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THE INFLUENCE OF PARENTAL EDUCATION ON THE ENVIRONMENTAL EDUCATION OF PRE-SCHOOLERS: A CASE STUDY OF SELF-DESIGNED PICTURE BOOK

Shyang-Chyuan Fang

Abstract. *Environmental problems nowadays pose threats to the sustainability of environment, such as global warming, urban air pollution, water scarcity, environmental noise, and biodiversity loss. The root cause of those problems is human behavior. Inspiring the interest of preschoolers is crucial in their future cognition of the environment. This research discussed the influence of parent-child reading on the children's environmental interest. It also integrated environmental education into the learning process of preschoolers more comprehensively and continuously. A questionnaire was used for data collection and the data were analyzed using Smart PLS 2.0. The results show that personality trait, visual attention, and expression of ideas have statistical significance in terms of the children's learning attitude. The picture book designed in this study can improve the pro-environmental behavior after parent-child reading.*

Keywords: *parent-child reading, picture book, environmental education, pro-environmental behavior, parenting education.*

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Introduction

The environmental problems, such as global warming, urban air pollution, water scarcity, environmental noise, and biodiversity loss, are all rooted in human behaviors (DuNann Winter & Koger, 2004; Gardner & Stern, 2002; Vlek & Steg, 2007). Thus, the changes in environmental concepts and facilitation of environmentally-friendly behaviors are necessary in order to reduce the impact on environment. The advancement of technological efficiency, such as energy-saving appliances, home insulation, and water-saving equipment, tended to be overtaken by consumption growth (Midden, Kaiser, & McCalley, 2007). In order to cope with an increasingly diversified society, schools and families play a definite role in cultivating our future citizens (Hoosain & Salili, 2010; Knoester, 2012; Sleeter & Soriano, 2012; Wee, Harbor, & Shepardson, 2006). In consideration of environmental instability and global environmental degradation, greater attention should be paid to environmental education (EE) (Blanchet-Cohen & Reilly, 2013; Sauvé, 2009b), thereby creating and maintaining a sustainable relationship between humans and the environment. Therefore, EE has become an international pedagogic trend (Hamzah, 2008; Pizmony-Levy, 2011; Ravindranath, 2007; Wood, 1989).

Literature Review

Positive parent-child relationships during early childhood are essential for positive development throughout life. Conversely, children who have negative relationships with their parents often develop diverse problems including low academic achievement, negative social relationships, and delinquency (Breitenstein et al., 2012; Kupersmidt, Coie, & Dodge, 1990). Parenting education refers to education for adults, specifically for parents, with the purposes of enhancing parents' knowledge on rearing their children, and improving the parent-child relationship. Hence, parenting education is voluntary, practical, real-time, and continuous. Other research has shown a significant association between negative parent-child relation-

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ships and the incidence of problematic behaviors during early childhood and adolescence, and has proven that parents play important roles in both preventing and treating their young children's behavioral problems (Doh, Kim, Shin, Park, & Choi, 2013; Moffit, 1993; Tremblay, 2000).

Reading is one of the main activities of human learning. Preschoolers' interest in reading can be developed under the guidance of their parents or teachers. Reading can facilitate parent-child relationship and enhance preschoolers' language skills and knowledge. The characteristics of picture books include artistic images, life cognition, education, and visual effect and metallic feelings, imagination stimulation, and creativity (Yu, 2002). When the content displayed in picture books is related to the life experiences of children or the things that they understand, the message that the author intends to convey can be understood correctly in most cases. Otherwise, the understanding of children usually will deviate from the original meaning of the books (Jane, 2002).

