

A Study on the Teaching Practices of Applying Dewey's Aesthetic Experience in a Science Thematic Curriculum for Young Children

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As aesthetic education has become a core element of school curricula, the application of it in science education is also valued. Using collaborative action research, this study aimed to explore the teaching practices of applying Dewey's theory of aesthetic experience in a science thematic curriculum, "Little Vegetable Farmers," in a preschool. The researcher served as a curriculum consultant, and two preschool teachers served as the co-teachers. The participants were 24 young children of age 5. Data sources included classroom observations, interviews, young children's plant diaries, artwork, teaching reflection notes, and so on. The findings showed that the preschool teachers guided the young children to perceive the vegetables growing in detail and to share ideas, to try their ideas in doing science, to create artworks related to the science theme with imagination, and to appreciate the works of science and arts with meaning-making. Through this action research, the preschool teachers improved their science and aesthetic teaching, as well as their abilities integrating curriculum design and instruction in science. This study is helpful for educators to understand how preschool teachers integrate aesthetics into a science thematic curriculum in a preschool, which provides a reference for early childhood science and aesthetic education.

Keywords: Dewey's theory of aesthetic experience, early childhood science thematic curriculum, science and aesthetics

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Introduction

As aesthetic education has become a core element of school curricula, the application of it in science education is also valued (Hadzigeorgiou, 2016a). The aesthetics of science can be reflected in natural science objects, science experiments, theories in science, and the spirit of science inquiry (Lin, Jen, & Lee, 2007; Wang, 1994). Guiding students to appreciate the aesthetics of science is also important in science curricula and instruction (Ministry of Education, 2002, 2003). Some researchers have found that the integration of aesthetics into science teaching helps students develop their scientific literacy, raise their interest and involvement with science, learn to appreciate aesthetics of science, or apply science knowledge in everyday life (e.g., Girod, Twyman, & Wojcikiewicz, 2010; Girod & Wong, 2001; Jakobson & Wickman, 2008a; Lin, Hong, Chen, & Chou, 2011; Pugh & Girod, 2007). However, most of these studies focused on students at elementary school and high school levels, rather than on early childhood education.

The Ministry of Education (MOE) in Taiwan promotes aesthetic education in early schooling. According to the Early Childhood Education and Care Curriculum Framework (Ministry of Education, 2016), the principle of the aesthetic domain is to evoke preschool teachers and young children to gain aesthetic experience and feel enjoyment and satisfaction by doing and undergoing in life. Children can learn to explore the natural phenomena and artifacts, and perceive the beauty in their surroundings. Dewey (1980) believed that aesthetic experience is an experience that has pattern and structure and consists of continuous interactions of doing and undergoing in our everyday lives. His idea of aesthetic experience can be reflected in the aesthetic domain, including the natural phenomena and artifacts. It is also possible to apply Dewey's idea of aesthetic experience to teach science in preschools.

It has been reported that early childhood educators lack enough confidence and knowledge in science teaching (McNerney & Hall, 2017). Some researchers have also found that preschool teachers in Taiwan are not confident in their science teaching (Chang, Shieh, & Huang, 2009; Chen, 2016; Lin, 2008); hence, the quality of early childhood science education needs to be improved. Some researchers have argued for integrating science into other content areas (Trundle & Sackes, 2012). Furthermore, the integration of the arts and science can make science learning an artistic activity for students to perceive and appreciate beauty (Hadzigeorgiou,

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2016b). As a preschool consultant and teacher educator in early childhood education in a university, the researcher has found that preschool teachers are not unfamiliar with the integration of science into early childhood thematic curricula. It is therefore possible to help them employ a thematic approach to integrating science into a thematic curriculum and improve the quality of their science teaching.

In order to help preschool teachers apply Dewey's idea of aesthetic experience in science education to benefit young children's learning, the researcher conducted this collaborative action research in collaboration with preschool teachers to implement a science thematic curriculum in a preschool. This study provides us with a lens through which to examine the application of Dewey's aesthetic experience to the implementation of a science thematic curriculum for young children. It also provides a reference for early childhood science and aesthetic education.

Literature Review

Dewey's Aesthetic Experience and its Application in Education

Dewey's aesthetic theory is grounded in his conceptualization of human experience in education as a mode of being and knowing (Choi & Bresler, 2000-2001). According to Dewey (1980), experience comes from the interaction between living creatures and surroundings. An experience has its generic traits of completeness, uniqueness, and emotions (Jackson, 1998). Aesthetic experience is an experience that has the features of transforming impulses into expressions, unifying emotions to reconstruct our experiences, and doing and undergoing in relationship (Dewey, 1980).

Dewey regarded art as the highest form of human experience. "Art" refers to the process of art making and experiencing. Artists are in the process of doing and undergoing their artwork at every stage. "Aesthetic" refers to the action of perception and enjoyment (Dewey, 1980). To perceive an artwork, a beholder engages in an active reconstruction of an experience. It begins with an initial and immediate impression when a beholder confronts an artwork in its entirety. The use of abstract language about art can be extracted from the aesthetic experience, which is the direct interaction with the work of art itself. This is a meaning-making process for a person to experience an artwork in context. Thus, we may gain our aesthetic experience through active participation in appreciating, perceiving, and enjoying the

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work of art.

