INTEGRATING SCIENCE IN MATHEMATICS TEACHING IN VIETNAMESE ELEMENTARY SCHOOLS

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ABSTRACT: In teaching mathematical in Vietnamese elementary schools, teachers must place emphasis on both the science and mathematical contents in the teaching and learning. This paper presents the importance of the integration of mathematics and science and describes what the integration of math and science at primary schools should be by providing some examples which illustrate.

KEYWORDS: Integration science, mathematics, teaching methods.

1. INTRODUCTION

In Vietnam, mathematics education has moved to the forefront of education requiring direct and specific action to improve student mathematical accuracy and understanding. An science based approach to mathematics provides an invaluable addition to the mathematics classroom as it addresses the multiple ways of understanding and expressing knowledge.

As ([Nam16]) state that, the empirical research provided a new approach in teaching applied to mathematics and opened new ways of thinking about integrating real world situations in the process of learning and teaching school mathematics; ([HN16]), suggest, there is a positive relationship between science integration and academic achievement and participation. That is, students who are taught through science integration tend to be more actively involved in the process of learning and tend to score higher on various levels of assessment. Creating an environment that uses cross-curricular teaching to harness student skills creates a unique and engaging classroom environment.

([BU11]) found that, science teachers have complaints about the lack of connections between science and math in the existing programs of science and technology and math courses. They also stated that they have to deal with math topics before certain science units such as physical science since prior math knowledge is required for the learning of such topics. Watanabe and ([Hun98]) state that, science teachers mostly regard math as a tool for science or the language of science. ([K+08]) concluded that math teachers are not aware of the necessity of math knowledge for the course of science and technology. However, both science teachers and math teachers believe that student achievement in either of these courses affects the achievement in other course. ([FG05]) found that pre-service teachers are aware of the blending nature of science and math and of the significance of the connections between these two courses. However, the participants were found to have the fear of using the program for the integrated science and math. The reasons for this fear included the lack of teaching experience and deficiency of content knowledge.

Much of the research focuses on science integration in social studies in Vietnam but rarely addresses the impact on science and mathematics. Because it is evident that science integration is important to student learning and success, it is imperative that the specific academic knowledge in the area of science integration be extended into all areas of the curriculum.

2. RESEARCH CONTENTS

2.1. Purpose of the study

The main focus of this study is to explore the ways in which educators are employing an science based curriculum in mathematics and to examine the perceived benefits of these practices in the elementary schools in Vietnam.

2.2. Research questions

The study sought to provide answers to the following questions:

+ How do elementary school educators teach mathematics through the science?
+ What factors support the perceived successful science based curriculum in math?
+ What perceived benefits do these educators see for students being taught mathematics/science by through the examples?

3. RESULTS AND DISCUSSION

This section provides answers to the research questions raised.

3.1. What is integrated teaching?

According to research by ([Mar08]) The 20th century in the USA has witnessed a continuous discussion about integrated Science education. Intertwined with this discussion has been a discussion of progressive education. The demand for integrated education reached its climax in 1970 when the U.S. Advisory Committee for Science Education of the National Science Foundation recommended a curriculum that related Science and Technology to human and social affairs. During the same time period, two large international organisations started a continuous mapping and development of integrated Science education. One of these organisations is UNESCO, which publishes the report series 'New trends in integrated Science teaching' and the other is ICASE, the International Council of Associations for Science Education, an association of teacher organisations with the goal of integrating Science education.

Integrated Science treats scientific concepts in a manner free of the restrictions imposed by the arbitrary subject boundaries of the separate sciences. It has a dynamic process approach to the teaching and learning of science ([MD13]).

As ([Mar08]), One of the first steps in mapping and developing integrated teaching education was to find a model for integrated. Blum created a two-dimensional model consisting of scope and intensity. Scope deals with the disciplines that are integrated. Intensity has three levels: full integration (amalgamation), combination and coordination. He uses this model to categorize curricula in different parts of the world ([Blu73]).

Some researchers described the occurrence of integrated Science curricula; they also analysed and discussed implementation trends in different countries for integrated science curricula. At the same time, Brown wrote about the meaning of integrated education and argued in favour of integration ([Mar08]).

I state that, an integrated curriculum is one in which a teacher, or teachers, explicitly assimilates concepts from more than one discipline during instruction. It is typified by approximately equal attention to two (or more) disciplines.

