



A study to understand the role of visual arts in the teaching and learning of science

Saroja DHANAPAL

Taylor's University, 47500 Subang Jaya, Selangor, MALAYSIA

E-mail: saroja.dhanapal@taylors.edu.my

Ravi KANAPATHY

Taylor's University, 47500 Subang Jaya, Selangor, MALAYSIA

E-mail: ravi.kanapathy@taylors.edu.my

Jamilah MASTAN

Selangor Darul Ehsan, MALAYSIA

E-mail: jammy.mastan@gmail.com

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Abstract

This research was carried out to understand the role of visual arts in the teaching and learning of science among Grade 3 teachers and students. A mixture of qualitative and quantitative research design was used to discover the different perceptions of both teachers and students on the role of visual arts in science. The data for the research was obtained from an international school in Malaysia through a survey distributed to the teachers and students. The researchers identified how the usage of visual arts motivated students to learn science. The research was supported with literature reviews of various educationists. The study found that children's mental and physical development was not merely enhanced and stimulated through the learning of science alone but with the integration of visual arts which aids their growth and progress. The findings also indicated that almost all teachers and students gave positive views for the integration of visual arts in science lessons. Teachers noticed positive changes among their learners as they enjoyed the freedom of choosing their preferred form of art to express their learning of science. Teachers also noticed that integrating visual arts as a medium to teach science motivated students to attain a higher level of achievement. Finally, it is concluded that visual arts play a useful role in the teaching and learning science. Since visual arts has been proven to play an important role in the development of individuals, the researchers advocate for its integration in science lessons at all levels of study to promote higher order thinking skills and abilities to survive in the 21st century.

Introduction

The education system practiced today has been reshaped and structured several times since the 1980s, for the betterment of all children (Tsimboukidou, 2010). Among the various changes, the integration of visual arts in children's academics has resulted in



showing major effects on their learning abilities and performance in school (Gelineau, 2011). In fact, the existences of arts date back to the ancient times when people drew and used dyes to paint stories on caves (Dickinson, 2005). Research proves that it is good for people to have been acquainted with visual arts as it is a unique approach towards knowing and understanding the world we live in (Mcdougall et al., 2011). The different elements of visual arts enable children at a young age to explore, imagine and create what they perceive. Hence, it is believed that 'the arts make a contribution to education that reaches beyond their intrinsic value as direct forms of thinking' (Horon, 2009).

Over the years as visual arts has shown a prominent effect on children's development, educational authorities have stressed on the integration of visual arts with other subjects like mathematics, science, geography and history (Nunan, 2009). Alberts (2010:1) states that 'art and science are intrinsically linked [as] the essence of art and science is discovery'. Shlain (2007, cited in Gelineau, 2011:9) concurs that arts 'are primary sources of material with which to engage in scientific thinking. Moreover they provide connections that allow lateral leaps between cognitive domains which can produce sudden scientific insights'. The learning of visual arts enhances children's ability to understand and attain knowledge. Hence, the connection of visual arts and science lists various significances in education.

According to Darby and Catterall (1994) arts have become an important part of education. According to Gullat (2008:13), the importance of arts in teaching other subjects started as early as in the 1800s when Mann called for visual arts and music to be taught in the common schools in Massachusetts as an aid to the curriculum and an enhancement to learning'. This call enabled the first integration of arts into the curriculum used by the state. In addition, Gullatt (2008:13) mentions that '...Dewey (1859-1952) posited the correlation between instruction in the arts and cognition to be positive [leaving] a profound effect on curriculum decisions of the time in many locations'. Together with researches conducted by 'international organizations ... about issues of current art education' (NACCCE, 1999; Bamford, 2006; European Parliament, 2009, cited in Tsimboukidou, 2010:24), a number of studies have proven the success of integrating visual arts into the teaching and learning of other subjects, especially mathematics and science (Gelineau, 2011). Despite the existence of extensive research, the researchers have identified a gap where there is insufficient study conducted on the views of teachers and students on this integration. Thus, this research was carried out mainly to understand the role of visual arts in the teaching and learning of science. The outcomes of this research will advocate a change or



improvement in the teaching strategies and approaches used during the science lessons through the use of visual arts. Researchers like Acker (1990) and Robinson (2006) confirm that, ‘the provision of art education is also influenced by people’s perceptions and attitudes which affect the educational process’ (cited in Tsimboukidou, 2010:23). Tarr mentions that ‘art making is a form of inquiry and way of learning about oneself and the world’ (1997, cited in Bullard, 2013:3). This means that it is beneficial for children when educators incorporate the different strands of arts with the learning of other subjects. Thus, this research is significant especially to educators as it allows them to understand students’ feelings about integrating visual arts in the teaching and learning of science. It will also allow them to understand and identify the different approaches to boost students’ motivation in the learning of science.