Dewey argued for an integrated art-based curriculum that refers to the application of arts to all of the subject matters, including science and mathematics. For example, he directed the curriculum through the practical arts of gardening, carpentry, cooking, and weaving, especially in the lower grade classes in the University of Chicago Laboratory School (Jackson, 1998). Children's aesthetic experience can be related to the various arts activities, science, and mathematics that occur in children's everyday life. They can undergo aesthetic experience through observing and drawing a plant, as well as having special experiences of hearing and feelings of walking on a rainy day. Children's aesthetic experience can depend on the vividness and intensity of their engagement with the provided activities (Lim, 2004).

Aesthetics can be combined with the cognitive aspects in science education (Girod et al., 2010). Dewey's theory of aesthetic experience has influenced teaching styles in school science education (Hadzigeorgiou, 2016a). Dewey considers the importance of creating more new ideas and actions in the aesthetics of science inquiry. Some researchers have advocated the application of Dewey's theory of aesthetic experience in science teaching and learning (Girod & Wong, 2001; Pugh & Girod, 2007). In this context, the central curricular elements involve students' ideas and experience. Teachers play the important role of helping students to see the possibilities and potentials for scientific ideas to re-shape and re-vitalize the world. They also emphasize that truth and beauty can be verified in the world. Consequently, teachers can encourage students to try out their scientific ideas to re-see and reconstruct the world. Students actively verify their ideas individually or cooperatively, and apply their scientific knowledge in their life. It is also important for teachers to show their passion for science and the impact of science ideas on their life (Girod et al., 2010; Hadzigeorgiou, 2016a; Pugh & Girod, 2007). Thus, it can help students to experience what their teachers have experienced (Hadzigeorgiou, 2016a).

In this study, the researcher proposes that preschool teachers apply Dewey's idea of aesthetic experience and integrate the aesthetics of natural science into thematic curricula as a form of holistic learning. A theme develops important concepts and various activities of different learning areas in an integrated thematic curriculum. The selection of themes can be diverse, such as the natural environment,

the four seasons, vegetable gardens, the power of nature, and environmental protection. Teachers regard children as active agents and doers. They can therefore guide children to observe and appreciate the aesthetics of natural science, encourage them to use their imagination and try out their ideas to create something or perform experiments, as well as expressing their ideas of the mystery of science. Moreover, Dewey maintained an integrated art-based curriculum that refers to the application of arts to all of the subject matters, including science. Hence, the application of aesthetic experience in science and the arts is valued in this study.

Research on the Application of Aesthetics in Science Teaching

Since aesthetics can be integrated into science education, a number of studies focusing on the application of aesthetic theories in school science education have increased. Most of the science education researchers have applied Dewey's aesthetic theory in science teaching at the elementary school or high school levels (e.g., Girod & Wong, 2001; Girod, Rau, & Schepige, 2003; Girod et al., 2010; Lin, 2010; Lin et al., 2011; Pugh & Girod, 2007). They argue for teaching for aesthetic understanding in science. In the teaching process, the teacher values students' ideas and experiences, and uses story metaphors to guide students to experience and perceive, appreciate the beauty of science, try out new ideas, and verify their ideas. Some researchers (Yang, 2012, 2014) have applied natural aesthetics and emphasized the appreciation of the natural environment, such as the beauty of the senses, the beauty of science, and the beauty of the imagination. Yang (2012) further argued for applying Joseph Cornell's flow learning sequence to teach students—awakening enthusiasm, focusing attention, offering direct experience, and sharing inspiration. The results of the above studies showed that the application of aesthetics in science teaching helped students raise their consciousness of science and interest in science learning, appreciate the beauty of science, or apply science knowledge in their daily life.

As for the methodical issues, many researchers have applied the quasi-experimental method to examine the effects of teaching for aesthetic understanding in science classes (Girod & Wong, 2001; Girod et al., 2003; Girod et al., 2010; Lin et al., 2011). The results revealed that teaching for aesthetic understanding had positive effects on the students' aesthetic understanding or their abilities of applying science knowledge. Some researchers have conducted case studies to explore students' science learning or aesthetic experience. Girod and Wong (2001) explored the learning of fourth-grade students who were taught for

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aesthetic understanding in the geology unit. The result showed that the students performed better in the post-test of conceptual understanding; however, they presented different degrees of aesthetic understanding based on their different characteristics. In another case study, Chou (2011) explored the fifth and sixth grade students' aesthetic experience in learning different subjects, a science class and an art class. She found that students' aesthetic experience involved their attentive engagement, emotional involvement, and feelings of newness and surprise in their science and art learning. Some researchers have conducted action research to explore the practice of integrating aesthetic education into science education. Cheng (2011) explored second-grade students' aesthetic experience in the Life Curriculum focused on the theme of Grasshoppers. Through the teachers' guidance of aesthetic experience, the students showed their enthusiasm and greater involvement in science learning.

In addition, some researchers integrated scientific and artistic activities for students to learn about science and art and to enrich their aesthetic experience. Jakobson and Wickman (2008b) conducted a study for scientific and artistic purposes for elementary school students to learn about goldfish. The students learned facts about fish, as well as the aesthetics of science and artwork. In another study conducted by Jakobson and Wickman (2015), the elementary school students participated in two activities of scientific inquiry and art practice. They observed leaves and further rubbed leaves in various colors of paint. It helped the students to enhance their scientific learning about leaves, as well as their aesthetic experiences which were shown by their aesthetic judgements of the leaves and their features.