The definitions of picture book agree on the importance of illustration and story, and provide visual and verbal experience to children (Kiefer, 1988; Nodelman, 1988; Owens & Nowell, 2001; Stewig, 1995; Thibault, 2003). As a unique genre, picture books provide children with a narrative language model and aesthetic experience. Children can use picture books to appreciate art, learn language, and become familiar with the surrounding environment. Similar to the concept of "object-to-think", picture books show some illustrations of objects, such as people and events, about the surrounding environment or world of children. Illustrations and stories in picture books establish strong narration, which conveys message, beauty, and even emotion (Bang, 1991; Cooper, 2002a; Harper, 2001; Lurie, 2003; Yu, 2009).

This research aimed to explore the influence of parent-child reading on the multi-language family education. Through the cognition and perspective of education, this research integrates EE into the learning process of preschoolers more comprehensively and continuously.

Research Focus

Two aspects of parental behaviors are positively related to the cognitive development of children: 1) the enthusiasm and response of the parent-child interaction; 2) the amount of cognitive stimulus provided by those interactions. In fact, cultivating citizens that are environmentally conscious, are eager to discover environmental problems and seek after solutions is an important task in the teaching environment (Veeravatnanond & Singseewo, 2010). Environmental literacy is the understanding of the interactions between natural systems and human social systems (Barrett et al., 1997). The working definition of an environmentally literate person is one who uses critical thinking, problem solving, and effective decision-making skills to weigh all sides of an environmental issue (McBeth, 1997). A person is able to take responsible actions to resolve environmental issues because he/she has environmental literacy: knowledge, skills, affect, and behavior.

Parent-child reading is critical in cultivating children's interest in reading. Although there is relatively little literature on preschoolers' literacy, there is evidence suggesting that exposure to books and amount of reading in preschoolers is related to their interests (Lonigan, 1994; Scarborough & Dobrich, 1994). However, these findings neither established a causal relationship, nor examined other factors that might promote interest, such as how parents read to their young children. In addition to potential and practical benefits for children, the attempts to cultivate interest might facilitate the theory of reading acquisition. Lonigan (1994) suggested that it was incomplete if there was no information on the causes of children's interest. Lonigan carried out a serious study on the decisive factors influencing the interest and participation in learning. Teaching staff and researchers often praise the value of reading to encourage children to read and even recommend parents and teachers to do so. For example, when reading with children or reading to children, parents and teachers could ask questions to allow children to actively participate and make reading a period of close and special time (e.g., Strickland & Morrow, 1990; Wahl, 1988). However, there was little empirical evidence on how to increase the interest in reading (Baker, Scher, & Mackler, 1997).

This research intended to explore the interactive patterns during parent-child reading and learning improvement of the children after the reading. The picture book also helps the parents to connect the story to the surround environment for children. Through their the behavioral models (personality trait, visual attention, expression of ideas, learning attitude, etc.) of parenting education, parent-child reading could help the children to change their behaviors, thus promoting environmental sustainability.

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Methodology of Research

General Background

Taiwan's Environmental Protection Administration (TEPA) implemented the Environmental Education Act in June 2011, employees of government institutions and public business organizations, and the staffs and students of elementary and junior high schools are required to attend more than four hours of EE courses annually. This action indicates the active promotion of EE in Taiwan.

This research established a theoretical model to explore the behavior of parent-child reading of picture books. The empirical research could provide explanation to the diversity of methodology for understanding the phenomenon comprehensively. A structured questionnaire was used to collect data for rigorous statistical analysis. A self-administered, closed-ended questionnaire with ordered choices was adopted for subjects in Taiwan.

Research Participants

This research conducted a survey from August to December 2016 on 375 subjects. After eliminating the samples with incorrect answers and more than 10% of omissions, there were 346 valid samples, with a valid return rate of 92.3%. The demographic data of the sample in Table 1 demonstrate different levels of population. Among the respondents, 56% of the parents are male and 44% are female. Among the children, 62% are boys and 38% are girls. The average age of the children is 4.6 years (the standard deviation was 0.9 year). When the respondents were asked if they were taking or had taken EE related courses, 60% answered yes and 40%, no.

Table 1. Statistics of research participants.