Objectives of study

In order to understand the role of visual arts in the teaching and learning of science, the researchers came up with three key objectives. Firstly, the researchers identified teachers’ perceptions on the incorporation of visual arts in the teaching and learning of science. Secondly, the researchers ascertained students’ perceptions on the incorporation of visual arts in the teaching and learning of science. Lastly, the researchers analyzed how the usage of visual arts motivates students to learn science. In line with these objectives, the researchers derived the following research questions:

1. What are teachers’ perceptions on the incorporation of visual arts in the teaching and learning of science?
2. What are students’ perceptions on the incorporation of visual arts in the teaching and learning of science?
3. How does the incorporation of visual arts in the teaching and learning of science motivate students to learn science?

Using these questions as a guide, the researchers were able to develop the structure of this research and accomplish focused results.



Literature review

This section provides an in-depth review of the literature based on the research topic carried out by the researchers. A description on related learning theories introduced by famous educationists is also included to explain the role of visual arts in the curriculum of schools today. The various positive developments in children are further illustrated in relation to the teaching and learning of both subjects; visual arts and science.

The curriculum

When it comes to teaching and learning, curriculum is always linked as the connection of subjects, where it allows educators to incorporate their teaching and learning methodologies to what is supposed to be taught to the respective age groups of children. Addison and Burgess highlight that ‘learning does not take place in a vacuum. The ethos of the school, its rules, regulations, shared values, the individual beliefs and interests of teachers all form part of the pupils’ curriculum’ (2007:69). The curriculum illustrates the aims and learning objectives of the content that all children should learn throughout the academic year. Educators abide by the curriculum as it is designed based on the various policies and framework introduced by authorities. Many studies have been carried out on the teaching and integration of art education in schools for the betterment of all children. Al-Amri (2011), a member of the International Advisory Committee for Arts Education, UNESCO, mentions that the trends of art education have constantly been changing directions due to several factors. These factors may include the national or school policies, results of studies carried out by experienced educationists, school environment and so on. He believes that art education needs to be much more comprehensive today as it particularly promotes young learners’ development in creativity. This is supported by Trilling and Fadel (2009) who claim that creativity and innovation are the two key skills that ought to be developed among young learners in the 21st century. Previously, the significance of arts education was emphasized in the Asia and Pacific Regional Conference, stating that we achieve a peace and sustainable development by accomplishing quality arts education (UNESCO, 2006). Arts education has shown integral outcomes as it allows equal opportunities for cultural and artistic activities. Hence, UNESCO aims to ensure arts education gets privilege and obtains a central place in all educational programs and activities worldwide as it ‘... is a key



to training generations capable of reinventing the world that they have inherited' (Bokova, 2012).

The arts and science integration

Friedman says that, 'the secret sauce comes from our ability to integrate art, music, and literature with the hard sciences' (2008:2). This integration currently plays a major role in education. Researches show that these conversions in education greatly affect students' academic results as they get to develop their visual-spatial abilities, reflection, and experimentation skills as well. It is seen that when schools give more importance to mathematics and science, students are limited to developing only certain skills. Leaders such as Obama agree with the integration of arts education as he states that, 'in addition to giving our children the science and math skills they need to compete in the new global context, we should also encourage the ability to think creatively that comes from a meaningful arts education' (2013, cited in National Art Education Association, 2013:3). Nunan described the term creativity as 'the act of turning new and imaginative ideas into reality' (2009:12). Naiman (2013), founder of Creativity at Work, adds on that thinking and producing are the two key processes involved in creativity. Greene (2007) explains that arts inspire and allow imagination producing a different "reality" for children. "Imagination is more important than knowledge because knowledge is limited to all we now know and understand, while imagination embraces the entire world, and all there ever will be to know and understand." (Einstein cited in Nunan, 2009:11). Through their own creativity, children learn to bring out innovative ideas developing various cognitive skills and understanding the world in a whole different way.

In order to fulfil the requirements of the curriculum, it is important for art teachers to be professional who understand how to deliver the various skills to children. Many researches like Pearson (2001), Bracey (2003) and Hedges & Cullen (2005) agree that teachers need to understand the theoretical tools and have a sufficient background of art education to ensure children attain the knowledge of art (cited in UNESCO, 2006). The Road Map for Arts Education conference by UNESCO summarized Learning in and through the arts (Arts Education and Arts-in-Education) can enhance at least four of these factors: active learning; a locally-relevant curriculum that captures the interest and enthusiasm of learners; respect for, and engagement with, local communities and cultures; and trained and motivated teachers (2006:6).



