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Development and Implementation of a Science-based Integrated Curriculum for Nurturing the Gifted Potentials of Young Filipino Children

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Abstract

This is a descriptive study focusing on the development and implementation of a science-based integrated curriculum to nurture the gifted potentials in science of young Filipino children. Specifically, it answers four questions: (1) What are the interests, characteristics, and learning styles of young children that are potentially gifted in science? (2) What are the contents of the science-based curriculum for young children with gifted potentials? (3) What instructional model can be used to implement the science-based curriculum? (4) How is the science-based integrated curriculum implemented to nurture the gifted potentials of students in science? This study was participated by young children who are potentially gifted in science and expert teachers. To gather data, the gifted characteristics and interests of the children were identified, the contents and activities of the curriculum were selected, classes were observed, and a regular collaborative planning and evaluation sessions were done. The data was analyzed qualitatively looking into the learning behavior of the students as they do integrated science activities, perform experiments, and learn various science concepts and process skills. The result includes observable gifted characteristics and learning styles of the students, important principles and contents, and instructional design for the science-based integrated curriculum.

Keywords: science-based curriculum, gifted potentials, science education, young children

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Introduction

This study aims to cultivate the gifted potentials in science of young Filipino children through a science-based integrated curriculum. Specifically, it answers four essential questions: (1) What are the interests, characteristics, and learning styles of young children that are potentially gifted in science? (2) What are the contents of the science-based curriculum for young children with gifted potentials? (3) What instructional model can be used to implement the science-based curriculum? (4) How is the science-based integrated curriculum implemented to nurture the gifted potentials of students in science?

Nurturing giftedness in science and developing gifted potentials in science of young children are a part of the educational agenda in many developed countries. This is in recognition of the important role of science as one of the pillars of economic development and as a necessity for the survival of the human race. In the case of developing countries like the Philippines, building a foundation for a strong science education and science culture and developing giftedness in science are still a work in progress.

In this study, the science-based integrated curriculum is an experimental program and project of a school in the Philippines to contribute to the development and nurturance of young children with gifted potentials in science. Patterned from Kids Academia Science Program (Faustino, Hiwatig, & Sumida, 2011), the curriculum was conceptualized to respond to the needs of young children who have high interest in learning science and in doing science activities. It is a pioneering enrichment program in the area of gifted education and science education in the country. It follows an integrated curriculum design incorporating mathematics, music, language, and arts. It is developed for young children from ages five to eight. This is a response to the growing need of providing an educational program that promotes science education to young children who have gifted potentials.

Van Tassel-Baska (2004) observed that curriculum for the gifted has always been a major issue in the field over the past 25 years as attested to by the proliferation of books and articles on the subject. Zirkelbach (2011) also observed that there has not been much focus on gifted programs or on gifted students. Kerr (2009) pointed out that a science curriculum developed specifically for gifted students is a rare commodity in many countries. Gittman and Koster (2000) also pointed out that the needs of gifted and talented students

are not being met at school and that these students need special education programs.

In the Philippines, gifted education is still a growing field, especially, in the context of science education. Science schools were established and special science classes have been organized in selected public and private schools; however, these conventional approaches are not enough. The Special Science Elementary School (SSES) project was supposedly designed for scientifically gifted learners in public elementary schools. It starts with the teaching of science from Grades 1 and 2 and with the use of investigatory projects and other strategies for teaching science from Grades 3 to 6. However, it does not have a special curriculum to serve its purpose and there is no assurance that all the students enrolled in the SSES project are gifted or potentially gifted in science and mathematics. There is a need to explore more approaches and develop programs to nurture giftedness in science and to develop gifted potentials of young children in science. There is also a need to study gifted characteristics of young Filipino children in science.

In general, gifted students exhibit high performance capability in intellectual and creative pursuits, possess an unusual leadership capacity, or excel in specific academic fields (Davis, Rimm, & Siegle, 2011; Sternberg, 2004). In science, both gifted and potentially gifted students have this natural curiosity to learn science at an early stage in life and science can satisfy their curiosity to learn through science discovery and investigation where they use science process skills in learning. If their potentials, abilities, and talents are fully developed and utilized, they can be valuable assets to the nation. They will grow up to be the next scientists, engineers, artists, leaders, and technocrats. They will become invaluable resources of the country.

There are cultural factors that influence the development of giftedness and gifted potentials of individuals. The socio-cultural contexts in which the gifted and potentially gifted are immersed certainly affect their development, behavior, and success. The community where they live plays an important role in providing nurture and support for gifted learners (Pawilen, 2006, 2014). For example, in the Philippines, many gifted and potentially gifted individuals belong to various indigenous groups and local communities. Society and culture are instrumental in shaping their abilities and talents. Gifted and potentially gifted individuals need an environment where they can think critically, develop innovations, and express their creativity. It is, therefore, the role of education to provide

supportive and nurturing environments for gifted and potentially gifted individuals in the country.