Variables	Type	Percentage (%)
Gender(parent)	Male	56
	Female	44
Gender(child)	Boy	62
	Girl	38
Have learned environmental education (parent)	Yes	82
	No	18
Have learned environmental education (child)	Yes	60
	No	40
Times of reading with children (per week)	1 or less	17
	1-2	46
	3-4	23
	5 or more	14
Duration of reading with children each time (min)	10 or less	9
	11-20	16
	21-30	11
	31-40	42
	41 or more	22
Participate in environmental activities (e.g. beach cleaning and volunteering) after parent-child reading	Yes	76
	No	24
Energy saving and carbon conservation after parent-child reading	Yes	85
	No	15

Design Achievements

This research was creative work of picture book. The name of the work is "Fate of Turtle" (Figure 1). The story depicts a brother and a sister who live in Taiwan's Penghu Island. One day, they found a sea turtle trapped by fishing net at the seaside. Their neighbor who is also a volunteer at the Marine Biology Research Center brought

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the wounded turtle to the Center for treatment. Finally, the turtle recovered and returned to the sea. Apart from learning how to treat wild animals properly, the two kids have gained precious memories.

Ten kindergartens provided parents with parent-child reading materials. Through onsite interviews and questionnaire, their feelings after reading were collected. First-year kindergarteners believe that they are friends of turtle; second –year kindergarteners 2 think that turtle live in a poor environment; third-year kindergarteners indicate that they can do many things for turtle. Certainly, all of them are touched by the story and agree on the importance of environment. During the interviews of children and parents, the children showed great passion for reading this picture book. This is the charm of a picture book. Thus, picture book is a perfect tool to guide children developing good conducts.

Figure 1: Homemade ecological picture book.

P1
At dawn, the yellowish light illuminated the window outside and the ocean breeze swung by.
The best moment for hunting the treasure at the beach
Although the moon is yawning high up in the sky, John can't wait to play with her little sister outside.
P2
"Wow! Look! There is a huge black rock at the beach which is moving."
"You still aren't awake! How come a rock can move?"

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Waiting attentively for the crabs to be caught, John replied lazily.
Watched John walking away quickly, Lucy ran to the beach alone.
"Hey! Don't run too far!" John was running after in haste.
P3
When Lucy took a close look, realizing that it wasn't a rock but a sea turtle.
"Brother, what should we do? He is tangly trapped in a net."
Lucy was frightened and a big drop of tear was rolling around her little eyes.
Both of them put on their gloves and took up the small scissors, tearing the net apart carefully.
P4
There were two deep marks of bruise imprinted and covered all over the shell of the sea turtle.
"Are you crying because of a fall, little kids?" A familiar sound was coming from behind.
Lucy seemed to have found the savior, running with her arms embraced tightly, exclaiming while crying:
"Hurry up!
Sister. He is aching."
With the help of Sister Plum, the sea turtle was quickly sent to the sea turtle hospital by an emergency car.
P5
Tick-tack, tick-tack the clock ticked slowly, ignoring the anxious John.
"Staring at the clock, the time won't run faster!" Sister Plum giggly passed a cup of juice.
"Relax and take it easy for a moment! Let's have confidence in the doctor, shall we?"
P6
"What is the sea turtle hospital for? Lucy asked with her hands up."
"Fisheries Research Institute, COA –Marine Biology Research Center" This is the full name of the sea turtle hospital.
When sea turtles have been stranded, caught, abandoned like today, the treatment and shelter will be given and offered the medication. It is the mission that Emergency center does.
P7
Volunteer workers help to cruise beaches, keep everything informed and cooperate with each other.
Thank to your discovery of the little green sea turtle and torn down the net made the rescue so efficient.
"Well, green sea turtle is green, isn't it?" both of them exclaimed surprisingly.
"Beep~ wrong answer. Well, in fact it is the seaweed that accumulates in the fat layer of the sea turtle's body makes it call green sea turtle."
P8
Apart from seaweeds the green sea turtles will also eat jellyfish. Because they don't have the sense of taste, even they have accidently eaten plastic bags. They still don't know about it. Unluckily if they can't discharge the plastic bags, they may get stomachache.
P9
Pollution makes the ocean turn "colorful" the sea turtles are in great danger and crisis.
"Sister Plum, can't we find a way to help seat turtles?"
"Of course, we do. Even much more than you can think of."
Bring personal cutlery and carry the environmental friendly shopping bag wherever you go.
To participate in the beach cleanup activity of Ocean
Foundation with your friends
To accumulate it little by little to reduce the pollution, the sea turtles will eventually live safely.
P10
"And the ocean will become beautiful again." Lucy exclaimed excitedly.
Sure, as long as we collaborated with each other to protect our hometown, we can not only make the sea turtles come back but also bring more tourists to Penghu island and in love with one of the most beautiful beaches in the world.
P11
"Knock! Knock!" A sound was coming from the door.
Sister Plum, the sea turtle had been rescued by Shih Li and already dealt with wounds this morning. It was now at ST-9, the visit permission was granted for children.
"That's awesome! John and Lucy let's hurry!"

