lesson they learnt and the funny activities they did with friends when trying various ways to get the height of the pole.

3.3. From Living values in Math

After doing this project, students are able to:

- improve drawing skill, promote space imagination, practice geometric thinking, calculate related to real lives;

- stimulate linguistic thinking, the ability to write creative stories in English;

- work effectively in a teamwork;

- practice and experience living values.

3.4. The development of the project

- Stories and short films from this project will be used as teaching resources for living values lessons.

- The kit of characters will be uploaded to a social network, so many people can use them to improve their children's thinking ability.

- Connect with Orphan Impact Organization to teach the smaller kids how to create various characters and share the 12 living values (UNESCO, 2000).

4. Conclusion

“Knowledge becomes most powerful when students can use information to gain deeper understanding of specific problems” (Fred M. Newmann).

The results of example activities presented in this paper have shown that students get a full understanding of key Math concepts. At the same time, they can greatly improve many important skills, such as raising questions, logical and critical thinking, communication, decision making, collaboration, planning and so on. They also have fun with their teammates while completing the challenge. Based on the well-designed learning-

by-doing lesson plans, solving Math problems can be integrated into every-day life activities. In consistently doing so, students get familiarized with the application of Math to daily situations. Generally, repetitions of these activities make it become their own habit.

As the activity is based on daily problems, answers such as pouring water into the can to get the volume, wrapping a piece of paper around the can, or even visits to the store in a search for measurements of the original can become reasonably acceptable. In such circumstance, if they as students refuse to use Math but another method, we as a teacher, can make advantage of this situation instead by putting an emphasis on the importance of Math. For example, teachers could explain that people actually do not have to go to the store, cutting the paper into pieces to get the lateral area, or getting wet while pouring water into the can to estimate the volume if they know the way to get the formula. In this regard, Math will appear as a genius, professional, and magical tool to solve all the problems.

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APPENDIX: Rubrics

Table 1. Rubric for measuring the height of the flag pole

Categories		Max score	Group's score
Report	Each measure is explained clearly in details	15	
	Content	Number of possible options	10
		The creativity, originality and effectiveness of options	10
	Form	Content is clear and highlighted	15
Using appropriate animations, pictures, sounds, text colors and themes		10	
Presentation	The speaker shows his deep understanding of content, presents fluently.	10	
	The speaker presents confidently, knows how to communicate and engage audiences.	5	
	Respect others when they are presenting, have good questions or comments.	5	
Group work effectiveness	Communicate effectively and have fair share among group members.	15	
	Punctual	5	
		Total	

Table 2. Rubric for character evaluation

Category	5 pts	4 pts	3 pts	2 pts	1 pt
Kit	- Exactly fit with the structure of the character - Arrange parts of character reasonably (in order of priority: the order of character creation, making use of the gaps) - Sharp drawings.	- Exactly fit with the structure of the character - Arrange parts of character unreasonably - Have 1-2 blur detail (s).	- Exactly fit with the structure of the character - Arrange parts of character unreasonably - Have 3-4 blur details.	- Exactly fit with the structure of the character - Arrange parts of character unreasonably - Have 5-6 blur details.	- Exactly fit with the structure of the character - Arrange parts of character unreasonably. - Have more than 6 blur details.

Flap	- Sufficient, well organized, easily cut and glue. - No overlap.	- Sufficient. - No overlap. - Unreasonable layout, not convenient to cut or glue	- Sufficient. - Overlap 1-2 flap(s). - Unreasonable layout, not convenient to cut or glue	- Insufficient/ overlap 3-4 flaps. - Unreasonable layout, not convenient to cut or glue.	- Insufficient/ overlap more than 5 flaps. - Unreasonable layout, not convenient to cut or glue
Note	- Have the model. - Full, clear and accurate notes. - Notes are succinctly expressed.	- Have the model. - Full, clear and accurate notes. - Notes are reasonably expressed.	- Have the model. - Notes are sufficient but have 1-2 errors.	- Have the model. - Have some missing notes or/ and 3-4 errors.	- Have the model. - No notes or more than 5 misused notes.
Joint	- Can move in more than 2 directions - Firm structure.	- Can move in more than 2 directions - 1 detail is separated.	- Can move in just 1 direction - 2 details are separated.	- Can move in just 1 direction - 3 details are separated.	- Cannot move. - More than 4 details are separated.
Aesthetics	- Lively decorations - Harmonious, eye-catching colors. - The edges fit snugly. - Surfaces of the character are clear.	- Lively decorations - Harmonious, eye-catching colors. - The edges fit snugly. - 1-2 surface (s) of the character have some stains.	- Lively decorations - The colors are quiet harmonious. - The edges don't fit perfectly with others. - 3-4 surfaces of the character are blur, messy.	- The decorations are quiet lively. - The colors are not harmonious. - The edges don't fit perfectly with others. - 5-6 surfaces of the character are blur, messy.	- Colorful decorations. - The edges don't fit perfectly with others. - More than 7 surfaces of the character are blur, messy.
Diversity in structure	- Firm structure. - Use a variety of shapes (rectangular prisms, right prisms, pyramids).	- Firm structure. - Use two of three kinds of shapes.	- Unstable structure. - Use two of three kinds of shapes.	- Unstable structure. - Use one of three kinds of shapes.	- The structure is soft, dented, distorted. - Use one of three kinds of shapes.