Saloma (2016) observed that there is a need for developing the next generation of Filipinos in the Science, Technology, Engineering, and Mathematics (STEM) areas and there is a need to encourage and mentor more students to pursue their studies in these disciplines. This could start ideally from kindergarten up to the elementary levels where the children are developing their potentials and are growing in their interest in STEM topics and activities. Basic education provides great opportunities to capture and nurture children's interests and potentials in STEM. The science-based integrated curriculum could be used in public elementary schools in the country to serve the needs of the gifted and nurture the gifted potentials of some students.

In other Asian countries like Thailand, Brunei, Indonesia, Singapore, and Malaysia, most of the programs for gifted are based on the Headstart program. They also have programs offered for gifted students in the fields of art and music. They commonly use acceleration and advance placement for students who are gifted. Most programs offered focus on students that are already formally assessed to be gifted. Less attention is given to students with gifted potentials and to offering an integrated curriculum that incorporates other areas of giftedness.

High-ability learners need educational challenges, faster-paced instruction, and deep exploration of content (Kerr, 2009). Consequently, there is a need to help science teachers facilitate, organize, and implement advanced science instruction for them. The study of Mingoa (2006) revealed that many Filipino scientists were influenced by their former teachers in basic education to love science. It is, therefore, imperative to develop an instructional model for teaching science that will empower teachers in the task of handling students who are gifted and potentially gifted.

The development and implementation of a science-based integrated curriculum for young children with gifted potentials in science are a pioneering research in the Philippines. Giftedness starts with gifted potentials that need to be developed and nurtured. The study aims to contribute to the development of innovative and responsive education for Filipino students who are potentially gifted.

The Idea of a Science-based Curriculum

Science-based curriculum means an interdisciplinary learning framework that integrates other subject areas' content and learning experiences to science in the early childhood curriculum (Pawilen, Sumida, & Clavio, 2005). As most curricula in early childhood are developed and designed around different themes in a science-based curriculum, these themes should use science experiences, concepts, and skills to integrate other learning areas and interest of the learners (Pawilen et al., 2005).

The science-based curriculum is activity-centered. The learners are exposed to different science activities involving real-life experiences where young children learn science skills and processes. The integration of science with mathematics, language, art, and music is useful for learners to see the connectivity of knowledge in real-life context. It is also learner-centered wherein the interest, ability, and capacity of the learners are carefully considered in the design and implementation of the curriculum. The science-based curriculum necessitates that all the learners should enjoy learning through the lessons, experiments, activities, and projects that they do in the class.

The integrated design of this science-based curriculum was influenced by the theory of constructivism. The cognitive view of constructivism exemplified by Piaget (1983) posits that people develop universal forms or structures of knowledge that enable them to experience reality. In constructivism, knowledge is individually constructed and is based on the learners' intellectual development as they experience reality while doing or engaging themselves in either physical or social activity (Hodson, 1998; Martin, 2001). It gives a new paradigm on how learners address or solve problems and build up models of the learners' conceptual structures (von Glasersfeld, 1995).

Aligning constructivism to the development of a science-based curriculum for developing the gifted potentials of young children leads to a curriculum that is characterized by the following: (1) active learning; (2) learning in a meaningful context; (3) reflective and intuitive problem solving; (4) doing science investigations; (5) learning science in the context of children's culture; and (6) providing real-life and hands-on experiences to the learners (Chaille & Britain, 2002). In a science-based curriculum, every learner is seen as a scientist doing active investigation of different topics and problems.

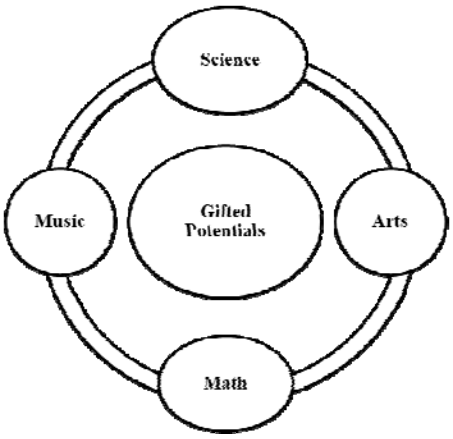

Figure 1. Curriculum Framework

The framework, as shown in Figure 1, indicates that the science-based curriculum is an integrated one that connects science, mathematics, arts, language, and music to develop the gifted potentials of young children in science. This design allows the young learners to explore science concepts and discover the connection of science to other disciplines.

While the curriculum is integrated, science is still the dominant core of the curriculum. It serves as the theme for organizing the lessons and activities. This type of integrated curriculum is similar to the approach for designing gifted lessons developed by van Tassel-Baska (2004). An integrated curriculum is perfect for the science-based integrated curriculum because it allows the learners to see the connections of every knowledge and skill that they learn and apply in real-life.

Four-Pronged Approach for Teaching Science to Young Children

Pawilen (2014) developed a model for teaching gifted and potentially gifted students in science. The model is called the Four-Pronged Approach for Teaching Science.