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P12
As soon as they had received the news, they couldn't wait to go and see the sea turtle. Wow! Lots of big buckets, sister.
What were these buckets for?
Although we had applied the ointment to the sea turtle, yet it needed a little more time to recover.
This was a special made ward for the sea turtle to have a good rest.
P13
"So, we can't send him home today." A moment silence, Lucy asked timidly. So was it. Bei Bei was worried about the sea turtle and wanted to stay with him for a while.
Let's have a pinky swear to see if you could take care of it every day. Then I would promise you to take him home.
P14
"We are going out." After that, John would take Lucy on his bike to Marine Research Center after lunch every day. Except for helping good friends: scratch the back of green sea turtles, both of them occasionally do some errands.
So, they have known many different ocean species.
P15
As time crept on, the summer vacation was going to end soon.
In the corner of the office, swiftly fixing the front and hind legs of the green sea turtle on the stretcher. Lucy softly patted John and then busily installed the satellite sender.
"Ready to go!" Sister Plum shouted accompanied by the engine sound. "It's time to release the ROCK."
P16
Leaning against the car window, feeling a little chilly wind from the ocean breeze. "Here we are." While talking, the beach was just around the corner. Lucy and John voluntarily lifted up the crate, somehow the "ROCK" seemed to understand he had reached home, walking straight forward and bravely to the vast sea.
"Going back home." As the wave moved up and down, the shadow gradually faded away.
"Well." Lucy responded lightly, both of them were hand in hand walking home.

Instrument and Procedures

Three experts with environmental, educational and psychological background examined the research constructs and questionnaire. Based on the expert opinions, the questionnaire was modified. The face and content validities of the instrument were verified based on the in-depth interviews with these professionals. Considerable effort was made to ensure that each statement in the formal survey instrument captured the intended meaning of the construct under investigation. The revised content is related to EE. The questionnaire contains three reverse questions to ensure that participants answered the questions seriously. If there were more than two positive answers to the reverse questions, the answers of the respondent were considered to be invalid.

A pre-test was performed to verify that questionnaire items were clearly phrased and categorize individual items into substrata. The participants included 30 students. After completing questionnaires, researchers explained meaning of every question to participants and ensured no misinterpretation. All questionnaires were carefully revised and confirmed that all items were clear and unambiguous.

