Fostering Better Learning of Science Concepts through Creative Visualization

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ABSTRACT The study explored the use of creative visualization to foster Grade 6 students' better learning of science concepts. Creative visualization activities were given on a regular basis for one quarter, and students' outputs were compiled in their science folio. The findings demonstrate that, though the young learners were initially doubtful of their ability in doing the activities as it was their first time to do them in their science class, the creative visualization activities made them learn the science concepts better, redounding to a significant increase in the their post-test scores as compared to their pre-test scores.

Keywords: Creative visualization, learning of science concepts, creativity

Introduction

That science education is an important key to succeed in today's global knowledge environment profoundly shaped by science and technology is indisputable. UNESCO (2010) states that scientific development has and will continue to have a significant influence on topics that have great importance for humanity, quality of life, the sustainable development of the planet, and peaceful coexistence amongst

Suggested Citation: Sunga, D. L. & Hermosisima, M. V. C.. (2016). Fostering Better Learning of Science Concepts through Creative Visualization. *The Normal Lights Special Issue 2016*, 50 – 63.

peoples. Both the immediate basic essentials of life such as access to water, food and shelter, and the important issues that affect humanity (management of agricultural production, water resources, health, energy resources, biodiversity, conservation, the environment, transport, communication), have a strong science component. Everybody should have a the opportunity to take part in local, regional, national and transnational decisions in regarding these issues or concerns in a meaningful way. Many of the skills needed to compete successfully in today's economy will require students to have a solid comprehension of science concepts.

A major goal of science education is for all students to acquire scientific literacy. Scientific literacy refers to the ability to engage with science-related issues, and with the ideas of science, as a reflective citizen. A scientifically literate person, therefore, is willing to engage in reasoned discourse about science and technology which requires the competencies to explain phenomena scientifically, evaluate and design scientific enquiry, and interpret data and evidence scientifically (OECD, 2013). As the world faces the consequences of increasing population pressures, limited resources and environmental degradation, the pressing need for a scientifically literate populace is increasingly recognized (ICSU, 2011); thus, the direction of curriculum reform in many countries is geared towards the attainment of such.

There is a consensus that in many places around the world, science education is facing serious challenges. Lack of educational and financial resources, a dearth of adequately trained teachers, the growing popularity of non-scientifically-based belief systems, lack of teaching materials including books, computing and communications technologies, community-based science centers, laboratory facilities and equipment, and shortage of skilled teachers are some of the factors that contribute to this global scenario (ICSU, 2011).

The Philippines is one of those places where science education is facing serious challenges. International and local studies have revealed thatFilipino students have low retention of concepts, and limited reasoning and analytical skills (UP-NISMED, 2004); a large percentage of Grade 6 and fourth year students in selected schools cannot apply concepts to real-life problem solving situations nor design an investigation to solve a problem (UP NISMED, 2005); and student performance in TIMMS (1995,1999, 2003, 2008) and in the National Achievement Test (NAT) is consistently low (Tan, UNESCO; Jalmasco, 2014). In the school where this action research was conducted, the NAT results for Grade 6 in 2010-2011 revealed that the Mean Percentile Score (MPS) in science is only 52.76%, falling short of the passing grade which is 75%as per the school's Improvement Plan for 2010 to 2011. Though the mean percentage scores gradually increased from 2011 to 2014, they still reflected poor performance in the NAT. This implies that the Grade 6 students lack mastery of the science concepts. To provide a viable solution to the problem, this action research explored the use of creative visualization in fostering science concept understanding among elementary grade students.

According to Gilbert (2005), there are two meanings of the word 'visualization': 1) the representation of a model in the mind of an individual (otherwise called a 'mental model'); and 2) the expression of that mental model in a form that can be perceived by others, e.g., in a material form, as a diagram, in verbal description. He further states that visualization is important in all learning, especially in science.

Creativity is an important component in the construction of scientific knowledge, and it is important to motivate students and inspire creativity in the science classroom (Csikszentmihalyi, 1996; Taylor, Jones, & Broadwell, 2008). For many decades, science educators promoted the idea that learners should be engaged in the excitement of science; they should be helped to discover the value of evidence-based reasoning and higher-order cognitive skills, and be taught to become innovative problem-solvers (DeHaan, 2009).

Gawain (2011) states that" creative visualization is a technique of using our imagination to create what we want."Our imagination is a critical part of Creative Intelligence because it is a powerful tool that helps us visualize and understand alternatives. Visualization helps us to understand unexpected ideas and new possibilities (Anikulmar & Nagaveni, 1990). It is a factor in scientific understanding (Earnshaw & Wisemen, 1992), and it is also an important part of becoming a creative thinker (Torrance & Safter, 1999).