As shown above, the application of aesthetic theories in science teaching helped students to enhance their science awareness and interest in science learning, as well as appreciating the aesthetics of science and applying science knowledge in life. The integration of scientific and artistic activities also helped students to learn about science and art and to enrich their aesthetic experience. Most researchers studied the application of Dewey's aesthetic theory in science education, in which the teacher valued students' ideas and experiences. Most studies on aesthetics in science classes are related to students' attitudes towards, motivation for, and interest in science (Wickman, 2017), rather than on teachers' teaching practices. Moreover, most studies focused on elementary school level and above, rather than on early schooling. Therefore, the researcher conducted this research with preschool teachers to explore the teaching practices of the application of Dewey's aesthetic experience

in a science thematic curriculum for young children.

Research Purpose and Research Questions

Using collaborative action research, the purpose of this research was to explore the teaching practices of applying Dewey's aesthetic experience to a science thematic curriculum in a preschool in Taiwan. The researcher served as a curriculum consultant, and two preschool teachers served as co-teachers. The participants were 24 young children of age 5. The research questions are as follows.

1. How do the preschool teachers apply Dewey's idea of aesthetic experience to the science thematic curriculum?
2. What professional development do the preschool teachers promote in their teaching?

Methodology

Collaborative action research includes more than one member on a research team (Chen, 1998). It is a process that enables teachers to improve their teaching practice and teaching profession as well as students' learning (Sagor, 1992). This study applied the idea of collaboration among an expert and preschool teachers. In order to help preschool teachers apply Dewey's aesthetic experience in science education to benefit children's learning, the researcher applied the collaborative action research method, collaborating with two preschool teachers to implement a science thematic curriculum in a preschool class. The research design is described as follows.

Sites and Participants

The criteria of choosing a preschool as a research setting include (a) attention to science education and arts education for children; and (b) willingness to improve the quality of education for children. The researcher invited Mr. Hong (pseudonym), the founder of Nature Preschool (pseudonym), and his preschool teachers to participate in this research.

Nature Preschool is a private preschool famous for its science and natural

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environment in the countryside of Chiayi County, Taiwan. It provides thematic curricula and various learning activities for young children, such as block learning, Orff music, clay art, and physical activities. It also provides a learning environment for children to observe and take care of small animals, vegetables, and flowers. The participants in this research were 24 young children of age 5, including 16 boys and eight girls, and their two preschool teachers.

Research Team Members

The researcher served as a curriculum consultant, and two preschool teachers in the class of age 5 served as co-teachers. Ms. Hu (pseudonym), aged 30, was a young teacher and had a Bachelor degree in early childhood education and care. She was lively and enthusiastic. She loved to explore and discover things in life. Her teaching belief was to accompany and care about children with love. She expected the children to have sympathy and to learn to take care of themselves and others. Ms. Fang (pseudonym), aged 50, was an experienced teacher and had an associate degree in early childhood education. She was mild, easy-going, and responsible. She loved learning and enjoyed sharing her life experience with children. Her teaching belief was to teach children depending on their personalities and aptitudes, and she expected the children to grow up happily. Ms. Fang loved gardening and shared more experiences of gardening with Ms. Hu and the children in this study.

Action Research Process

The researcher referred to some researchers' idea of action research (Chen, 2003; Poon, 2008). Through observation and reflection, the researcher and the preschool teachers discussed the problems and modified the curriculum content and instruction during the process. The action research process is described as follows.

Analyzing the teaching situation and the need for change. According to some research, preschool teachers in Taiwan are not confident in their science teaching (Chang et al., 2009; Chen, 2016). Some teachers are accustomed to teaching children to follow their procedures in science hands-on activities, and even provide the answer directly. Therefore, the quality of early childhood science education needs to be improved. The researcher contacted the founder of Nature Preschool and talked about the collaboration of implementing science thematic curricula and the enhancement of the quality of science education. He and his preschool teachers agreed to participate in this study.

Identifying the problems. Although the teachers in Nature Preschool provided science learning opportunities for children, they used to teach children to follow their procedures in science activities or let the children explore science materials in the interest corner by themselves. They did not have enough time for children to share ideas or engage in discussion. According to some studies, the application of aesthetic experience in science can help children express their ideas and try out their ideas in doing science, and show more involvement in science learning (e.g., Girod & Wong, 2001; Pugh & Girod, 2007). Aesthetic education is promoted in early schooling in Taiwan and can be integrated into a thematic curriculum and everyday life. As a result, the researcher invited Ms. Hu and Ms. Fang to collaborate to integrate aesthetics into a science thematic curriculum.

Designing the reform project of curriculum and instruction. The researcher organized workshops on Dewey's aesthetic experience, science thematic curriculum, and action research for the teachers in the preschool in August, 2017. Dewey's aesthetic experience can be integrated into everyday life, including the practical arts of gardening. With the natural environment in the preschool, the young children had experience of gardening in their preschool vegetable garden. It was also convenient for them to visit different vegetable gardens in the neighborhood. The teachers and the researcher decided to apply the thematic approach to organize a thematic curriculum of "Little Vegetable Farmers" and to provide experiential learning for children to plant vegetables. Through doing and undergoing, it aimed to enrich children's aesthetic experience and to enhance their science cognitive abilities and aesthetic abilities. The researcher organized the thematic curriculum web and learning activities, and Ms. Hu and Ms. Fang were invited to discuss and modify the thematic curriculum web and curriculum content.