A pilot study was therefore conducted before the formal test to fine-tune the wording of the questionnaire and check the psychometric properties. Fifty questionnaires were distributed, and after eliminating the incomplete questionnaires, there were 45 valid samples. Next, the following processes were adopted when preparing the questionnaire for the pilot survey: (a) the correlation coefficient matrices of all the questions were calculated. If two questions had similar words and a high degree of correlation (with a correlation coefficient greater than 0.9), one of the questions would be eliminated, or both questions would be combined; (b) the total scores of all the samples in the pre-test questionnaire were sorted in descending order, using internal consistency indicators; scores in the top and bottom 25% were selected to form a high- and low-score group, separately; the difference between the two groups was set as the discriminant for the questions, while non-discriminant questions were eliminated; (c) questions with a similarity value smaller than 0.5 were eliminated, in accordance with the proposal by Hair et al. (2010).

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The above three procedures were used to examine all the survey questionnaires to ensure their reliability and validity. The questionnaire was finalized after examination of the correlation coefficient, as well as question discrimination versus similarity. All research construct scale was measured with the 5-point Likert scale (ranging from strongly disagree to strongly agree) adapted from prior researches. The overall reliability of Cronbach's alphas for the factors of each research construct were .73,.78,.88,.83 and.76, which implied that the scales were appropriate measures of the research constructs. The questionnaire contains closed-form questions that make interpretation of respondent's answers easier.

Data Analysis

Partial least squares (PLS) was used to explore or construct linear models. In a general linear model, there are at least two sets of variables, one independent and the other, dependent. A general regression equation can only handle one set of dependent variables, whereas PLS can handle several sets of independent variables, as well as a set of dependent variables. This research used the Smart PLS 2.0 software developed by Ringle, Wende, & Will (2005) to measure the analysis model for the measurement and structural models. Petter, Straub, & Rai (2007) considered it more appropriate to use the PLS analysis tool for components-based models, while LISREL and AMOS are more suited for covariance-based models. Components-based models have generally replaced covariance-based ones, and can handle both measurement and structural models. Bootstrapping was a resampling technique and used to compute the standard error and *t* value of each model parameter.

Reliability and Validity

Based on Bagozzi & Yi (1988), the three most commonly used indicators were selected, to evaluate the measurement model for the reflective indicators. Two latent variables, environmental attachment, psychological distance, are formative indicators in this research. Their reliability indicators of latent variables could not be calculated. The explanations of the various indicators are stated below (Table 2).

Table 2. Reliability and validity indicators of the research model.

	CR	AVE	R^2
Learning Attitudes	0.77	0.64	0.21
Learning Perception	0.82	0.60	--
Learning Interaction	0.81	0.58	0.10
Express Ideas	0.78	0.54	0.11
Visual Attention	0.77	0.54	0.15

a. Individual item reliability is an evaluation of the factor loading of the measurement variable to the latent variable, and tests for the statistical significance of each variable loading. With the exception of formative indicators, the loadings for the individual measurement variable were greater than 0.5, and exhibited significance. The loading coefficients of the sample factor ranged from 0.60 to 0.95, which complied with the values suggested by Hair, Black, Babin, & Anderson (2010).
b. Composite reliability (CR) of the latent variable is the composition of the reliabilities of all the measurement variables. The meaning of its indicator is similar to the Cronbach's alpha, and it can be used

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to indicate the internal consistency of the construct indicators. The higher the reliability, the greater is the internal consistency of the latent variables. The threshold value suggested by Fornell & Larcker (1981) was 0.6. The CR value of this research was between 0.77 and 0.82, whereas the CR values of all the variables were greater than 0.7 (Wynne, 1998), indicating good internal consistency.

c. Average variance extracted (AVE) of the latent variable calculates the variation in the explanatory power of each measurement variable of the latent variable, and evaluates the variance of individual measurement variables, as explained by several common factors. The higher the AVE is, the better the convergent and discriminant validities of the latent variable are. The standard value suggested by Fornell & Larcker (1981) was 0.5. The AVE value of each latent variable was between 0.54 and 0.64, whereas the AVEs of all the variables in the research model were greater than 0.5.