As shown in Figure 2, the small circles surrounding science indicate the four phases of instructional procedures in designing science lessons. The two rings of circle connecting the small circles represent science process skills and concepts that are utilized and developed in the learning process. This model implies using the constructivist approach to science teaching. De Vries and Zan (1994) summarized the definitions of constructivist

education into three words: *interest, experimentation,* and *cooperation*. These are emphasized in this model through the following procedures.

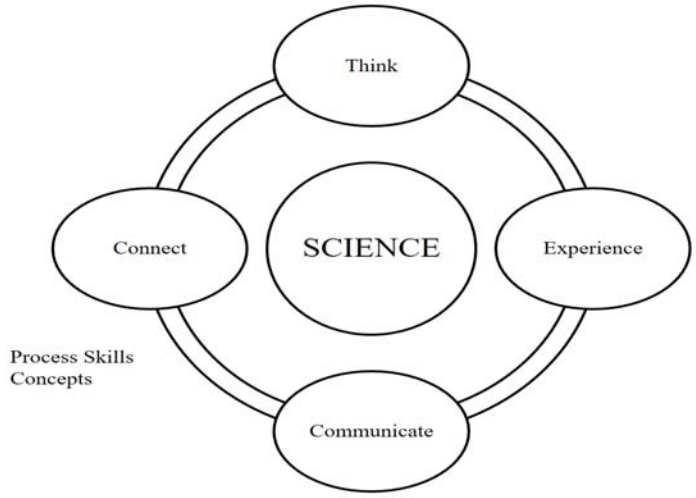

Figure 2. Four-Pronged Approach for Teaching Science to Young Children

Thinking about science. In this phase, the students were guided to identify the science-related questions they are interested in to answer through the topic. The students were also led to develop science hypothesis related to the topics and questions they wanted to study. It is important in this phase that students develop motivation and high interest in science.

Experiencing science. In this phase, the students with the guidance of the science teacher planned, designed, and implemented science investigations, observations, projects, and other activities that will help them gather and analyze data in answering and verifying the questions and hypothesis they formed in Phase 1.

Communicating science ideas. In this phase, the students formulated science ideas, conclusions, or generalizations from the result of phase 2. The students learned how to analyze data and make science reports from the findings. The science teacher taught the learners different ways on how to present the results of their study and how to present their projects to other people or other students.

Connecting science to other disciplines and to real-life experiences. This phase includes connecting the findings or concepts learned to other subjects or disciplines. It also calls for finding real-life applications of science learned to everyday life.

This instructional model is essential in this study. It can be helpful in teaching the science-based integrated curriculum for young children with gifted potentials in science. The procedures in this instructional model are not prescriptive; hence, teachers and students can exercise flexibility in terms of selecting activities and strategies under each phase.

Method

This study is a descriptive research. It describes the development and implementation of science-based curriculum for developing the gifted potentials of young children.

Research Participants

Admission was opened to young children based on four simple criteria that show their gifted potentials in science: (1) those who showed some general interest in learning; (2) those who showed interest in learning science topics; (3) those who showed interest in doing science activities and experiments; and (4) those who were assessed to be gifted. There were 15 young children who were accepted to participate in the program. The teachers intended to limit the number of participants in order to effectively respond to the learning needs of the students. Among the 15 students, 3 were assessed as gifted in their schools while 12 were observed potentially gifted by their parents and teachers. The participants were within ages 4-8.

The teacher-participants were chosen based on their areas of expertise and experience in handling gifted learners. Teacher-participants included (1) a young gifted music college instructor who is a piano and music education specialist, (2) a young gifted Math teacher from the high school department, (3) a Physics teacher from high school department, (4) a Biology professor, and (5) one reading and language specialist. This team of teachers was organized to plan, design, and implement the science-based integrated curriculum.

Data Gathering Procedure

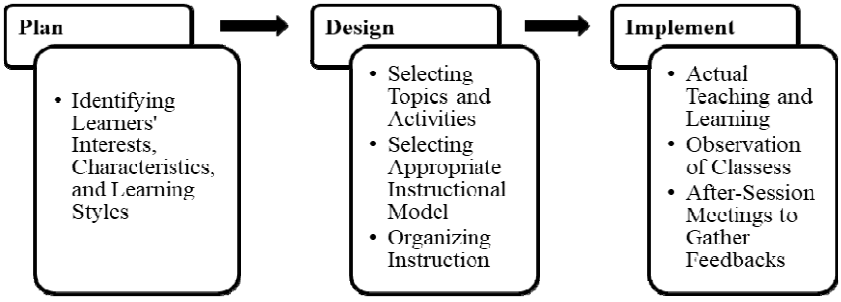

Figure 3. Data Gathering Process

Figure 3 shows the procedure followed in gathering the data for this research. The research utilized significant qualitative data to answer these questions and to gather the necessary data needed. The following research activities were done:

Phase 1: Planning. In this phase, the behavioral characteristics of the learners, learning styles, and interests were discussed and analyzed by the team of teachers. The information regarding the learners came from the parents and from feedback from their former teachers.