Arts integration promotes the child-centred pedagogical approach towards teaching and learning as it calls for hands-on tasks linked to other subjects ensuring the learning of maximum skills. The Primary Years Programme (PYP) of the International Baccalaureate Organisation (IBO) consists of one 'Transdisciplinary' and one 'Stand-alone' unit. This means that the first one encourages the integration of all subjects while teaching a particular subject whereas the latter means that the respective subjects need to be taught on their own without incorporating other subjects. During the 'stand-alone' unit, teachers focus on teaching only important art skills or genres whereas teaching and learning is combined with the unit of inquiry in the transdisciplinary unit (International Baccalaureate Organisation, 2010). This integration with the central idea also allows teachers to provide a profound understanding of art and the world through art (Immanuel Primary School, 2009).

Visual arts and science are linked fundamentally as they both promote discovery learning (Alberts, 2010). The integration allows students to attempt artistic science projects that enhance their imagination, higher-order thinking skills, creativity and knowledge on both art and science. These projects provide outstanding opportunities for students to discover and explore the world on their own. It also encourages them 'to pursue their scientific inquiries in which arts is embedded, and work on both art and science disciplines simultaneously' (Inan, 2009:1379). For example, the Reggio Emilia-inspired preschool shows that the science projects are not only visually done well but also full of science facts, children's reflections and in-depth thinking (Inan, 2009). Inan reviews that 'their creativity skills and discoveries are guided with their inquiries and questions, which become the seeds of long term projects' (2009:1378).

Social development

Visual arts allow children to develop their social skills as they share and explain their beautiful artwork with their classmates and teachers (National Art Education Association, 1994). The different elements of visual arts enable children to develop confidence, communication skills, an understanding of how they learn and most importantly the art of expressing themselves. Self-expression promotes the freedom for all children as they are given the opportunity to imagine and express their emotions (Efland, 2004, cited in Tsimboukidou, 2010). As they become more expressive, their language skills improve as they use different words to share their feelings and art creations. Additionally, visual art lessons allow learners to engage with people by communicating through images (Kear & Callaway, 2000). They



develop metalanguage as they discuss their different art and design experiences and write them down as reflections (Bloomfield, 2000).

Social development through visual arts education also means that children get familiarised with the diverse cultures and artwork from different time periods. They understand the uniqueness of diverse people and stimulate their minds to look at the world differently (Bullard, 2013). The Road Map of Arts Education (2006) conference listed two effects caused by arts integration. Firstly, the demand for professional art teachers having knowledge of cultural diversity rises. Secondly, the various historical and cultural art programmes and activities are easily organised and carried out in educational premises and organisations. As past researches suggest, one factor affecting positive arts integration would be one's environment (Nunan, 2009). Children's creativity gets stimulated through an inviting and resourceful surrounding where they enjoy exploring their art skills by integrating them into different subjects like science.

Cognitive development

Among all the different skills, educationists emphasize extensively on children's cognitive development that is affected by not only the curriculum used but also how the different subjects are taught in classrooms. The integration of visual arts into the teaching and learning of science show positive improvements in children's thinking skills, reasoning abilities and organization levels (Riley, 2012). These improvements could be made with teachers' continuous effort of practising a teaching method that increases active student engagement during lessons. Edwards and Springate (1995) confirm that children learn better when the facilitators revisit and revise their lessons often. This becomes easier when the child-centred pedagogical approach is practised as it allows active learning to take place through sharing and gaining knowledge from one another. According to Vygotsky (1978), expertise in art education is essential for individuals to work actively and develop 'higher psychological functions' or in other words, the processes stated in Bloom's (1956) taxonomy; analysis, synthesis and evaluation (cited in White, 2012). Children develop these skills when science activities are carried out using the integration approach in which teachers encourage them to use the elements of visual arts to understand the science topics better. The Primary School Curriculum developed by the National Council for Curriculum and Assessment explain that the visual arts curriculum 'presents a range of activities in perceiving, exploring, responding to and appreciating the visual world' (1999:8).



The World Conference on Arts Education summarized that the teaching and learning of arts ‘... is recognized as a means of achieving one of UNESCO’s central educational goals: quality education’ (UNESCO, 2006:6). The arts education framework includes the Arts in Education (AiE) approach which ‘... uses the arts as a tool for equipping students with knowledge and skills across the curriculum to stimulate cognitive development and to encourage innovative and creative thinking’ (UNESCO, 2006:5). The Roadmap for Art Education by UNESCO in 2006 highlights the importance of visual arts integration in the other subjects’ curriculum as its learning relates to the modern world’s requirements. The integrated curriculum will then naturally prepare children for the future they will be living in.