Teaching action, observation, and reflection. The teachers began to implement the thematic curriculum in October, 2017. The researcher assisted Ms. Hu and Ms. Fang and observed their teaching once a week. They reflected on the teaching, and planned and modified the learning activities weekly. However, some activities were added or cancelled by the teachers or children in the process. They spent 4 months completing a total of four concepts and 46 learning activities. The four concepts consisted of types of vegetables, ways of vegetable planting, the bugs' crisis, and harvest of vegetables. Each concept was related to different learning activities. Each learning activity was associated with different learning domains, such as cognition, aesthetics, language, body motion and health, social studies, or emotion suggested by the *Curriculum Framework* (Ministry of Education, 2012,

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2016). Because the core of the thematic curriculum was science, the concepts were more related to science, and most of the learning activities were related to natural science in the cognition domain. The content of the theme, concepts, learning activities, and learning domains are shown in the appendix. The action research cycle of planning, action, observation, and reflection was employed in this research.

Data Collection, Data Analysis, and Ethics

This research was conducted for six months in the academic year of 2017, that is, August 2017 through February 2018. Ethical approval was received from the preschool, the preschool teachers, and the young children's parents. The research data sources included (a) observations of classroom activities; (b) semi-structured and open-ended interviews with the teachers and young children; (c) young children's plant diaries, worksheets, and artwork; (d) teaching reflection notes by the teachers and researcher; and (e) notes on curriculum discussion by the teachers and researcher. The classroom observations were videotaped or sound-recorded, and photographed. The formal interviews were sound-recorded and transcribed.

The qualitative data were analyzed by coding and categorizing. The idea of Dewey's aesthetic experience was also used to analyze the data of teaching practices. Some issues emerged in the process, such as the emergent activity and teachers' problems guiding the children to solve problems in science. The data were also triangulated using methodological triangulation (i.e., observation and interview) and data source triangulation (e.g., observation records, interview transcripts, and young children's plant diaries, worksheets, and artwork). The teachers were invited to do member checking, such as checking the interview transcripts and the draft of the research report. All the participants' names are pseudonyms.

Results

The Application of Dewey's Aesthetic Experience to the Science Thematic Curriculum

Since the young children had experience of gardening, the researcher led the preschool teachers, Ms. Hu and Ms. Fang, to apply Dewey's aesthetic experience and organize a thematic curriculum on the theme "Little Vegetable Farmers." They applied four important ways based on Dewey's idea of aesthetic experience, which

are described as follows.

Guiding the children to perceive the vegetables in detail and to share ideas.

Dewey's idea of aesthetic experience can be integrated into everyday life, including gardening. Visual language, such as sketches and paintings, can also be included in science education (Caiman & Jakobson, 2019). Preschool teachers can evoke children's aesthetic experience through perceiving and exploring the environment with their senses (Ministry of Education, 2012, 2016). For instance, children undergo their aesthetic experience through observing and drawing plants in science. Children's aesthetic experience can depend on the vividness and intensity of their engagement with the activities (Lim, 2004).

In this study, the preschool teachers believed that it is important to guide the children to perceive the vegetables in detail by applying their senses of sight, hearing, touch, smell, and taste in the process of vegetable planting. They guided the children to apply their senses to observe the growing vegetables in the vegetable garden in detail and then the children shared their observations and recorded them in the plant diary. For example, in the activity of Taking Care of the Vegetables 3, child 19 concentrated on her observation of her cabbage plant. She measured the height of the plant, smelt and touched the leaves, and found tiny holes in the leaves. After the observation, Ms. Hu guided the children to share their observations of growing vegetables, such as the height of the plant, the number of leaves, the smell and touch of the plant, and insects or anything special on the plant. She further guided them to record their observations in the plant diaries (Observation 13, 20171103). Below is an example of child 19's plant diary, in which she recorded the date, the height of the cabbage plant, and the number of leaves. She drew the cabbage plants with holes in the leaves, along with the soil, a moth, a sun, and clouds that she observed in the environment (Figure 1). She also drew herself and her classmate using the watering cans to water the plants. Her drawing reflected her keen observation and her effort to take care of the plant. It also reflected her artistic expansion of perception, to perceive the nuance and to re-see the detail of the world (Girod et al., 2003).

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Figure 1 *The growing cabbage in child 19's plant diary.*

The preschool teachers also guided the children to see, touch, smell, and taste the raw and cooked vegetables and to share their feelings. In the activity of What a Good Pumpkin, Ms. Fang cut the pumpkin in half and the children observed the inside of the pumpkin. The children touched and smelt the pumpkin and were surprised that the pumpkin smelt like a watermelon. Some children shared their observations, such as “*it is yellow.*” “*It has many seeds.*” “*The seeds look like teardrops*” (Observation 4, 20171013). In the other activity of Cabbage Cooking, Ms. Fang shared her experience of making cabbage soup in daily life, and the children participated in the making of cabbage soup and tasted the cabbage soup. Ms. Fang further guided the children to share their feelings about the soup. The children enjoyed their soup and shared their ideas by saying, “*The cabbage is soft.*” “*It is tasty!*” “*It is sweet and salty*” (Observation 22, 20171124). In addition, the teachers guided the children to show their kinesthetic sensation. In the activity of Taking Care of the Vegetables 3, each group was invited to use their body movement to perform different creatures they observed in the vegetable garden. For example, the cabbage group played the roles of cabbage plants, a caterpillar, and a moth. Five children squatted down to pretend to be the short cabbage plants; child 23 pretended to be a

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caterpillar and held onto the cabbage plant; child 18 pretended to be a moth flying close to the cabbage plant. The children enjoyed their moving and other children enjoyed watching their performance and laughed while watching (Observation 13, 20171103).