Phase 2: Design. In this phase, members of the academic team selected appropriate topics and learning activities that were included in the science-based curriculum. The teachers ensured that all topics should be connected to the science in K-12 Basic Education Curriculum. Teachers selected an appropriate instructional model that will be used in developing the lessons. After preparing the instructional plans, individual and group activities were decided, instructional materials were prepared, and worksheets were created.

Phase 3: Implementation. In this phase, the lessons were implemented in actual classes with the members of the academic team serving as facilitators of learning and as expert teachers. The academic team also observed the gifted behaviors and characteristics of young children, recorded their questions and discussions, served as guide during experiments and outdoor activities, and prepared observation logs. After each session, the academic team met and discussed the results of the lessons and the results of their

observation. This was a moment of evaluation and serious reflection for the members of the team to improve the delivery of the lessons and make the next ones more exciting and mentally engaging for all children.

Data Analysis

This is a descriptive study. The result of the planning and discussion sessions with teachers was used for developing contents and activities for the science-based integrated curriculum and for selecting the appropriate instructional model for implementing it. The result of the class observation was analyzed qualitatively and reported narratively in this study. Some of the original comments of teachers and students are included in the manuscript to provide examples and to support the explanations of the results of the study.

Results and Discussion

The result of the study was organized based on the three research questions. The data were analyzed and presented qualitatively.

What are the Interests, Characteristics, and Learning Styles of the Young Children who are Potentially Gifted in Science?

The comments from the children during the orientation are important data in this study. Their comments show their interests and expectations on the program, which serve as one of the important basis for selecting the contents and activities for the science-based integrated curriculum. Some examples of the comments are the following:

I want to see microorganism using the microscope. (Student 1)

I am interested to discover how a volcano erupts. (Student 5)

I like to study how water enters the body of the plants. (Student 8)

I like math and science activities. (Student 14)

I am excited to see how science is taught through music and arts. (Student 10)

I am anxious to do experiments and see how can I be a scientist someday. (Student 12)

This shows that they have genuine interest and capacity to learn science. Children's interest in learning science and in doing science comprises the greatest capital for developing the gifted potentials of young children and it is an important driving force for nurturing the creativity, innovative behavior, and giftedness of the learners.

Table 1. *Observed Characteristics of Potentially Gifted Young Children in Science*

Characteristics of Potentially Gifted Filipino Children in Science
• Very inquisitive
• Interested to study how things/objects work
• Like doing science experiments and activities
• Enjoy learning science concepts
• Show interest in the natural and physical environment
• Enjoy observing plants and animals
• Ask questions related to science
• Possess interest and talent in mathematics, arts and music
• Love reading science-related books and magazines
• Take initiative to lead in group activities
• Have sense of humor
• Persistent in achieving or accomplishing some tasks
• Capable of doing multitasking
• Use science process skills in activities and experiments

Table 1 shows the general observable gifted characteristics of young children who participated in this study and program. This is based on the interview of teachers to the parents and based on the observed characteristics of the students during the program.

Table 2. *Observed Learning Styles of Potentially Gifted Young Children*

Learning Styles of Potentially Gifted Filipino Children
• Like to share their ideas
• Capable of collaborating with others
• Capable of interdisciplinary thinking
• Love to explore and enjoy discovering new things
• Like to interact and discuss
• Find ways to express ideas and questions
• Creative in expressing ideas
• Organize thoughts and ideas in a meaningful way

Table 2 shows the observable learning styles of the young children. These could be one of the basis for organizing instruction and for the science-based integrated curriculum. The teachers observed that these young children are capable of studying independently; they can

present ideas creatively and they are persistent in finishing their experiments and activities. They are not intimidated working with teachers and children who are either older or younger than them. They can easily work and study with anyone. They do not require special attention. They enjoy learning together as a team. These characteristics and learning styles of the participants are also parallel to the general characteristics of scientifically gifted students identified by Sumida (2010). Aside from having the general characteristics and learning styles of young children, they also possess talent in music and arts, which confirms that study done by Pawilen (2014) that gifted and potentially gifted Filipino students also possess special talent and skills in either music or arts.

What are the Contents of the Science-based Integrated Curriculum for Children with Gifted Potentials?

The science-based integrated curriculum was developed for a special summer program for the children who are potentially gifted in science. The program was implemented in 12 days. There were no special lessons or activities for older or younger children. All the young children participated in the same activity and experiment. This helped the young children develop their social skills. The science-based integrated curriculum aims to develop and enhance the creativity, critical thinking, and the gifted potentials of young children in science.

Table 3. *Goals of the Science-based Curriculum*

Curriculum Goals
• Develop gifted potentials of young children in the fields of science, mathematics, music, and arts • Develop leadership skills of young children • Develop Higher Order Thinking Skills (HOTS) • Develop interdisciplinary thinking skills of young children • Provide interesting opportunities for learners to experience science through hands-on experiments and integrated activities • Link science to other learning areas and to real-life experiences

The curriculum goals are shown in Table 3. Based on the curriculum goals, teachers selected and planned the contents of the curriculum. It is important that the content of the curriculum is aligned to the K-12 Basic Education Curriculum prescribed by Department of

Education (2012). The contents should also be based on the interests of the students.