Evident in the literature (see Anilkumar & Nagaveni, 1990; Clary & Wandersee, 2011; Dias, 2013; Hsieh & Cifuentes, 2006; Li, 2010; YaHadzigeorgiou, Fokialis, & Kabouropoulou, 2012) is that visualization, imagination, creativity, and creative thinking are intertwined concepts. All of the above support the view that science is a creative endeavor, and that visualization/imagination is a factor in scientific understanding and discoveries.

This study is anchored on the theory of constructivism which contends that learning occurs when learners actively construct their own knowledge and think reflectively when information and concepts are presented to them (Lee, 1997). Through creative visualization activities, students are provided with constructivist learning experiences that also give teachers an alternative way of assessing their understanding of science concepts. In this study, creative visualization refers to student creative outputs such as painting, sculpture, and written songs through which students' science concept understanding was assessed. Creative visualizational so refers to that the dramatization and role playing the students performed.

Purpose of the Research

This action research explored the use of creative visualization in gauging sixth graders' science conceptual understanding. Specifically, this action research sought to:

1. Describe the students' performance in the creative visualization activities;
2. Determine the significance of the differences in the students' pre-test and post-test scores; and
3. Document the students' feelings experienced during the creative visualization activities and their thoughts about learning the concepts after the activities.

Methodology

This action research utilized the quantitative and qualitative approaches of research. The participants were Grade 6students of an intact class (n=47) of an elementary school in the district of Manila. They belonged to the highest performing class because they were included in the highest 30% of the total Grade 6 population of the school based on their weighted general average in the previous school year.

Creative Visualization Activities

The creative visualization activities were developed by the researchers. They are varied activities wherein the students were required to show in creative visual representations what they have learned.

Table 1 shows the list of the creative visualization activities (CVAs).

Table 1. List of Creative Visualization Activities

Title Activity	Topic
1. Pumping Heart; Straw sculpture	Circulatory System (Parts of the Heart)
2. Bloody; Thread & button installation	Circulatory System (Parts of Blood)
3. Lucky Me!; Cotton painting	Circulatory System (Prevention of Cardiovascular Diseases)
4. Mario the Brainy Kid; Dramatization	Nervous System (Parts of the Brain)
5. Believe It or Not!; Role Playing	Nervous System (How the Nervous System works)
6. Major Reaction....; Song writing	Nervous System (Ailments of the Nervous System-Group Presentation)

Instrument

A validated teacher-prepared 25-item multiple-choice pre- and post-test on circulatory system and nervous system was used. Experts-validated rubrics were also used to assess the students' creative visualization outputs.

Data Collection

Pre-Intervention

Prior to the implementation of the creative visualization activities, a meeting with the parents was conducted. The importance of the study was explained to the parents, as well as to the students. It was also during this meeting that copies of the parent's consent form were distributed and collected. Thereafter, the pre-test on circulatory system and nervous system was administered to the students. The students were also asked to prepare their Science Folio for the compilation of their creative art outputs.

Intervention and Post-Intervention

On the next meetings with the students, lessons were taught, and instead of the usual paper-pencil assessment/ formative test, the creative visualization activities were given so as to gauge the students' learning of the concepts. For the first two lessons about the parts and functions of the heart, the students were asked to create outputs in art form about what they learned. They placed their outputs in their respective science folios. The students' outputs were evaluated using a set of validated teacher-made rubric. The criteria were application of concepts learned, creativity, and mechanics. Then, for the next two lessons on the circulatory system, the students were asked to demonstrate the concepts learned through group work and presentation (Table 1). The same process was done for the lesson on the nervous system.

On the last week of the implementation of the intervention, the students were asked to write in their journals answers the guide questions given (Table 5).Thereafter, the post-test was administered.

Data Analysis

Means and standard deviations were computed to describe the performances of the students in the different creative visualization activities and in the pre- and post-tests, while the t-test for dependent samples was applied to find out the significance of the differences in the students' performances in the said tests. For the qualitative data, dominant themes were identified.

Results and Discussion

Student Performance in the CVAs

Table 2 shows the performances of the Grade 6 students in their creative visualization activities. The students were rated according to these criteria: application of concepts learned, creativity, and mechanics.

Table 2. Descriptive Statistics on the Student Performances in the Creative Visualization Activities

Title	Activity	N	Minimum	Maximum	Mean	Std. Deviation
Pumping Heart	Straw sculpture	47	4	10	7.02	1.553
Bloody Red	Thread and button installation	47	4	10	6.68	1.682
Lucky Me!	Cotton painting	47	4	10	6.43	1.815
Mario the Brainy Kid	Dramatization	47	4	10	6.68	1.831
Believe It or Not!	Role Playing	47	4	10	6.47	1.828
Major Reaction	Song writing	47	4	10	6.81	1.650

The data in Table 2 reveal that it was in the straw sculpture activity that the learners performed the highest, with a mean score of 7.02. In this activity, students freely expressed the concepts they learned about the parts of the heart using straws. Indeed, students' learning is more visible using alternative assessment (Cheong, 1993). Also, the creativity of the students was evident in this activity.