Guiding the children to try their ideas in doing science. For Dewey, aesthetics of science inquiry is to create more new ideas and actions. Although the preschool teachers were used to guiding the children to follow the teachers' ideas to do something, the researcher designed some activities to help them guide the children to share their thoughts and try out their new ideas to solve the problems in vegetable planting. They further discussed how to guide children to create new ideas, such as raising questions and encouraging them to think and to provide answers.

For example, Ms. Hu raised questions and asked the children what problems they had when picking the tomatoes. While some children expressed that it was difficult for them to pick up the tomatoes because the tomato plant was too high, some children expressed that they could not find the tomatoes because they were hidden inside or the leaves were too thick. Ms. Hu further guided the children to share their thoughts and try out their ideas to solve the problems. Finally, the teachers led the children to bring their tools to pick up the tomatoes in the vegetable garden. For instance, child 7 stood on a small chair to pick the tomatoes growing high up on the vine; child 2 used the scissors to cut the tomatoes; child 8 took the weeding hook and picked the tomatoes hidden inside. They were glad to try out their ideas and solve the problems successfully. Below is an excerpt from the observation notes.

Ms. Hu then asked the children how to solve the problem of picking the tomatoes in a high position. Child 2 answered, "Ask for help from adults." Child 8 responded, "Ask for help from a taller classmate." Child 22 said, "Stretch your hand." Child 4 responded, "Ask a taller classmate to stretch the hand and stand on tiptoes." Child 7 said, "Take the chair." Ms. Hu applauded their good ideas... They further discussed the tools that they could use to pick up the tomatoes... Finally, the teachers led the children to bring the tools to pick the tomatoes. Child 7 stood on a small chair to pick the tomatoes growing high up on the vine. Child 2 used the scissors to cut the tomatoes. Child 8 took the weeding hook and picked the tomato hidden inside... (Observation 45, 20180131) .

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Guiding the children to create artworks related to the science theme with imagination. Art refers to the process of art making and experiencing art at a particular time. Aesthetic experience has some degree of imaginative quality (Dewey, 1980). The preschool teachers guided the children to apply various artistic materials to create artworks of visual arts, music, and drama related to the theme of the science thematic curriculum with imagination. The children enjoyed the process of the art making.

For example, Ms. Hu guided the children to make pictures with different shapes of vegetable stamps and water colors in the Vegetable Stamping activity. She encouraged the children to try different materials to make their paintings better. She also encouraged them to create their own artworks with imagination. They concentrated on their art making and enjoyed the process. Eventually, the children made their different pictures of vegetable stamps, such as flowers, fireworks, scooters, and so on. Below is an excerpt from the observation notes.

In the beginning, Ms. Hu cut up different vegetables such as cucumber, bitter melon, okra, celery, cabbage, and sweet potato. She and Ms. Fang then invited the children to observe the vegetable cuttings and slices by seeing, touching, and smelling. In the process of art making, Ms. Hu encouraged the children to use different shapes of vegetable cuttings and different water colors and their imagination to create their own pictures. She said, "You can try those different materials. It can make your painting look better!" ... The children tried different materials, enjoyed their art making, and finally made their different pictures using vegetable stamps, such as flowers, gardens, windmills, fireworks, a scooter, tornado, snow, snowmen, etc (Observation 3, 20171006).

The preschool teachers further integrated the creation of visual arts, music, and drama in some activities. For example, they led two groups of children to make props for the drama play in the Prop Production activity. Ms. Hu guided the role-play group to make their headgear props for different roles, while Ms. Fang guided the music group to observe different beans and to make bean shakers which produced different sounds (Observation 30, 20171214). In the other activity of Drama for Little Vegetable Farmers, the role-play group played the roles with their headgear props and the music group shook their bean shakers to accompany the songs in the play which they created. They enjoyed their music and role play as they

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showed their lived experience as vegetable farmers (Observation 31, 20171215).

Guiding the children to appreciate the works of science and arts with meaning-making. According to Dewey (1980), aesthetic refers to the action of perception and enjoyment. The preschool teachers guided the children to appreciate the works of science and arts, including their vegetable produce of cabbage, tomatoes, and white radish, along with their artworks of visual arts, music, and drama. The children perceived their works and used their language to talk about their feelings about the work and the meanings of the work to them.

For example, the children pulled out their white radishes and showed their produce with enjoyment in the White Radish Harvest activity. Ms. Hu invited the children to share their perception and feelings about their white radishes. Some children responded by saying, “*We got a big white radish*”; “*it smelt good*”; “*it smelt salty*”; “*it smelt like the sea.*” Ms. Hu applauded their different ideas, especially the salty smell and the sea-like smell (Observation 38, 20180111). In another activity, Vegetable Stamping, Ms. Hu invited the children to appreciate and talk about their vegetable stamp pictures. While some children made flowers with vegetable stamps, child 5 made a unique picture of “My Scooter.” Ms. Hu applauded him for his creative idea. He shared his picture and explained, “*This is my scooter. I used a slice of bitter melon to stamp the wheel of the scooter*” (Observation 3, 20171006). This is the meaning-making of his artwork. Below is child 5’s vegetable stamp picture.