One can see a clear definition of integrated science as one study the ways different authors describe the discipline.

Brown ([Bro77]) describes integrated science under four broad characteristics:

i) The unity of all knowledge… that integrated science has a holistic view of knowledge as essentially one and undivided;

ii) The conceptual unity of the sciences… the various conceptual units that make up the framework are identified;

iii) A unified process of scientific enquiry… this characteristic place emphasis on the methodological distinctions and similarities among the sciences;

iv) An interdisciplinary study… that the discipline is a collaborative venture between subjects and viewing of topics or themes from logically different viewpoints with the learner left to synthesize in any way teacher chooses.

3.2. Integrated teaching in the Classroom

The integration of the science into the classroom involves bringing science into all areas of the curriculum. J. Davis developed a number of ways the science can be integrated into the classroom.

As ([HT16], [THH17]), mathematics teachers in their efforts to help their pupils' success, strive to find the best ways to teach, so that the pupils are engaged in the learning process. Briefly, an science based approach involves the science being a required core subject in the curriculum. Using the science as a medium, students use the skills acquired in their science classes in other subject areas. Additionally, the science injected approach uses the science to enhance various areas of the curriculum. Finally, the problem solving education model allows educators to use the science as a way for students to exemplify their particular ways of knowing and constructing that knowledge in alternative forms. In combination, these approaches are comprised to form the understanding of an science based approach to the curriculum for the use of this research paper. The science are used in the classroom as a way for students to make meaning of their learning and as a way for them to express their learning.

Science integration stems from the notion that the science play a significant role in keeping students engaged in education by encouraging their learning through problem solving way. Integrated learning incorporates multiple subjects, which are usually taught separately, in an interdisciplinary method of teaching. The goal is to help students remain engaged and draw from multiple sets of skills, experiences and sources to aid and accelerate the learning process.

3.3. The integrated science and math includes some principles as follows:

The content knowledge in this model is similar to the models developed by ([LD97]; [Hun98];

[HN16]). These scholars also refer to balance model in their accounts of the integrated science and math, suggesting that content of science and math should be represented equally in the program for the integrated science and math. Recognizing the value in teaching mathematics and science with varying degrees of overlap between the disciplines, participants at the 1967 Cambridge Conference defined five categories for describing various interactions between mathematics and science: (a) mathematics for the sake of mathematics (At this dimension, only the objectives of the math course is taken into consideration); (b) mathematics for the sake of science, (c) mathematics and science (The objectives are developed in what that science and math are completely blended); (d) science for the sake of mathematics; (e) science for the sake of science (At this dimension, only the objectives of the science course is taken into consideration). Transforming these discrete categories into continuous categories, the different possibilities regarding the extent of interaction between mathematics and science during instruction can be represented in a Mathematics/Science continuum.

3.4. Some examples integration of mathematics and science through problem solving

- Example 1. Mathematics for the sake of Mathematics

This example consisted of 3 parts: (a) writing expressions of Cauchy–Schwarz inequality (for two pairs a_1, a_2 and b_1, b_2); (b) writing inequalities of Cauchy–Schwarz inequality (for n pairs a_1, a_2,..., a_n and b_1, b_2..., b_n); (c) use the Cauchy-Schwarz inequality to find the maximum of $x + 2y + 3z$, given that $x^2 + y^2 + z^2 = 1$.
Mathematics was conducted in an interactive fashion-the teacher wrote the problems on the over head and called on students for solutions, which were then written on the overhead.
This lesson focused on students developing their understanding of mathematics. There was no investigation of science in this activity, nor was science used as a context for any of the problems posed. Hence, the relationship between the disciplines is best characterized as mathematics for the sake of mathematics.