Table 4. *Criteria for Selecting Contents and Activities for the Science-based Curriculum*

Criteria Selecting Contents and Activities
• Integration of science with mathematics, music, and arts • Appropriateness to the level of learners' interests • Relevance to everyday life • Application of science process skills, mathematics skills, musical skills, and artistic skills • Utilization of local and indigenous materials • Mentally challenging and interesting • Provision for group and individual instruction

To support the science-based integrated curriculum goals, the teachers selected topics, lessons, and activities based on the criteria shown in Table 4. The teachers, as a result of the planning session and discussion, developed these criteria to guide them.

Table 5. *Contents of the Science-based Integrated Curriculum*

Curriculum Content
• What happens when a volcano erupts? • How do plants eat and drink? • Why is it not safe to drink water from unsafe sources? • How can sound travel? • How does energy make things move? • How can we measure the direction of the wind? • How can we use the sun to determine time? • How do electric circuits develop? • What are mixtures? [Chemistry in everyday life]

Table 5 shows the contents of the science-based curriculum. The interests of young children are valuable input in selecting the content of the curriculum. Through these contents, the learners conducted experiments and many forms of science investigations that are related to everyday life experiences. They learn science process skills and concepts; they develop higher-order thinking skills and explore real-life application of science. These contents also served as the theme for curriculum integration. Mathematics, music, language, and arts are integrated in all the topics.

To illustrate how integration is done, Figure 4 shows a sample of a thematic web for one of the topics in the science-based integrated curriculum. In this lesson, the learners explored the lessons about sound. They learned about vibrations, sound waves, basic measurement

concepts, colors, classifying, and comparing properties of different materials. With the help of the teachers, they planned their own experiments and activities and created a model of objects and tools that produce sounds like a telephone toy and other musical instruments. They used art to illustrate their ideas and make models. They used indigenous materials like used paper cups, strings, sticks, empty bottles, paper bags, and other materials that they can use to produce sounds. It is important for young children to explore their surroundings and make use of various materials available.

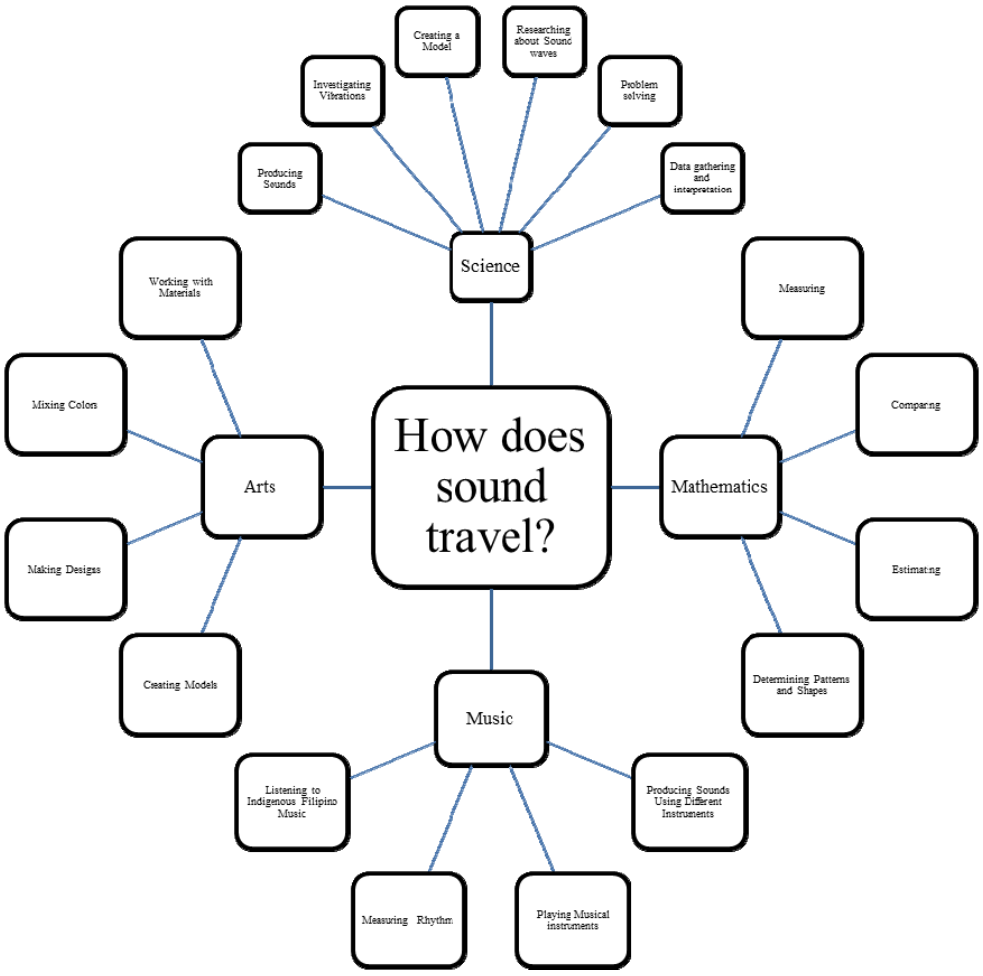

Figure 4. Sample Curriculum Thematic Web for the Lesson on Sounds

Table 6 shows how the topics were connected with the K-12 Basic Education Curriculum contents. Since the science-based integrated curriculum was intended to develop gifted potentials of young children, the curriculum was flexible to allow the learners to discuss advanced concepts in science, mathematics, music, and arts. It also provided the learners an opportunity to exercise interdisciplinary thinking and explore topics that are interesting and related to their everyday life.