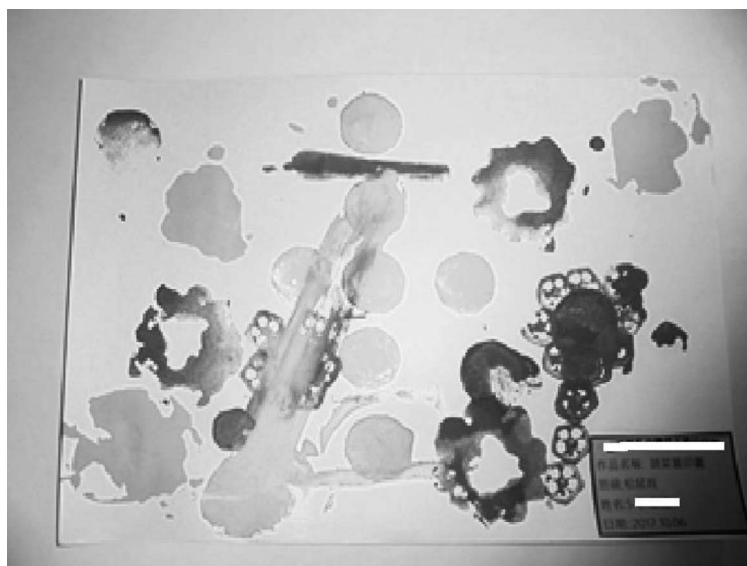


Figure 2 Child 5's picture, “My Scooter.”

Teachers' Teaching Professional Development

Through the action research cycle of planning, action, observation, and reflection, the preschool teachers improved their science and aesthetic teaching, as well as their abilities of science integration curriculum design and instruction. Their teaching professional development is described as follows.

Teachers' improvement in science and aesthetic teaching. Through this action research, the teachers improved their science cognitive abilities and applied these abilities in their science teaching, such as discovering problems, gathering information, organizing information, and solving problems by looking for information and discussing with others. As a curriculum consultant, the researcher also shared the information of vegetable planting with them, such as the reference books and the on-line information of vegetable planting. The teachers felt that they taught and learned about science simultaneously.

Ms. Hu: I don' t have enough knowledge of vegetable planting. Therefore, I have to look for more information...and organize it. It helps me discover the problems and learn more about science...Additionally, I asked the expert, Mr. Huang, questions. I also discussed the problems with my co-teacher.

Ms. Fang: Yes, I also have to look for information...We have to teach (science) and learn (science) at the same time (Interview 2, 20180129).

The teachers also learned to apply the aesthetic teaching skill in teaching a science thematic curriculum, such as the use of the senses in perception and exploration in detail. They guided the children to learn to perceive and explore the vegetables and the surroundings with their senses thoroughly. The use of aesthetics helped the children to learn about science from different perspectives. The teachers learned to know how to infuse Dewey's idea of aesthetic experience into the curriculum in the process of curriculum implementation. As Ms. Hu reflected,

I wondered how to infuse the idea of aesthetic experience into the curriculum... Later, I learned to know about it in the process of curriculum implementation... Because we chose this science theme...I guided the children to apply their five senses to get to know and explore different

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things...In aesthetic teaching, it is important for children to practice using their five senses...and to perceive their surroundings... (Interview 2, 20180129).

The teachers were delighted to see the children's active participation in the class activities. As the teachers reflected, "*The children usually ask us teachers, 'what are we going to do today?' They were curious about and expectant for the class activities*" (Curriculum Discussion Note 7, 20171020). The children also showed their concentration and enjoyment in the class activities, which reflected their aesthetic experiences in their learning.

Teachers' improvement in science integration curriculum design and instruction. In the curriculum design, the preschool teachers and the researcher discussed the science thematic curriculum web, the details of the learning activities, and referred to the learning indicators in different domains in the Curriculum Framework (Ministry of Education, 2012, 2016). They discussed and reflected on the curriculum before and after the class each week. Some activities were merged, cancelled, or rearranged in the process. The teachers found that they improved their skills of curriculum webbing, such as leading the children to brainstorm and to classify their ideas. They also learned to enrich the science thematic curriculum with the integration of aesthetics.

Ms. Fang: I think I learned to discuss the theme with the children... design the thematic curriculum web and classify the children's ideas.

Ms. Hu: I also learned more about curriculum web design...One teacher leads the children to brainstorm, and the other assists by writing the children's ideas on the board... Then the teachers and children classify their ideas... and plan the activities... I also learned that... with the integration of aesthetics into the science curriculum... it makes the curriculum diverse, and it enriches the curriculum (Interview 2, 20180129).

Moreover, the teachers learned to apply picture books in the science thematic curriculum. Most children enjoyed their storytelling. There were 19 who expressed that they enjoyed listening to the stories about vegetables (Worksheet 7, 20180129). The teachers also felt confident in their teaching. They inspired children's expression and ideas in the process of learning. Ms. Hu reflected by saying, "*I think*

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we feel confident in our teaching...We didn't expect such a good result." Ms. Fang responded, *"Yes! We did inspire children's expression and ideas"* (Interview 2, 20180129).

In the following semester, the teachers organized a thematic curriculum focused on the theme of little flower farmers. Furthermore, they participated in the preschool professional development guidance program and also organized some science thematic curricula, such as lovely animals, bugs' world, and the change of food. They also learned to pay more attention to the children's ideas and experiences in the process.