Emotional and physical development

Studies have proved that arts education connects children to their cultural background, cultivating ‘... a sense of creativity and initiative, a fertile imagination, emotional intelligence and a moral “compass”, a capacity for critical reflection, a sense of autonomy, and freedom of thought and action’ (UNESCO, 2006:4). Emotional development plays an important role in the decision-making abilities and affects how children give ideas and carry out their actions. Many like Damasio believe that arts education sustains a peaceful culture as it provides a balance between cognitive and emotional development (2013, cited in Bullard, 2013). Art is a form of language, a communication technique whereby children having difficulty in speaking are allowed to express their deepest emotions openly (Nunan, 2009). Together with enhancing the children’s conversation and discussion abilities, it also affects their emotional development as they are able to understand their perceptions and feelings as well (Dickinson, 2005).

Besides emotional development, arts education also enhances physical development as movement is part and parcel of art activities. According to Burrill, ‘movement is the foundation for learning and development’ (2010:1). Among the activities employed to enhance movement during lessons, teachers may include art making in which movement is fundamental (Burrill, 2010). Alberts (2010) lists various ways in which visual arts could be integrated especially during the teaching and learning of science. Teachers organise various hands-on tasks in which learners are given opportunities to explore, discover and create themselves, promoting their cognitive skills (Burrill, 2010). Research shows that ‘art and science are two subjects that complement each other [as] art projects turn science concepts that may or may not work in an experiment into something hands-on and visual’ (Collins, 2013).



Children tend to correlate the difficult science facts and concepts with visual representations that aid in easier understanding and long-term memory (Dickinson, 2005). Facilitators encourage the visual arts and science integration in several ways such as creating mobiles, sculptures, 3D models, crafts, drawings and paintings in order to boost the understanding of the concepts learnt in science (Alberts, 2010). UNESCO adds on that ‘arts education contributes to an education which integrates physical, intellectual, and creative faculties and makes possible more dynamic and fruitful relations among education, culture, and the arts’ (2006:5).

It has been argued that students learn better when they are given different opportunities to express their knowledge (Sawyer, n.d.). Many students might feel comfortable with drawing out particular science topics discussed in class. Others might want to paint or even make models based on the science topics. This makes learning the hard sciences fun and interactive during lessons. Children are motivated to enjoy and inquire more about science as they get a chance to interact with their classmates during the activities too. Bloomfield too mentions that ‘the creative arts permit individual children to conceptualise and understand their strength areas to compensate or overcome weakness in other areas’ (2000:108). Among the various impacts of visual arts, motivating and upholding their interest is significant to ensure quality education is taking place. Teaching strategies are vital in bringing big changes in children as they ensure children’s self-esteem is always improved (Dickinson, 2005).

‘Over the past 10 years prominent theorists and practitioners such as Catterall (1998), Eisner (1998) and Gardner (1999) have begun to argue that the arts are integral to the education of the "whole child"’ (cited in Gullat, 2008:1). Art and design stimulates creativity and imagination. It provides ‘visual tactile and sensory experiences and a unique way of understanding the world’ (DfEE, 1999, cited in Addison & Burgess, 2007:306). Hence the integration of visual arts and science is a necessary change in today’s curriculum.

Methodology

The research was carried out using the qualitative research design that allowed the researchers to obtain a deeper understanding of the research situation. In this case, the researchers studied the participants’ perceptions on the integration of visual arts in science. This research design known as phenomenology, enables ‘the researchers



[to] develop an understanding of a subject's or subjects' "reality" however he, she, or they so perceive' (Leedy, 1997:161). As the research title suggests, the researchers intended to understand the role that visual arts play in the teaching and learning of science. The research objective includes the investigation of how this integration will affect students' motivation level too. Qualitative researches are carried out using real life situations instead of artificial experimenting as they occur naturally, encouraging researchers to have open-minded approaches towards collecting and interpreting the data (Pratt, 2006). Berger (1996) explains that a situation can usually mean a number of things, thus, the researchers are required to 'lift veils' (Blumer, 1976:15) in order to learn the inmost meanings. Consequently, to obtain effective results, the researchers observed and handed out survey forms to the participants. Pratt (2006) also suggests that for researchers to be able to develop a good understanding of people's outlooks or experiences, they should be close to them, observing and studying them from time to time.