Table 6. *Alignment of the Science-based Integrated Curriculum to Science, Mathematics, Music, and Arts of the K-12 Philippine Curriculum*

Science-based Integrated Curriculum			
Contents of the Science-based Integrated Curriculum	K-12 Subjects		
	Science	**Math**	**Music and Arts**
• What happens when a volcano erupts? • How do plants eat and drink? • Why is it not safe to drink water from unsafe sources? • How can sound travel? • How does energy make things move? • How can we measure the direction of the wind? • How can we use the sun to determine time? • How do electric circuits develop? • What are mixtures? [Chemistry in everyday life]	• Matter • Living Things and their Environment • Force, Motion, and Energy • Earth and Space	• Numbers and Number Sense • Measurement • Geometry • Patterns • Algebra • Statistics and Probability	MUSIC CONCEPTS • Rhythm • Melody • Form • Timbre • Dynamics • Tempo • Texture • Harmony *ART PROCESSES* • Observing • Reading • Imitating • Creating • Responding • Performing • Analyzing • Applying

What Instructional Model can be used to Implement the Science-based Curriculum?

To help the teachers implement the curriculum, it is important to select an instructional model or approach. The researcher solicited ideas and experiences from the teachers to select an appropriate model for implementing the science-based integrated curriculum. These are the important comments and suggestions made:

Instruction should allow students to conduct experiments and activities that will develop and apply

the science process skills. (Teacher 1)

Instruction should allow students to communicate their ideas and questions. They should be taught how to present their findings and ideas. (Teacher 2)

Instruction should commence from questions or activities that the students wanted to explore. This will help the learners plan, develop hypothesis, and formulate science questions. (Teacher 3)

Since the science-based curriculum is integrated, the students should be given time to connect their ideas and lessons learned to other curricular areas and to real-life contexts. (Teacher 4)

Instruction should provide opportunities for collaboration, scientific investigation, and finding scientific explanations to some questions. (Teacher 5)

Other suggestions from the teachers were the following:

In all phases of instruction, all the activities should connect science with other curricular areas like mathematics, arts, and music.

Active learning should be promoted.

The learners should be given time to present their activities and results of experiments to their classmates.

Indigenous and local materials should be utilized in the activities.

The science-based integrated curriculum was learner-centered, so during the orientation period, the students also provided the following expectations that were considered in the development of instruction:

We should experience how to be scientists. So I want many experiments and observation. (Students 1 and 15)

The activities should be enjoyable and meaningful. (Students 3 and 12)

Hands-on experiments should be provided. (Students 2 and 5)

No or less lecture. I want to explore, observe, and do what scientists do. (Student 6)

I expect the music and arts activities to be fun and connected to science. (Student 9)

I always like math and science. So I expect to learn more from these subjects. (Student 10)

Based on the suggestions given by teachers and students, the Four-Pronged Approach for Teaching Science developed by Pawilen (2014) was chosen to implement the science-based curriculum. As mentioned earlier in this paper, the model has four phases of instruction. The followings were the things agreed upon by the teachers to do to implement the lessons:

Thinking about science. The teachers agreed that this is the phase of instruction where excitement for doing science should be developed among the students. At this point, teachers served as facilitators, helping students organize their ideas, clarify some important points, and provide thought-provoking questions based on the curriculum topics and activities.

Experiencing science. In this phase, the students were considered as scientists doing active investigation or experiments on a certain problem or any subject of inquiry. To experience science, teachers agreed to use differentiation principles in grouping students to work on certain science activities. The Total Group, Alone, Pair, Small Group (TAPS) principle can be used in grouping students during this phase of instruction.

Communicating science ideas. In this phase, teachers agreed that they would teach students different ways on how to present the results of their experiments and activities and how to present their projects to other people or other students.

Connecting science to other disciplines and to real-life experiences. In this phase, teachers agreed to plan activities that will provide students with an opportunity to find the relevance of science, particularly their findings, to other social issues and special topics from other subjects.

Table 7 shows an example of an instructional plan developed by the teachers using the model. The teachers collaboratively planned the lessons. All the young children will do the same activity or experiments regardless of their age. Throughout the lesson, the teachers served as instructional coach guiding the young children in doing activities and experiments, answering inquiries, and providing explanations when needed.