Discussion

This discussion focuses on the issues of applying Dewey's aesthetic experience in science education, as well as preschool teachers' teaching professional development through this action research.

In this study, the preschool teachers applied Dewey's idea of aesthetic experience to implement a science thematic curriculum. The preschool teachers guided the children to perceive the vegetables in detail and to share their ideas, as well as guiding the children to try their ideas in doing science. As Girod and Wong (2001) indicated, the central curricular elements to apply Dewey's aesthetic experience in science education are to involve students' ideas and experience. Through the teachers' guidance of applying the senses, the children showed their keen observation, and their plant diary records also reflected their artistic expansion of perception—to perceive the nuance and to re-see the detail of the world (Girod et al., 2003). Moreover, the teachers provided the learning environment of doing and undergoing, as well as sharing and encouragement. The children showed their concentration and enjoyment in the class, which reflected their aesthetic experience in their science learning. On the basis of Dewey's aesthetic theory, Chou (2011) found that students' aesthetic experience involved their attentive engagement, emotional involvement, and feelings of newness and surprise in their learning. Cheng's study (2011) also revealed that through the teachers' guidance of aesthetic experience, students showed their enthusiasm and greater involvement in science learning. Therefore, it is beneficial for teachers to apply Dewey's idea of aesthetic experience to guide children in science learning.

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While art refers to the process of art making and experiencing art at a particular time, aesthetic suggests the action of perception and enjoyment (Dewey, 1980). The preschool teachers guided the children to apply various artistic materials to create artworks related to the science theme with imagination and to appreciate their works of science and arts with meaning-making. They provided opportunities for the children to create different artworks and share their different ideas, and applauded their creative ideas. The infusion of arts in the science thematic curriculum helped the children to enrich their aesthetic experience of exploring the world of vegetables. Some researchers also found that the integration of scientific and artistic activities helped students to learn about science and art, as well as enriching their aesthetic experience (Jakobson et al., 2008b, 2015).

As for the teachers' teaching professional development in this action research, the preschool teachers improved their science and aesthetic teaching, as well as their abilities of integrated science curriculum design and instruction. The teachers expressed that they enhanced their science cognitive abilities, such as discovering problems, gathering information, organizing information, and solving problems. In the Curriculum Framework (Ministry of Education, 2012, 2016), science is one of the learning aspects in the cognition domain which emphasizes developing children's cognitive abilities of gathering information, organizing information, and solving problems. Thus, it is important for preschool teachers to have better cognitive abilities, so that they can provide thoughtful guidance for children in the cognitive learning process. The preschool teachers also improved their aesthetic teaching skills in teaching science. Their application of aesthetic experience in science helped the children explore and perceive the vegetables in detail, share ideas and feelings, and create ideas and actions in science. However, the opportunities for the children to solve problems in science inquiry were not enough. It is suggested that the preschool teachers provide more opportunities for the children to discuss their problems and create new ideas to solve problems in science. The preschool teachers sometimes shared their experiences of vegetable planting and cooking with the children. Teachers are encouraged to show more of their passion for science and the impact of the ideas of science on their life, so that it can motivate their students to experience what the teachers have experienced (Hadzigeorgiou, 2016a).

Moreover, the preschool teachers felt confident in their teaching and they learned to apply picture books in the science thematic curriculum, which most of the children also enjoyed. It is suggested that preschool teachers apply picture books to guide children to learn about science. Some researchers (Girod & Wong, 2001) also

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found that storytelling was helpful for evoking students' imagination in science and aesthetic understanding.

Conclusion and Recommendations

Using collaborative action research, this study aimed to explore the teaching practices of applying Dewey's aesthetic experience to implement a science thematic curriculum in a preschool. The major findings were as follows. (1) The researcher led the preschool teachers to apply Dewey's idea of aesthetic experience to organize a thematic curriculum focused on the science theme "Little Vegetable Farmers." In the process of vegetable planting, the preschool teachers guided the children to perceive the vegetables in detail and to share their ideas. They also guided the children to try their ideas in doing science, to create artworks related to the science theme with imagination, and to appreciate the works of science and arts with meaning-making. (2) Through this action research, the preschool teachers improved their science cognitive abilities and applied these abilities in their science teaching, as well as improving their aesthetic teaching skills in science teaching. They also enhanced their abilities of science integration curriculum design and instruction.

This study provides a lens to examine how preschool teachers integrate aesthetics into a science thematic curriculum in a preschool classroom. Preschool teachers can apply Dewey's idea of aesthetic experience to implement science thematic curricula in accordance with children's life experiences and bring aesthetics and science into everyday life. They can integrate the arts and science to help children learn about science and enrich their aesthetic experience. There are recommendations for early childhood educators and future research in early childhood science and aesthetic education. For early childhood educators, first, teachers play the important role of helping students perceive the nuance and re-see the detail of the world. They can provide more opportunities and raise more questions for children to observe details and nuances, discuss their problems, create and try out their new ideas, as well as appreciating the beauty of science. Secondly, preschool teachers are encouraged to use their knowledge of science and aesthetics in their everyday lives, as well as applying their aesthetic experience in science to their teaching. They can share their views and feelings of the beauty of science (Lin et al., 2007), and show their passion for science and the impact of scientific ideas on their life to their students (Hadzigeorgiou, 2016a). They can apply their knowledge

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in science and aesthetics to help students gain their aesthetic experience in science learning. For future research, researchers can conduct collaborative action research with preschool teachers to improve their science teaching practices. However, it takes more time for teachers to put theory into practice. It is suggested that researchers provide teachers with teacher training workshops for a longer period of time. They can choose different topics to organize science and aesthetic thematic curricula according to children's life experiences. They can also apply the idea of aesthetic experience to organize a STEAM (Science, Technology, Engineering, Arts, and Mathematics) integrated curriculum for children.