In terms of sampling, thirty-one students and four teachers participated in this study. The sample was selected from an international school in Malaysia. The researchers selected all the Grade 3 students for this study. Choosing students from the same grade level allowed the researchers to maintain consistency in terms of their age, maturity and level of understanding. Also, the researchers were able to concentrate on a specific number of participants as students from two out of the four Grade 3 classes were selected. This is known as quota sampling (Sharma, 2012). The researchers selected the homeroom teachers for this research for besides being their science teacher; they also spend a lot of time with the students. This allowed the researchers to understand how these teachers plan and facilitate their students' learning and development based on individual learning styles and objectives derived from the curriculum. Tsimboukidou (2010) suggests that researchers are required to develop a bond with the participants of the study in order to obtain a deeper understanding and win their trust. The respondents were reminded to provide honest answers while attempting the survey questionnaire. As this research required the observation method in collecting data, the researchers obtained permission to video record the respective two classrooms' homeroom teachers' lessons. Two out of the four Grade 3 classes were observed by the researchers. This method was essential as it helped the researchers to jot down details of how the teachers integrated visual arts into the teaching and learning of science. Silverman (2001) described the objectives of observational research as the viewing of events, actions, norms, and values. A science lesson was observed in which the teacher taught a particular science topic through the usage of a few elements of visual arts in order to develop students'



interest and understanding of the topic. A classroom observation form which included questions about the teacher's teaching methods, her instructions, students' interest and motivation level was used. As these questions were answered, the researchers were able to obtain a clearer understanding on the classroom practices adopted during the teaching and learning process.

The researchers designed two survey questionnaire; one for students and another for the teachers. The students' questionnaire consisted of three subjective questions inquiring their perceptions about learning science using visual arts' elements. They were required to also provide an example of a particular lesson they remember. In addition, the survey asked eight yes/no questions that enabled the researchers to understand their motivation towards learning science with the usage of visual arts. The teachers' questionnaire included ten open-ended questions which allowed the researchers to understand the teachers' perceptions on the use of visual arts' strands in science lessons. The teachers were asked questions on the learning outcomes of science and visual arts, students' development of skills and understanding, the teaching methods used as well as the changes noticed in students' interest and motivation level too.

The researchers used the triangulation method which supports multiple methods of data collection (Pratt, 2006). In this case, the method consisted of informal interviews, classroom observation and survey questionnaires. At first, the researchers tried to obtain a deeper understanding by informally discussing the planned lessons and objectives with the teachers before the lesson. Secondly, the lessons were observed and details were jotted. Lastly, the lessons were reviewed. The survey questionnaire was handed out after the lesson to learn not only the teachers' but also the students' perceptions on the lessons delivered. Merriam's (1998, cited in Tsimboukidou, 2010:117) descriptions on qualitative research's characteristics were adopted in this study where 'firstly, the study attempted to understand the situation from both the participants' and teachers' perspectives and secondly, the researchers took on the role of the research instrument to sensitively collect and analyse the data'.

Findings and discussion

This section presents a detailed analysis and discussion of the data collected for this study. The results are presented by answering the research questions proving the



outcomes with tables and charts. The researchers highlight key findings by relating them to the literature review.

Teachers' perceptions on the incorporation of visual arts in science lessons

Table 1 presents the teachers' responses to the survey questionnaire. The results show that the Grade 3 teachers portray positive perceptions and an adequate understanding of the science and visual arts integration.

Table 1. Teachers' responses to survey questionnaire (Part A)

Questions	Teacher A	Teacher B	Teacher C	Teacher D
Question 1: What are the most important learning outcomes in Science?	Knowledge to analyse and predict the outcome.	To know the concept of science topics	Understand the scientific concepts being taught and how to apply it to solve problems.	To be able to understand and apply essential skills and techniques of various topics with connection of our real life.
Question 2 What are the most important learning outcomes in Visual Arts?	To be creative and think out of the box to develop thinking skills.	To be able to use different elements of visual arts through other subjects.	How to express your feelings using art.	To master and create meaningful pieces of artwork of different designs, patterns and colours.
Question 3 Do you think it is useful to integrate the different strands of Visual Arts into Science? Why?	Yes, possible to include some since both subjects need development of thinking skills.	Yes, they will understand the topic. They seem also to be more interested.	Yes, because it helps them in visualizing their science concepts and processes to understand better.	Yes, because it creates an open learning whereby students are able to express and experiment many things.
Question 4 Based on your personal observation, what do you think interests students the most during their Science lessons?	The experiments & hands-on practical.	The experiments that we conduct in classes.	The applications of science concepts in everyday through experiments and observation.	Hands-on activity
Question 5 As a Science teacher, have you used any Visual Arts' strands such as drawing, painting or colouring, printing,	Yes, using different materials to learn about buildings & making them stable.	Yes I do all the time. There was once we did a diorama.	Yes, the students were involved in construction making for the unit of inquiry.	Yes, creating different life cycle of animals in a paper plate and draw/illustrate the famous Eiffel



using clay, construction making or using fabric and fiber in any of your Science lessons? If yes, please give an example.				Tower on drawing blocks.
Question 6 How often do you use Visual Arts' strands in your lessons?	Quite often	Quite often	Quite often in their unit of inquiry and science lessons.	Frequently