Table 3. Rubric for short story grading

CATEGORY	4	3	2	1
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1. Setting & Characters	Many vivid, descriptive words are used to tell when and where the story took place. The main characters are named and clearly described. Most readers could describe the characters accurately.	Some vivid, descriptive words are used to tell the audience when and where the story took place. The main characters are named and described. Most readers would have some idea of what the characters looked like.	The reader can figure out when and where the story took place, but the author didn't supply much detail. The main characters are named. The reader knows very little about the characters.	The reader has trouble figuring out when and where the story took place. It is hard to tell who the main characters are.
2. Plot Elements	It is very easy for the reader to understand the problem the main characters face and why it is a problem. The solution to the character's problem is easy to understand, and is logical. There are no loose ends.	It is fairly easy for the reader to understand the problem the main characters face and why it is a problem. The solution to the character's problem is easy to understand, and is somewhat logical.	It is fairly easy for the reader to understand the problem the main characters face but it is not clear why it is a problem. The solution to the character's problem is a little hard to understand.	It is not clear what problem the main characters face. No solution is attempted or it is impossible to understand.
3. Organization	The story is very well organized. One idea or scene follows another in a logical sequence with clear transitions.	The story is pretty well organized. One idea or scene may seem out of place. Clear transitions are used.	The story is a little hard to follow. The transitions are sometimes not clear.	Ideas and scenes seem to be randomly arranged.
4. Creativity	The story contains many creative details and/or descriptions that contribute to the reader's enjoyment. The author has really used his/her imagination.	The story contains a few creative details and/or descriptions that contribute to the reader's enjoyment. The author has used his/her imagination.	The story contains a few creative details and/or descriptions, but they distract from the story. The author has tried to use his/her imagination.	There is little evidence of creativity in the story. The author does not seem to have used much imagination.
5. Mechanics	The story contains no errors in grammar, usage, or mechanics.	The story contains few minor errors in grammar, usage, or mechanics.	The story contains many and/or serious errors in grammar, usage, or mechanics; may interfere with reading.	The story contains so many errors in grammar, usage, and mechanics that errors block reading.

GROUP	S	P	O	C	M	TOTAL
1						
2						
3						
4						

HỌC TOÁN QUA CÁC HOẠT ĐỘNG NG THỰC NGHIỆM VUI: VÀI TÌNH HUỐNG DẠY HỌC Ở TRƯỜNG TRUNG HỌC CƠ SỞ VÀ TRUNG HỌC PHỔ THÔNG ĐÌNH THIỆN LÝ

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TÓM TẮT

Những trải nghiệm trong quá trình học Toán không phải lúc nào cũng mang đến hứng thú cho hầu hết học sinh. Việc dạy Toán vì thế chưa bao giờ dễ dàng với giáo viên, đặc biệt là đối với những giáo viên phổ thông khi nhiệm vụ là vừa phải cung cấp những kiến thức nền tảng như những khái niệm và công thức cơ bản trong thời gian giới hạn, vừa phải cố gắng truyền đạt để học sinh thông hiểu và áp dụng được những điều đã học để giải quyết những tình huống thực tế. Về vấn đề này, bài viết tập trung vào việc triển khai các hoạt động dạy học Toán dựa trên lý thuyết của Học tập theo dự án, Học tập qua việc thực hành, Học tập để phục vụ cộng đồng và Học tập dựa trên việc truy vấn để biến những bài học Toán trở nên hấp dẫn hơn với học sinh. Trong bài viết này, quá trình giảng dạy được minh họa qua những lớp học khối 8, 9 ở trường THCS và THPT Đình Thiện Lý (Lawrence S. Ting School). Các hoạt động kết hợp với các lý thuyết nêu trên với mục đích không chỉ phát triển khả năng giải quyết vấn đề của học sinh mà còn tạo ra những lớp học thú vị và ý nghĩa. Việc áp dụng các hoạt động dạy học này cũng đã mang đến những ảnh hưởng tích cực lên thành tích của học sinh trong hơn hai năm học trở lại đây.

Từ khóa: *vấn đề thực tế hằng ngày; trải nghiệm; học tập phục vụ cộng đồng; giải pháp thực tế; học Toán qua các hoạt động thực nghiệm vui*