- Example 2. Mathematics with Science

([Qua16]) state that, teachers can create examples with different levels that will improve students' confidence when tackling open tasks. There are many situations in daily life as well as in mathematical, science that require the use of ratios and proportions. For example, in cooking, if we increase or decrease a recipe, we usually keep the ratios of the various ingredients the same. Any time we use percents, we are using a ratio. When pharmacists mix paint, they must pay careful attention to the ratios of the ingredients.
Four gallons of yellow paint plus two gallons of red paint make orange paint. I assume this makes six gallons. So the ratio is 4:2, or 2:1.
Question: how many gallons of yellow paint, and how many gallons or red paint, to make two gallons of orange paint?
$2y + r = 2$
$2y + y = 2$
$3y = 2$
$y = 2/3$
or
$4y + 2r = 6$
$(4y + 2r)/3 = 2$
so we get 4/3 and 2/3.
Take the problem in the other way.
You are told that 66 gallons of orange paint are made mixing 44 gallons of yellow paint and 22 gallons of red paint.
Divide these numbers by 6 in order to come back to one gallon of orange paint. Then, one gallon of orange paint is made mixing 4/6=2/3 gallons of yellow paint and 2/6=1/3 gallons of red paint.
Now, multiply by n which is the number of gallons of orange paint you want to make.
So, making n gallons of orange paint require mixing 2n/3 gallons of yellow paint and n/3 gallons of red paint.
Now, you want n=2; then we get 4/3 and 2/3.
In this example, we will study several different ways to work with ratios—you might have found some of these ways as you thought about the questions in the class activity. Some of these ways of working with ratios involve using only simple, logical reasoning about multiplication and division. Therefore a key point of this example is that if we understand multiplication and division, we can work effectively with ratios. Conversely, working with ratios can provide us with an opportunity to reason about multiplication and division. We will also see that ratios behave like fractions and can be viewed as fractions. In addition to solving a number of problems that involve proportions.

- Example 3. Science for the Sake of Science ([Hun98])

A major unit of study for this class involved the plight of endangered fish of Lake Victoria, Africa. One goal of this unit was to introduce cichlids, imported from Africa, into fish tanks in the teachers' classrooms. In preparation for the arrival of cichlids, students needed to carefully study and document the condition of the fish tanks in their classrooms. The following activity depicts their learning about water

chemistry and conditions necessary to support aquatic life.

The teacher began the investigation by dictating notes, which students copied into their notebooks. There were six points noted, and the teacher often stopped to elaborate on a point before moving on to the next one.

1. Dissolved oxygen (D.O.) is vital to all aquatic/ water life.
2. D.O. is measured in parts per million (ppm).
3. Healthy oxygen level is 5.0.
4. A level of 7.0 is necessary for fish to reproduce.
5. Temperature of water in tanks needs to be approximately 90 degrees.
6. Lake Victoria has lost its dissolved oxygen because of the death of plants.

The teacher then told students to determine, within their groups, who would do each of the 14 steps in the experiment. He distributed safety glasses to all students and explained, step by step, the procedure for using test kits to determine the amount of dissolved oxygen in the samples of water taken from the fish tank. Between each step, he demanded every student's attention so he could model the next step before students proceeded to do it themselves. The students followed his instructions, taking turns with the steps. The students' tests indicated dissolved oxygen levels of 7.6, 7.0, 10.0, 8.9, and 10.0 ppm. This lesson focused on students learning about water chemistry. The teacher did not take advantage of the potential for students to use mathematics during this investigation (for instance, to make comparisons with the accepted levels of dissolved oxygen, or compute the maximum and minimum levels of dissolved oxygen, which could serve as the basis for proportional reasoning and estimation). Hence, the relationship between the disciplines is best characterized as science for the sake of science.

CONCLUSION

Based on the research work above, the following suggestions have been put up by the researcher, which are not mandatory but essential.

1. The teaching of integrated science contributes towards general education, emphasizes the fundamental unity of science and leads towards an understanding of the place of science in contemporary society. Government should therefore encourage young scientists by way of symposium, science competitions, and science clubs and even give scholarships to those who have distinguished themselves in this area.
2. A course in integrated science should emphasize the importance of observation, testing and experimentation which are processes of science for increased understanding of the environment; it should introduce pupil to logical thinking and scientific aptitude.
3. As it may be necessary in an integrated science course to omit some details, it is essential that the content of the course should be judiciously chosen. It must be carefully compiled by collaboration between the different teachers and other specialists.
4. The extent of integration and the balance between integration and co-ordination will depend on the age of the pupils, the type of educational institution and local condition. At the higher stages of secondary education such a course may also be desirable especially for those students who have decided not to specialize in science.
5. Further experiments in the development of new integrated science curricula and the production of teaching material are needed, drawing on those resources that are already available. The results of such experiments would be widely disseminated. These conclusions and recommendations thus emphasize the fact that integrated science is able to meet the general education needs of each learner and the common needs of the society.

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