First of all, the participants were asked to list down the learning outcomes of science and visual arts. This allowed the researchers to gauge the teachers' basic knowledge on the subject taught and integrated during lessons. According to the learning outcomes of science listed by the participants, students should be able to apply the 'knowledge [learnt] to analyse and predict the outcome'. Teacher C stated that students should also be able to 'understand the scientific concepts being taught and how to apply it to solve problems'. Problem solving is a vital learning outcome required to be developed by all young learners today (DfE, 2012). The key processes listed by the Department for Education (2012) include that all key stage 2 children should be able to develop enquiry skills with the usage of 'a range of scientific methods and techniques to develop and test ideas and explanations'. Teacher D stated that students should 'be able to understand and apply essential skills and techniques of various topics with connection of our real life'. This is supported by Reis who believes that 'science is a body of knowledge about the world' (2002, cited in Devereux, 2007:5). Thus, it is important for young children to develop the understanding of science concepts with the ability to connect to the real world rather than rote memorizing the content in schools. The curriculum opportunities listed by the Department for Education (2012) too emphasizes on learning science through real-life exemplars, for instance, engaging them in practical life scenarios or delivering lesson content in different environments aid students' learning and understanding.

Although the samples comprised of science teachers, the participants also had a basic background on the learning outcomes of visual arts. Teacher D stated that students should be able 'to master and create meaningful pieces of artwork of different designs, patterns and colours'. Teacher C added on that students learn to express their emotions through arts education. As a summary, all teachers believe that visual arts aid in developing creative thinking skills. This is supported by Dobbs who confirms that 'the study of art promotes attention to perception and expression, and



thus contributes to the building of language and communication, critical thinking and problem-solving skills' (1998:9).

The researchers found that all teacher participants believe that the integration of different visual arts' elements into the teaching and learning of science is useful. Teacher D pointed out that this integration encourages open learning in which students are given the freedom to understand and analyse the science concepts through their preferred form of art. The results of this study show that all the teachers use the strands of visual arts; drawing, painting or colouring, printing, using clay, construction making or using fabric and fibre during their science lessons. The teachers observed that students are more interested in learning science when experiments and hands-on activities are carried out during lessons. Teacher A noticed that students like to draw or create visuals to support and explain their learning of science. This is in line with the Primary School Curriculum developed by the National Council for Curriculum and Assessment which highlighted that 'in drawing, painting, constructing and inventing, the child assimilates and responds to experience and tries to make sense of it' (1999:11). This learning outcome is also achieved when teaching ensures 'that 'investigating and making' includes 'exploring and developing ideas' and 'evaluating and developing work'. 'Knowledge and understanding' should encompass this process' (DfE, 2011). The teachers provide opportunities for learners to inquire and explore learning after which they are encouraged to create or participate in hands-on activities to stimulate new ideas and thinking skills. The teacher participants confirmed that through the integration of visual arts, science concepts and processes are easily understood by all learners.

Students' perception on the incorporation of visual arts in science lessons

Another survey questionnaire was used to gather the data required to answer the second research question: What are students' perceptions on the incorporation of visual arts in the teaching and learning of science? Table 2 presents the outcomes obtained from the students' survey questionnaire. The questionnaire was designed primarily to identify their perceptions on the integration of visual arts in their science lessons.



Table 2. Students' perceptions on science lesson using visual arts

Question	Yes (%)	No (%)
Do you enjoy doing Visual Arts such as drawing, colouring, painting or using clay?	100	0
Do you enjoy your Science lessons?	97	3
Are you happy with the activities in your Science lessons?	100	0
Do you like to work in groups with your other classmates?	90	10
Do you enjoy making 3D models for your Science topics?	94	6
Do you like it when your teacher allows you to draw something for your Science topic?	97	3
Do you think it is fun to learn Science through Visual Arts?	77	23
Did you like today's Science lesson?	94	6

The findings show clearly that all students enjoy doing the different strands of visual arts where 97% of the students enjoyed their science lessons. All the students were happy with the activities carried out during their science lessons as they were allowed to draw images to express their learning of science. Despite favouring the visual arts subject more than science, 23% of the students did not find it fun to learn science through visual arts. A minimal 10% of the students did not enjoy making 3D models or drawing images of their particular science topics. From the classroom observation, the researchers noticed that teachers manage these students by grouping them with those who are capable of learning through the elements of visual arts. However, the results show that 10% of the students did not prefer working in groups. Table 2 also shows that all students think it is important for them to learn visual arts. Some mentioned that learning arts is fun and interesting while others merely believe that art is another lesson that is planned to be taught in school. Besides this, one student mentioned that 'it helps us to explain the drawing'. All the student participants except for two of them felt happy about learning science through visual arts and claimed that it helps them understand their science topics better. The researchers noticed that students find science fun and interesting as they get to draw, design and create models and learn both subjects at once. The students provided examples of lessons in which their teacher incorporated the elements of visual arts in the learning of science. This includes activities like making 3D models of man-made structures, creating dioramas of habitats and drawing living things and their processes.



