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Relationship between Parents' Perceptions of Programming Education and Their Emotional and Behavioral Outcomes

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Abstract: Parents are assumed as one of the key figures to foster programming learning among children after school. However, little effort has been directed to the examination of parents' perceptions and their consequent emotional and behavioral outcomes regarding programming education to date. This study attempted to explore how parents' intrinsic motivation and positive affect would positively influence the relationship between their perceptions of programming education and involvement for providing a better learning opportunity to children. We collected 695 questionnaires from parents who brought their children to a one-day coding fair where they could experience the fun of programming. Results from Structural Equation Modeling (SEM) analysis indicated that parents' programming perceptions is positively related to their intrinsic motivation and positive affect. Mediation results suggested that parents' perceptions such as understanding, support, and expectation can trigger their intrinsic motivation for encouraging children in programming learning and enhance their positive affect toward learning programming themselves, which consequently lead to increased attempts of parental involvement for the better guidance in technology use for children. Implications of the study were discussed.

Keywords: Intrinsic motivation, parental involvement, parents' perception, positive affect, programming education

1. Introduction

Programming education for younger learners has become a trend around the globe (e.g. Grover & Pea, 2013). Parents' role is important to help children learn programming after school. If parents understand the significance of programming education, they tend to provide greater emotional support and involve in children's coursework (Kong, Li, & Kwok, 2018a). In other words, parents' programming perceptions can lead to their emotional and behavioral changes in programming education. Kong, Li, and Kwok (2018b) developed a scale to measure parents' perceptions of programming education in P-12 schools. However, there is no existing literature further exploring the relationship between parents' perceptions and their consequent emotional and behavioral outcomes regarding programming education. To bridge this gap, this study aimed to investigate parents' dynamic changes in cognitive-behavioral mechanism via the potential factor of emotions towards programming. Specifically, this study comprehensively examined how parents' positive affect (*affect)* and intrinsic motivation (*motivation*) of programming education influence the relationship between their perceptions of programming education (*perceptions*) and involvement in guiding children to use technology (*involvement*). Abbreviations in parentheses for key study variables will be used throughout the paper.

2. Literature Review

2.1 Parents' Motivation of Programming Education as the Mediator

Kong et al. (2018b) proposed that perceptions of programming education include individuals' understanding, support, and expectation. Previous study found that intrinsic motivation is related to people's understanding and expectation. For example, if parents understand that the coursework is useful, they will highly encourage children to engage in it (Katz, Kaplan, & Buzukashvily, 2011). In technology education context, Rozell and Gardner III (2000) also found that perceived task importance will affect one's intrinsic motivation in completing the task. It means that people are more willing to motivate themselves or others to engage in the computer-related activities when they understand the usefulness of computer. Thus, this study expects that parents with positive programming perceptions will have greater intrinsic motivation to encourage children in programming learning.

Hypothesis 1: Parents' perceptions of programming education is positively related to their intrinsic motivation of programming education.

Past studies suggested that one's motivation will affect his or her involvement. For instance, students who have strong intrinsic motivation to study a subject are more likely to dive deeper into the topic (Bergin & Reilly, 2005). Witherspoon, Schunn, Higashi, and Baehr (2016) supported that there is a significant relationship between students' motivation in learning programming and their subsequent involvement. Regarding parents, motivation beliefs like parental role construction and self-efficacy are associated with their involvement in children's education (Walker, Wilkins, Dallaire, Sandler, & Hoover-Dempsey, 2005). Katz et al. (2011) also found that parents' supportive behaviors of helping with children's homework is related to their autonomous motivation. Thus, we assume that parents with greater intrinsic motivation will also have higher involvement in guiding children to use technology.

Hypothesis 2: Parents' intrinsic motivation of programming education is positively related to their involvement in guiding children to use technology.
Hypothesis 3: Parents' intrinsic motivation of programming education will positively mediate the relationship between their perceptions of programming education and involvement in guiding children to use technology.

2.2 Parents' Positive Affect toward Programming Education as the Mediator

Positive affect toward programming education refers to one's positive feeling towards the use of programming. For example, students' liking for school and their perceptions of school subjects are closely related to each other (Ireson & Hallam, 2005). Wang and Holcombe (2010) also found that students' perceptions of the school environment and school engagement will influence their affective reactions. In technology education context, Teo (2009) indicated that the perceived usefulness of technology will bring positive impact to a person's liking of using technology. Although there is a lack of literature directly investigating parents' perspective, this study expects that parents with positive programming perceptions will show more positive affect toward programming education.

Hypothesis 4: Parents' perceptions of programming education is positively related to their positive affect toward programming education.

Fredrickson (2001, p.218) argued that "experience of positive emotions broaden people's momentary thought–action repertoires". For example, Meyer and Turner (2006) argued that students with positive emotions at school will have higher levels of engagement. Besides, Katz et al. (2011) suggested that parents engage in children's homework because they think the work is interesting and enjoyable. In technology education context, it is also believed that people's perceived liking of computer will bring positive impact on the intention of using technology. For example, teachers with positive attitudes towards computers are more likely to integrate computers in their teaching (Zhao & Frank, 2003). Thus, this study expects that parents with higher positive affect toward programming education will have higher involvement in guiding children to use technology.