The explanatory capacity of the structural model is R^2, with the coefficient distributed within the range of 0.10-0.21. The standard path coefficients represent the direct effects, with the assumptions made from all nine paths being able to reach significance. The individual factor loadings of this measurement model were greater than 0.7, which means that the measurement results were stable and valid. However, when PLS analysis was carried out, the software did not provide any fit indicator. To test the overall fit situation, the indicator goodness-of-fit (GoF) proposed by Tenenhaus, Vinzi, Chatelin, & Lauro (2005) was adopted. The GoF indicator is the calculated coefficient of the maximum likelihood estimated in the analysis of the structural model, based on the minimum partial correlation method.

Marcoulides, Chin & Saunders (2009) suggested that the standard effect sizes proposed by Cohen (1988) (small: 0.02; medium: 0.15; large: 0.35) were not sufficiently rigorous. Combining the AVE value proposed by Fornell & Larcker (1981) and the GoF indicator, they proposed the standards for a new overall fit indicator (poor: 0.1; medium: 0.27; good: 0.42). This study obtained a GoF value of 0.40 in our study: this value falls between the intermediate and good level, which suggests that the research model was acceptable.

Results of Research

Path Analysis of the Research Model

This research established a mixed model using both formative and reflective indicators, and tested whether "learning perception" and "personality trait" are formative indicators. "Learning perception" is comprised of humanistic perception (0.31) and ecological perception (0.81); the latter remains the main target of "learning perception" studied in children. The discourse on "personality trait" notes that five major traits are essential to individual composition. To specify the latent variables of "personality trait", this research specifically defined "personality trait" as formative indicators instead of reflective indicators, although these five major personality traits are typically classified as reflective indicators. Among the five major "personality traits", test results for agreeableness, and extraversion all demonstrated statistical significance, whereas conscientiousness and emotional stability showed no significance.

Using a PLS assessment tool, we can identify the path coefficients between latent and measurable variables and present individual path values. Eight of the 9 hypothesized paths attained statistical significance in the validation research mode (α =.05). The paths for the individual sense of value to learning behavior were as follows: learning perception ->learning interaction (0.32), learning perception ->visual attention (0.16), and learning perception ->express ideas (0.33). However, the paths for visual attention and learning attitudes from express ideas were as follows: express ideas ->visual attention (0.24) and express ideas ->learning attitudes (0.29).

The two paths for the five major personality traits to visual attention and learning attitudes were as follows: personality traits ->learning attitudes (0.29) and personality traits ->visual attention (0.18), and these paths were statistically significant. Individually internalized express ideas and visual attention reflected a positive influence on learning attitudes, and express ideas ->visual attention (0.24), and visual attention ->learning attitudes (0.24). This result indicates that people's attitudes positively influence their learning attitudes. Although visual attention had a greater influence on their express ideas, the path relationship was significant. Previous results have indicated positive relationships between visual attention and express ideas regarding learning attitudes.

Learning perception also had a significantly positive influence on expressing ideas. The variance (R^2) of visual attention was 0.15; visual attention was significantly influenced by learning perception, learning interaction, express ideas, and personality traits, indicating that a perception, recognition, and attitude chain can be effectively predicted. The variance (R2) of learning attitudes was 0.21; learning attitudes was significantly affected by personality traits,

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visual attention, and express ideas, which again supports the formation of a perception, recognition, and attitude chain. However, our results did not demonstrate significant support for the path of environmental attitudes to learning attitudes, which differs from previous studies that have emphasized a strong consistency between visual attention and learning attitudes (see Figure 2).

This research also used structural equation modeling (SEM) as implemented in PLS for data analysis, and utilized the SmartPLS (a statistical package to compute partial least squares) to determine the fitness between the survey data and research model. A major reason for using PLS instead of covariance structure SEM is that PLS makes minimal demands on the sample distribution requirements, and does not require that data meet criteria for homogeneity and normality (see Table 3). Furthermore, learning perception and personality traits were treated as formative constructs according to the process outlined by Goodhue et al. (2012), with composites using optimized weights.