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Appendix

Table 1 *The content of the theme, concepts, learning activities, and learning domains*

Theme	Concepts	Learning Activities	Learning Domains
Little Vegetable Farmers	Types of Vegetables	1. The Crocodile Who Loves Vegetables	Language, Body, & Cognition
		2. Vegetable Classification	Cognition & Aesthetics
		3. Vegetable Stamping	Cognition & Aesthetics
		4. What a Good Pumpkin	Language, Cognition, & Aesthetics
		5. Vegetable Gardens in the Preschool and Neighborhood	Social Studies & Cognition
		6. Masquerade of Vegetables	Language, Cognition, & Aesthetics
		7. Halloween Vegetable Masquerade	Aesthetics & Social Studies
		8. Fiber Juice	Cognition & Body
		9. Pull out the White Radish	Aesthetics
		10. Potato Stamping Christmas Cards	Aesthetics & Body
		11. I Will Never Ever Eat a Tomato	Cognition, Body, & Aesthetics
Ways of Vegetable Planting	Planting	1. Preparation for Vegetable Planting	Language & Cognition
		2. Let's Plant the Vegetables	Body & Cognition
		3. Take Care of the Vegetables 1	Language, Cognition, Social Studies, & Aesthetics

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Table 1 *The content of the theme, concepts, learning activities, and learning domains(continued)*

Theme	Concepts	Learning Activities	Learning Domains
Little Vegetable Farmers	Ways of Vegetable Planting	4. Take Care of the Vegetables 2	Language, Cognition, Social Studies, & Aesthetics
		5. Take Care of the Vegetables 3	Language, Cognition, Social Studies, & Aesthetics
		6. Tomato Flower Blooms	Aesthetics & Cognition
		7. Tomato Vine Climbs onto the Web	Aesthetics & Cognition
		8. Tomato Plant Bears the Fruit	Language, Aesthetics, & Cognition
		9. The Talent of Compost	Social Studies & Cognition
		10. Organic Compost	Cognition & Body
		11. Open the Organic Compost Barrels	Cognition
		12. Liquid Fertilizer and Tomato Protective Bags	Cognition & Social Studies
	The Bugs' Crisis	1. Cabbage's Enemy 1	Cognition & Body
		2. Cabbage's Enemy 2	Cognition & Body
		3. Organic Vegetables	Language & Cognition
		4. White Radish's Enemy	Cognition
		5. Tomato's Enemy 1	Cognition
		6. Tomato's Enemy 2	Cognition
		7. Food Chains in the Vegetable Garden	Cognition
		8. Little Vegetable Farmers' Story	Language

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Table 1 *The content of the theme, concepts, learning activities, and learning domains(continued)*

Theme	Concepts	Learning Activities	Learning Domains
Little	The Bugs'	9. Prop Production	Aesthetics
Vegetable	Crisis	10. Drama for Little	Aesthetics
Farmers		Vegetable Farmers	
	Harvest of	1. Cabbage Harvest	Cognition & Language
	Vegetables	2. Cabbage Cooking	Cognition, Body, & Aesthetics
		3. The Grandma Who Sells Vegetables	Language & Social Studies
		4. White Radish Harvest	Body & Cognition
		5. The Little Can	Social Studies & Body
		6. Taste the Pickled White Radish	Aesthetics & Emotions
		7. Tomato Cooking	Cognition, Body, & Aesthetics
		8. Cabbage Growing Diary	Cognition
		9. Tomato Growing Diary	Cognition
		10. White Radish Growing Diary	Cognition
		11. Vegetable Games	Cognition & Body
		12. Pick Tomatoes	Cognition
		13. Curriculum Review	Language

杜威美感經驗理論運用於幼兒科學主題課程教學實踐之研究

陳玉婷

隨著美感教育成為學校課程的核心要素，美感教育在科學教育的運用也受到重視。本研究採協同行動研究法，探討杜威美感經驗理論運用於幼兒園科學主題課程「小菜農」之教學實踐。本研究由研究者擔任課程諮詢者，兩位幼兒園教師擔任協同教師，研究參與者為 24 位五歲幼兒。本研究的資料蒐集包括：教室觀察、訪談、幼兒種植日記與藝術作品、教學省思日誌等。研究結果呈現：（一）幼兒教師引導幼兒細心覺察蔬菜並分享想法、嘗試以他們的想法進行科學活動，並引導幼兒運用想像力創作與科學主題相關的作品、欣賞他們在科學與藝術的成果並建構意義。（二）透過本次行動研究，幼兒教師增進他們在科學與美感教學及科學統整課程設計與教學的能力。本研究有助於我們了解幼兒教師將美感結合於幼兒園科學主題課程之實踐，可作為幼兒科學與美感教育之參考。

關鍵字：杜威美感經驗理論、幼兒科學主題課程、科學與美感

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