Students' motivation when visual arts are used in the science classroom

With the help of the classroom observation procedure, the researchers were able to answer the final question of this research: How does the usage of visual arts motivate students to learn science? The results prove that the integration of visual arts in the teaching and learning of science motivate learners to acquire knowledge and understand the hard sciences well with the guidance and teaching approach provided by their teachers. This is supported by Dickinson who states that 'the arts are an incredible tool for 'ratcheting up' the quality of work and standards in a school (2005:4). The teacher participants of this study confirm that students seem to be more interested in attempting and completing given tasks within the time limit. They enjoyed using the strands of visual arts especially drawing. This is supported by Perin (1994) who proves that students' results excel even with just the devotion of 25% or more of arts.

The researchers observed two out of the four grade 3 classes in order to support the data collected through the questionnaires. The objective of the lesson conducted in Classroom A was to identify and understand an insect's life cycle while Classroom B intended to identify parts of a flower during the particular lesson. At the beginning of the lesson, the teachers' projected relevant visuals by which a discussion over the respective topic was carried out with the students. This allowed active engagement from all the students as they responded and shared their knowledge with others. In this way, the teachers were able to identify their students' prior knowledge before setting a task on the lesson. Instructions provided were clear and specific as the teachers equally emphasized the importance of presenting their respective learning with the usage of their creative art skills.

The students in both classrooms were happy to draw out their respective science tasks; an insect's life cycle and flower. They enjoyed working in their groups as they discussed while drawing and colouring. The students in Classroom A used colour pencils and markers while the students in Classroom B made use of paint and crayons to illustrate their drawings. The researchers noticed that the positive learning environment created by the integration of visual arts promoted the eagerness to learn the science concept well. At the end of the lesson, students in Classroom A were told to present their work to the classmates. The visuals enabled all the learners to present well as they were able to explain the life cycle step by step.



The researchers observed a positive learning environment during the classroom observations. They also observed students' expressions and responses towards the task given during their science lesson. A few students actually exclaimed happily when the teacher instructed them to draw, colour or paint the particular science concept and process to present their understanding. Both teachers from the two classrooms encouraged this enthusiasm by motivating them with positive verbal feedback such as 'good job' and 'excellent'. Consequently, many students showed the readiness to learn and eagerness to attempt the task well too. Participation of students increased when the teachers showed appreciation for each child's artistic expression and encouraged further spontaneity as well as risk-taking abilities. The researchers noticed that children's self-esteems were enhanced as they were given the independence to use their preferred strand of visual arts to complete the given activity. This is supported by Jensen's (2002) study where the findings indicated that students' attendance improved as they enjoyed coming to school to explore and discover their abilities (cited in Riley, 2012). Besides the findings from the researchers' classroom observations, the teachers too were asked to comment on their observations of the students' motivation levels during the lessons. Table 3 presents the data of the teachers' responses.

Table 3. Teachers observation of students' motivation level

Questions	Teacher A	Teacher B	Teacher C	Teacher D
Question 1: What are the most important learning outcomes in Science?	Knowledge to analyse and predict the outcome.	To know the concept of science topics	Understand the scientific concepts being taught and how to apply it to solve problems.	To be able to understand and apply essential skills and techniques of various topics with connection of our real life.
Question 2 What are the most important learning outcomes in Visual Arts?	To be creative and think out of the box to develop thinking skills.	To be able to use different elements of visual arts through other subjects.	How to express your feelings using art.	To master and create meaningful pieces of artwork of different designs, patterns and colours.
Question 3 Do you think it is useful to integrate the different strands of Visual Arts into Science? Why?	Yes, possible to include some since both subjects need development of thinking skills.	Yes, they will understand the topic. They seem also to be more interested.	Yes, because it helps them in visualizing their science concepts and processes to understand	Yes, because it creates an open learning whereby students are able to express and experiment many



			better.	things.
Question 4 Based on your personal observation, what do you think interests students the most during their Science lessons?	The experiments & hands-on practical.	The experiments that we conduct in classes.	The applications of science concepts in everyday through experiments and observation.	Hands-on activity
Question 5 As a Science teacher, have you used any Visual Arts' strands such as drawing, painting or colouring, printing, using clay, construction making or using fabric and fiber in any of your Science lessons? If yes, please give an example.	Yes, using different materials to learn about buildings & making them stable.	Yes I do all the time. There was once we did a diorama.	Yes, the students were involved in construction making for the unit of inquiry.	Yes, creating different life cycle of animals in a paper plate and draw/illustrate the famous Eiffel Tower on drawing blocks.
Question 6 How often do you use Visual Arts' strands in your lessons?	Quite often	Quite often	Quite often in their unit of inquiry and science lessons.	Frequently