Table 7. *Sample Instructional Plan Using the Four-Pronged Approach for Teaching Science*

	Instructional Plan for Science
Lesson	Electric Circuits
Objectives	In this lesson, the students should be able to: • Explain the concept of an electric circuit • Observe how electricity travels in a circuit • Construct a model of an electric circuit
Instructional Procedure	**Learning Experiences**
1. Thinking About Science	• Ask the students about their ideas on how electricity is transferred from a power source to their homes
2. Experiencing Science	Ask the students to: • Observe an example of an electric circuit • Observe how an electric circuit works. • Record observation. Take pictures if needed. • Explore other samples of electric circuit.
3. Communicating Science Ideas	Ask the students to: • Develop sample of an electric circuit using a battery, switch, electric wires, bulbs, and other materials (divide the class into small groups). • Prepare a short presentation to explain to the class how an electric circuit works using the model they developed.
4. Connecting Science to other Subjects and to Real-Life Experience	**Art** • Draw an example of an electric circuit model. **Language** • Define important terms like power source, electric conductors, electric current etc. • Use sentences and descriptive words to share observation **Mathematics** • Measure the length of wires • Estimate the number of bulbs needed for the model circuit they will develop **Music** • Compose children's song about electric circuit **Real-Life** • Observe how electric circuits are done in their house • Invite electrician to explain what happens during a electric brown out • Learn safety measures in handling electricity or any electric appliances

How is the Science-based Integrated Curriculum Implemented to Nurture the Gifted Potentials of Students in Science?

The science-based integrated curriculum helped to nurture the gifted potentials of young

children in science. During the sessions, the teachers observed the interest and high motivation of the students to do individual and group experiments and activities. It provided a venue to develop important science process skills and concepts. Throughout the 12-day session, science provided the uniting theme for the curriculum. The children learned science with emphasis on concepts and process skills. In the curriculum, concepts like patterns, changes, cycles, systems, properties, and materials, among others, were explored. Through the activities, they were able to develop new science ideas, explore scientific questions, and discover new learning. The following were some comments from the students:

> I think liquid like metals are conductors of electricity too. I can observe this through our experiment. (Student 4)
>
> I observed stomata through the microscope. Now, I understand better how plants breathe air. (Student 7)
>
> Now, I understand how scientists measure the direction of the wind during typhoon. (Student 9)
>
> I can explain to my siblings to be careful with chemicals after our lesson. (Student 14)

The curriculum also allowed the learners to develop science process skills and use them in experiments and in all activities. These process skills are observing, comparing, predicting, hypothesizing, experimenting, and communicating. The students also learned to analyze data from their simple experiments and activities and use simple science equipment like microscope, magnifying glass, and beaker.

It provided an opportunity to develop interdisciplinary inquiry among young children. Filipinos have always been fond of music. In the curriculum, children experienced playing indigenous music instruments, singing folk songs, dancing and making rhythmic movements, and producing various sounds from nature by imitating the sounds of animals, water, and wind using their voices or other materials.

Filipino arts were also part of the lessons. The curriculum puts emphasis on art processes prescribed by the K-12 basic education curriculum where young children were asked to examine colors, designs, patterns, textures, and visual and performing arts. The children were encouraged to explore the ideas of design and patterns from nature and other inspirational sources. They drew, painted, and illustrated ideas and concepts. Like music, art was used to communicate ideas and express emotions creatively. The science-based

integrated curriculum allowed young children to enhance their skills, talents, and interests in music and arts. The followings were examples of the activities done to integrate arts and music to science:

Making models of a sundial and propeller
Drawing the structures of plant's leaves, flowers, and stem
Drawing models of insects
Composing simple songs related to the lesson
Singing songs about plants, energy, and animals
Making a model of a volcano
Illustrating the concept of electric circuits
Illustrating concepts of cycles
Performing some rhythmic movements and dance

Mathematics was used as an important tool for learning various concepts. In every session, the children learned and used mathematical skills like logical reasoning, problem solving, measuring, estimating, counting, and comparing: mathematical concepts like geometrical patterns, time, number concepts, and probabilities and the fundamental mathematical operations. The curriculum wanted the learners to develop love and interest for learning mathematics and see how it is used as a tool in learning all subjects. The learners explored the application of mathematics concepts and skills in real-life context for example:

Solve word problems
Use numbers
Apply fundamental mathematical operations
Use graphs
Study patterns and colors
Measure materials and objects

Language and social studies concepts were also integrated in the curriculum as learners developed their vocabularies, expressed ideas, and learned various literatures like stories and poems. They also learned the concept of directions and community life. They encountered concepts about society and history in a natural way. They enjoyed community trip during the fifth day. Through science, they explored some social issues like the need

for clean surroundings, clean water, and planting trees around the community. The activity on developing sundial, telephone toy, and paper propeller provided the students with an opportunity to learn history of how tools and some objects are invented. It offers meaningful and enjoyable learning experiences for young children.