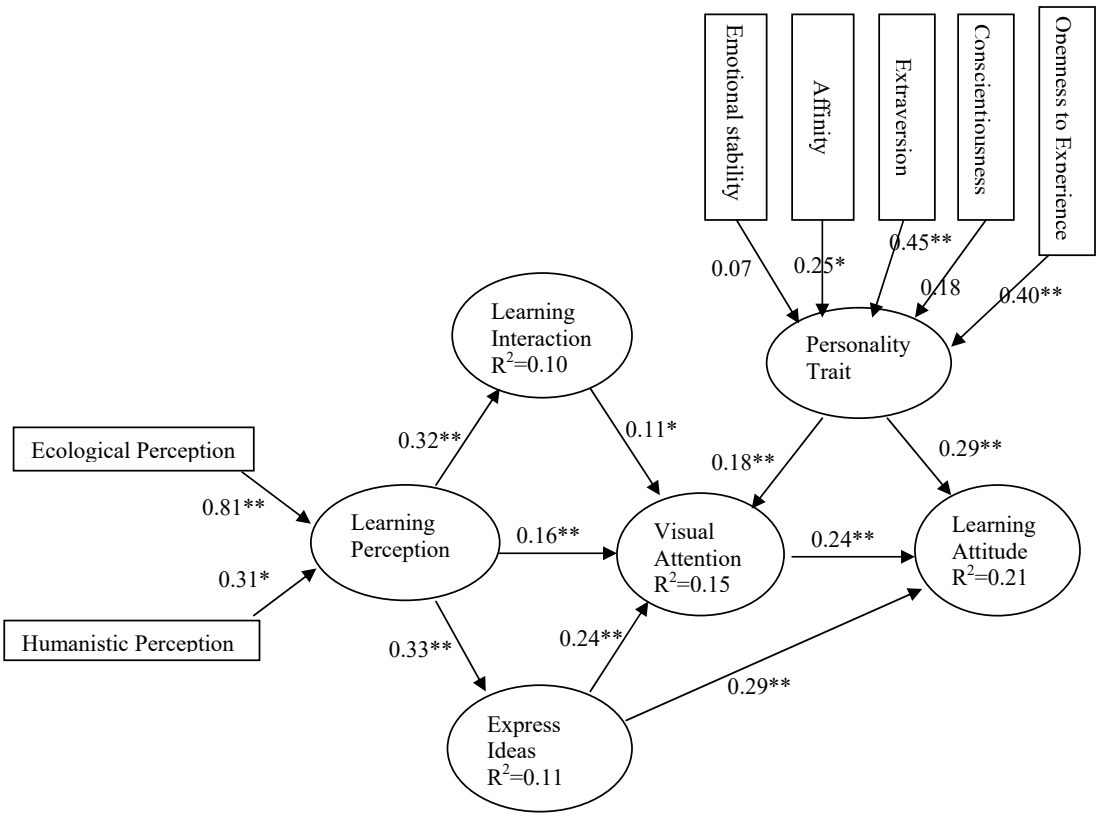

Figure 2: Path coefficients of the research model.

Table 3. Discriminant validity and correlation coefficient.

	Learning Attitudes	Learning Perception	Learning Interaction	Express Ideas	Visual Attention	Personality Trait
Learning Attitudes	1.00					
Learning Perception	.24	1.00				
Learning Interaction	.21	.32	.77			
Express Ideas	.39	.33	.35	.71		
Visual Attention	.35	.28	.25	.33	.86	
Personality Trait	.43	.21	.18	.24	.55	1.00

Notes: All correlations are significant at the .001 level; diagonal element is the square root of AVE and should be larger than the off-diagonal correlation coefficient.

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Discussion

Fishbein & Ajzen (1975) divided the meaning of reading performance into details, and beliefs, perception and attitude are the components of the triad. Bobel (1981) pointed out that family environment and parental influence are closely related to early reading. This research found that "family" is one of the important factors that affect children's learning perception, learning interaction, visual attention, express ideas, and learning attitude. they are the main source of reading material. It is the best media integration point in the school field and social field.