Teacher A underlines that students prefer drawing and explaining in their own words rather than constructing detailed sentences. This is similar to past research where 'drawing the content of science, geography, and social studies lessons resulted in noticeable differences in speed of learning and retention' (Brooke, 1997, cited in Dickinson, 2005:9). Besides playing a significant role in facilitating active learning and engagement during lessons, the teachers observed how students are motivated towards learning a particular subject when visual arts is integrated in the subject. All the teacher participants agreed that the incorporation of visual arts in the teaching and learning of science generally motivated their learners to study science. The teachers identified various skills developed by the students after the integration of visual arts in their science lessons. These include the development of creative thinking skills, the ability to express their thoughts and visualize real-life objects and planning and analyzing of concepts and processes. Teacher B highlighted the improvement observed among learners' communication skills after activities that integrated any strand of visual arts, for example model making. This finding is similar to previous researches. For example, the Department for Education (2012) reported that pupils begin to connect and explain science ideas using simple models and structures. Moreover, the Department for Education (2012) also reported that



arts education enables learners to explore and communicate their learning. The teachers believe that students learn and achieve better skills in their science lessons through the elements of visual arts. The teachers' and students' perceptions stated earlier prove that the integration of visual arts in the teaching and learning of science has positive outcomes on all learners. Teacher A observes that the students will 'draw diagrams to predict the outcomes and draft and plan the experiment'. Freedman (2003) believes that arts education provide cultural awareness as children learn how to express themselves based on their surrounding and social context. The researchers were able to obtain clear results through the data collection procedures used. The findings show that students indeed developed academic and cognitive skills when given opportunities of using the different elements of visual arts to express their learning of science. The findings also revealed both students' and teachers' have positive views towards this integration and that the use of visual arts does enhance the motivation level of students towards learning science.

Conclusion

This research mainly intended to identify and understand the views of teachers and students about the integration of visual arts in the teaching and learning of science. It also investigated how the usage of visual arts motivates students. Visual arts and science are said to be the two interrelating subjects that benefit children in preparation to living in the 21st century (Alberts, 2010). As the demands for individuals to possess efficient capabilities and skills are currently expanding, educationists continue to review the education system and its teaching and learning strategies practised. The integration of different elements in the teaching and learning of science develop young learners academically, socially, emotionally and behaviourally. The findings of this study prove that students are able to learn and attain the knowledge better when opportunities provided include hands-on activities with the independence of using elements of visual arts. Teachers tend to manipulate their lessons according to their learners' learning styles and understanding abilities. The results of the teacher participants' perceptions show that teaching and learning becomes easier upon integrating visual arts in science lessons as students become more motivated to complete their tasks on time. The teachers have positive views on the usage of visual arts as they state that learners were able to use the different elements of arts in order to boost their creativity, expressions and thinking skills. The results of this study also show that students have positive perceptions towards the integration of visual arts in science as they enjoy learning visual arts and science at



the same time. Students like the option of expressing their knowledge and abilities through drawing, colouring, painting and creating crafts or models. This is similar to Eisner who claims that ‘the arts are fundamental resources through which the world is viewed, meaning is created, and the mind is developed’ (1997:1). Various theories on understanding and intelligence introduced by Gardner and other cognitive researchers disclose that ‘artistic engagement is a mind-building experience’ (1989, cited in Dobbs, 1998:9). Freedman states that ‘if we want students to understand the new world of the visual arts, we will have to teach about what they need to learn, not what we were taught’ (2001:11 cited in Stott, 2011). As the education system today differs from that of the twentieth century, it is understood that it will continue to change. It is difficult to know what the future holds; hence educationists try their best to ‘provide a strong footing for the kind of education that will prepare children to reach their full potential in the rapidly changing times ahead’ (Eisner, 1997:3). Cultural art programmes organised today prove the importance of visual arts in the development of individuals. Facilitators ensure that arts education exhibits an integral position during lessons. The major implication of this study is to show that arts promote higher order thinking skills and abilities to survive in the 21st century. Educationists believe that further studies on arts education will continue to be the key to understanding the world we live in today. As people continue generating new ideas, new approaches towards teaching and learning the arts would always be introduced. In a nutshell, this paper managed to provide a positive understanding of the role exhibited by visual arts in the teaching and learning of science at present and advocates that visual arts should be incorporated in the teaching and learning of all subjects at all levels as it helps to cultivate a generation that can survive in a world which is constantly changing and highly demanding.

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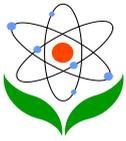
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