The lessons were conducted in such a way that every learner experienced the joy and excitement of learning science. In every activity, the learners were encouraged to collaborate with other children, take leadership and initiative, express ideas in different ways, and develop critical reflection through asking good questions and sharing innovative ideas. The learners were also encouraged to have creative presentations and demonstration of experiments in front of other children to develop their presentation and communication skills. As part of the culminating activity of the students, each of them performed a simple experiment in front of the parents and visitors. This culminating activity helped the young children develop positive self-esteem.

Conclusion

This study aimed at developing and implementing a science-based integrated curriculum to help develop and nurture the gifted potentials of young children in science. It also aimed to develop leadership skills and Higher Order Thinking Skills (HOTS) among the students. This curriculum integrates science to music, mathematics, arts, social studies, and language. It provided interesting opportunities for young learners to experience science through hands-on experiments and integrated activities. In the learning process, it developed collaboration among the learners and enabled them to enjoy learning the science by looking at its real-life application in relation to Philippine context and culture.

The experiences of the researcher and the teachers in this study could offer some valuable suggestions or recommendations for improving gifted education in the country to wit: (1) local schools should be encouraged to develop gifted programs and curriculum for their students; (2) there is a need to train teachers to develop curriculum for the gifted and gifted potentials and they also need training on instructional approaches and models for teaching gifted; (3) there is a need to conduct a study on the gifted characteristics of young Filipino children, especially, in the science; and (4) to respond effectively to the needs of

gifted and potentially gifted students, class size should be relatively ideal.

The science-based integrated curriculum could be adapted as a model for public and private schools in the country to develop and nurture the gifted potentials of students. The science-based integrated curriculum itself is a product of creativity, innovation, and collaboration among expert teachers. Finally, this curriculum is a testament of the many things that educators and educational institutions can do to advance the cause of gifted education in the field of science education.

References

Chaille, C., & Britain, L. (2002). *The young child as scientist: A constructivist approach to early childhood science education* (3rd ed.). Boston, MA: Allyn and Bacon.

Davis, G., Rimm, S., & Siegle, D. (2011). *Education of the gifted and talented* (6th ed.). Upper Saddle River, NJ: Pearson Education.

De Vries, R., & Zan, B. (1994). *Moral classrooms, moral children: Creating a constructivist atmosphere in early childhood education.* New York, NY: Teachers College Press.

Department of Education. (2012). *K-12 basic education curriculum guide.* Pasig: Bureau of Curriculum and Instruction.

Faustino, J., Hiwatig, A., & Sumida, M. (2011). Kids academia science program: Enriching exceptional needs and characteristics of gifted young children in Japan. *Ehime University Faculty of Education Bulletin, 58*(1), 125-135.

Gittman, E., & Koster, J. (2000, October). *Analysis of a teacher checklist used for assessment of students eligible for placement in a gifted and talented program*. Paper presented at the annual meeting of the Northeastern Educational Research Association, Ellenville, NY.

Hodson, D. (1998). *Teaching and learning science: A personalized approach.* Philadelphia, PA: Open University Press.

Kerr, B. (2009). *Encyclopedia of giftedness, creativity, and talent.* Thousand Oaks, CA: SAGE Publications.

Martin, D. J. (2001). *Constructing early childhood science*. Del Mar, CA: Thomson

Learning.

Mingoa, T. R. (2006). *The making of outstanding Filipino scientists: Implications for enhancing giftedness in science* (Unpublished doctoral dissertation). University of the Philippines, Quezon City, Philippines.

Pawilen, G. T. (2006). *Developing an indigenous science curriculum for kindergarten in the Philippines* (Unpublished master's thesis). Ehime University, Matsuyama, Japan.

Pawilen, G. T. (2014). *Developing curriculum standards for gifted students in science* (Unpublished postdoctoral research). Ehime University, Matsuyama, Japan.

Pawilen, G. T., Sumida, M., & Clavio, J. V. (2005). Developing a science-based curriculum for kindergarten: A vision for united Methodist kindergarten schools in the Philippines. *International Journal for Equity and Innovations in Early Childhood Education*, *3*(2), 118-126.

Piaget, J. (1983). Piaget's theory. In P. Mussen (Ed.), *Handbook of child psychology* (pp. 103-128). New York, NY: Wiley.

Saloma, C. (2016). The cost of a PhD degree. *The Philippine Journal of Science*, *145*(4), 5-6.

Sternberg, R. (2004). *Definitions and conceptions of giftedness*. Thousand Oaks, CA: Corwin Press.

Sumida, M. (2010). Identifying twice-exceptional children and three gifted styles in Japanese primary science classroom. *International Journal of Science Education*, *32*(15), 2097-2111.

Van Tassel-Baska, J. (2004). *Introduction to curriculum for gifted and talented students: A 25-year retrospective and prospective*. Thousand Oaks, CA: Corwin Press.

Von Glasersfeld, E. (1995). A constructivist approach to teaching. In L. P. Steffe, & J. Gale (Eds.), *Constructivism in education* (pp. 3-14). Hillsdale, NJ: Laurence Erlbaum Associates Inc.

Zirkelbach, A. (2011). *Identifying gifted students in science* (Unpublished master's thesis). Western Kentucky University, Bowling Green, Kentucky.