Consistent and continuous interactions provide contingent and appropriate responses to the communicative actions of children, and support the cognitive development of early childhood (Landry, Smith, Swank, Assel, & Vellet, 2001). Moreover, the responsive interaction during the cognitive development period through personalized responses and better scaffolding of skill development (Cristofaro & Tamis-LeMonda, 2012; Dieterich, Assel, Swank, Smith, & Landry, 2006; Mol, Bus, de Jong, & Smeets, 2008; Weizman & Snow, 2001). It also proves that, according performance is better.

Other studies also took into account the importance of interaction. Hinton and Nowlan (1987) demonstrated that learning can guide an evolutionary process to find the optimum. Mayley (1997) investigated different aspects of the interaction between learning and evolution, and found that the hiding effect can take place, if the learning is sufficiently strong. This research used the mechanism of interactive learning, discovering that interaction, besides being affected by perception, also affects attention, and the results are significant. These results are consistent with Peña and De Antonio (2008). In collaborative learning, nonverbal behaviors such as looking at other participants and note taking also plays an important role in facilitating effective collaborative learning.

The studies on the characteristics of personality are mature. According to Costa & McCrea (1992) and Goldberg (1990), the elements used in factor analysis include affinity, extroversion, openness, accountability, and emotional stability. Hence, this research employed confirmatory factor analysis to verify the stability of relevant elements and considered the model as a stable predicative variable. Past experience studies of Fraj and Martinez (2006), and Moody and Hartel (2007) concluded that those with high sense of responsibility usually purchased environmentally friendly products. Additionally, Rhodes et al. (2005) conducted empirical research on the five key personality traits. These studies concluded that the personality traits of an individual were stable. At present, researches commonly agreed that personality trait is a formative variable. Learning perception and learning attitude have positive influences.

Conclusions

For sustainable education, parent-child reading can promote pro-environmental behavior, the correlation among potential variables, and the design directions of EE courses available for policy decision-makers and teaching staff. This research collected relevant measurable and potential variables to form PLS learning and perception model. The model facilitated the evaluation of the casual relationship among potential variables related to environmental responsibility and behavior, which serves as reference for policy decision-makers and teaching staff in terms of sustainable education. The results indicate that the model is stable and exhibits a satisfactory fit.

Among the 9 proposed standardized path coefficients, 8 have statistical significance. The learning perception path coefficients from the perspective of learning attitude include: 0.32 is learning perception against learning interaction. 0.16 is learning perception against visual attention. 0.33 is learning perception against express ideas. The results demonstrate that, learning interaction and visual attention reflect positive influences on express ideas. However, although the influence of visual attention on learning change is greater than learning interactions, these path relationships do not reach statistical significance. It means that visual attention can guide personal learning attitude.

In this research, personality traits, visual attention, and expressing ideas have statistical significance in terms of the learning attitude of the respondents. As a personality trait, extraversion and openness to experience have high path coefficients, policy decision-makers and educators can develop EE courses to meet the demands of the individuals with the two traits, and enhance pro-environmental behavior after parent-child reading.

Research Limitations

When questionnaires requiring elaboration by participants are used to measure individuals' environmental behavior, common-methods bias usually arises when one participant responds to all the questions. This research adopted various methods, such as concealing respondents' details or the significance of the questions, and using reverse questions when designing the survey. In addition, we placed the behavioral questions at the last part of the questionnaire. The methods proposed by Harman (1976) and Sanchez, Korbin & Viscarra (1995) were adopted and, specifically, principal component factor analysis was conducted on all the research variables to check whether any single factor could explain most of the variability. The covariance matrix analysis was also used to validate the relevant post-hoc model. The impact of some covariance cannot be completely reduced, was the main limitation of this research.

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