The cotton painting activity had the lowest mean score of 6.43. This shows that the students performed and visualized concepts regarding the parts and functions of the heart better than concepts on the parts and functions of the human brain.

Pre- and Post-Test Performance of the Students

Table 3 displays the performance of the sixth graders in the 25-item pre- and post-tests.

Table 3. Pre- and Post-Tests Results

N=47	Highest score obtained	Lowest score obtained	Mean	Standard deviation	Mean Difference
Pre-Test	9	0	3.77	2.296	.335
Post Test	23	8	15.89	3.886	.567

Evidently, the learners performed better in the post-test. It may be inferred that engagement in the creative visualization activities made the understanding and retention of concepts learned possible. This finding is in consonance with that of Thompson (1995), that students can actively develop their own understanding using their own creativity. In this study, the students applied creativity particularly in performing the last three activities (dramatization, role playing, and song writing). They planned and designed the performance on their own.

Significant Difference in the Performance of the Students in the Pre- and Post- Tests

The t-test for dependent means results revealed that there was a significant difference in the performance of the students in the pre- and post-tests (Table 4).

Table 4. Paired Samples Test

	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Pair 1 pretest-posttest	-12.128	4.287	.625	-13.386	-10.869	-19.396	46	.000

Students' Feelings about the CVAs

Table 5 shows some of the students' responses written in their journals. There were three guide questions given to the students .Based on their responses, it is evident that the students had mixed emotions about the activities. They were excited and at the same time had doubts in performing the activities at first. Worthy to note is that they expressed that through the activities, they learned the concepts better as attested by their higher scores in the post-test.

Table 5. Sample Verbatim Responses of the Students in their Journal

Circulatory System Nervous System	Heart Blood Vessel Blood Brain Spinal cord Nerves	Explain your feelings while doing the activity on the parts of the circulatory system.	I am happy and excited because it is my first time to do it in Science class. Happy but nervous because I don't know how to do it at first. I feel nervous because I know I cannot do it perfectly, and it is hard at first.
		Did you learn the concept better after your activity? Why?	Yes, because I learned the parts of the heart by myself. Yes, because I learned the concept of the blood using straws, buttons and art paper. No, because I do not know how to draw.
		When did you learn the concept most? Why?	During creative visualization, because I'm doing it myself During creative visualization, because I learn to analyze it and then I create my own. During art work, because I can analyze it more.

Conclusion and Recommendations

This action research demonstrated that creative visualization may play a major role in the learning of science concepts. One limitation of this study is that there was no control group. However, based on the post-test scores and the written statements of the students in their journals, it can be concluded that creative visualization activities (CVAs) facilitated the learning and retention of science concepts, thereby confirming what the literature on visualization contends. Engaged in CVAs, the young students understood the concepts better and for some as expressed in their journal, on their own.

Based on the foregoing statements, it is recommended that science teachers employ the use of creative visualization in their classes. It should also be tried out in the lower or other grades and to supplement instruction in other subjects. Also, to determine CVAs effect on learning, a true-experimental research design is recommended to future researchers who intend to conduct studies on similar topics.

Reflection

Implementing this action research made the researchers realize two things. First is about how the action research gave them opportunities to make students learn science concepts better and on their own, which led to better student performance. Second is about how the action research made them go beyond their usual teaching practices, enhancing their instructional and assessment strategies.

After this experience of conducting action research, despite the challenges encountered like making the parents understand the need for and the benefits of the action research related to their children's learning and the element of time for student preparation of creative visualization outputs, the teacher-researchers are resolute to continue doing action research in their classes. They intend to come up with novel activities for creative visualization and may try to implement in the future a true experimental design to determine the significant effects of creative visualization on student concept understanding.

The action research, indeed, has enhanced not only the teacher-researchers' professional practice but also their self-esteem, knowing they have helped their students learned better and with fun. Their research skills are likewise honed. Of utmost significance is that the young counterpart of the study, the students, benefitted a lot from the research. Aside from learning science concepts better, their learning was accompanied by enjoyment and fun in doing the activities. Likewise, they became responsible for their own learning, planning and implementing the activities among themselves. Based on this realization, the researchers are pushing for action research to be, if not one of the drivers, an integral part of the teaching-learning process.

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