Hypothesis 5: Parents' positive affect toward programming education is positively related to their involvement in guiding children to use technology.

Hypothesis 6: Parents' positive affect toward programming education will positively mediate the relationship between their perceptions of programming education and involvement in guiding children to use technology.

3. Method

3.1 Procedures and Participants

A one-day coding fair was held in 2018 for parents to bring their children to experience the fun of programming. Some workshops and seminars were organized to introduce computational thinking education. The parents were required to complete the questionnaires before they participated in the fair. There were 695 parents who returned the questionnaires, thus the response rate was 69.5%. In our sample, 43.6% of the participants were male and 51.7% were female. 52.4% were between 41 to 50 years old. 75.5% obtained bachelor's degree or above. 58.4% of the parents did not know programming.

3.2 Measures

Perceptions: This is a 9-item scale developed by Kong et al. (2018b). The sample item is "It is good for my children to learn programming." In our study, the Cronbach's alpha is .96.
Affect: We adopted a 3-item liking subscale developed by Ng (2011). The sample item is "I like to discuss programing-related topics." In our study, the Cronbach's alpha is .90.
Motivation: We adopted 3 items from Gottfried, Fleming, and Gottfried (1994) for this study. The sample item is "I encourage my children to learn more programming." In our study, the Cronbach's alpha is .97.
Involvement: This study adopted a 5-item scale developed by Walker et al. (2005). The sample item is "I will provide feedback when my children are using technological devices." In our study, the Cronbach's alpha is .93. All the scales in the current study anchored from 1 strongly disagree to 5 strongly agree.
Control variables: We included gender, age, education level, and programming experience for investigation, as past studies found that these demographic variables might be closely related to parents' perceptions towards computer-related activities and involvement (e.g., Vekiri & Chronaki, 2008; Overstreet, Devine, Bevans, & Efreom, 2005; Walker et al., 2005).

4. Results

4.1 Descriptive Statistics

The descriptive statistics of mean, standard deviations, and reliability coefficients of all the variables were shown in Table 1. The Cronbach's Alpha coefficient of perceptions scale and its three subcomponents were ranged from .88 to .96, indicating good internal consistency. Besides, affect scale ($\alpha = .90$), motivation scale ($\alpha = .97$), and involvement scale ($\alpha = .93$) all showed satisfactory reliability. In addition, factor loadings for all items in each scale were ranged from .83 to .96, which confirmed convergent validity of the scales. Positive inter-correlations were found among the four study variables—perceptions, affect, motivation, and involvement.

Table 1
Mean, Standard Deviations, and Reliability Coefficients of the Variables

		Mean	SD	1	2	3	4	5	6	7
1.	Perceptions	4.00	.80	(.96)						
2.	Understanding	4.05	.88	.95**	(.95)					
3.	Support	3.88	.83	.93**	.82**	(.88)				
4.	Expectation	4.09	.84	.94**	.85**	.82**	(.93)			
5.	Affect	3.95	.82	.87**	.79**	.83**	.84**	(.90)		
6.	Motivation	4.10	.85	.84**	.82**	.73**	.83**	.77**	(.97)	
7.	Involvement	3.94	.86	.71**	.65**	.67**	.68**	.72**	.76**	(.93)

Note. N=673 *p <.05; **p <.01; ***p <.000.

4.2 Structural Equation Model

Hypotheses were tested using structural equation modeling (SEM) in AMOS version 24 (Ackerman, 2003). Several statistics were used to assess model fit, including the chi-square ($\chi 2$) statistic, the root mean square error of approximation (RMSEA), the comparative fit index (CFI), and Tucker–Lewis index (TLI). According to Hu and Bentler (1999), CFI and TLI which are greater than .95 suggested an excellent fit. RMSEA in the range of .05 to .08 also indicates acceptable fit (Browne & Cudeck, 1993). In this study, the hypothesized measurement model showed a good fit with the data collected ($\chi 2$ (95) = 455.695, $p < .000$, CFI = .97, TLI =.95, and RMSEA = .07). The SEM results showed significant paths from perceptions to motivation ($\beta = .89$, $p < .001$) and from motivation to involvement ($\beta = .56$, $p < .001$). Thus, Hypothesis 1 and 2 were supported. In addition, there were significant paths from perceptions to affect ($\beta = .94$, $p < .000$) and from affect to involvement ($\beta = .31$, $p < .000$). Therefore, Hypothesis 4 and 5 were also supported. Moreover, mediation analyses were conducted using bias-corrected bootstrap method (2000 resamples) in PROCESS (Hayes, 2012) to test the significance of the indirect effect of motivation and affect. Results indicated that the mediating effects are statically significant (95% CI*motivation* = [.40, .61], 95% CI*affect* = [.16, .36]). Thus, hypothesis 3 and 6 were fully supported. Figure 1 showed the theoretical model of this study.

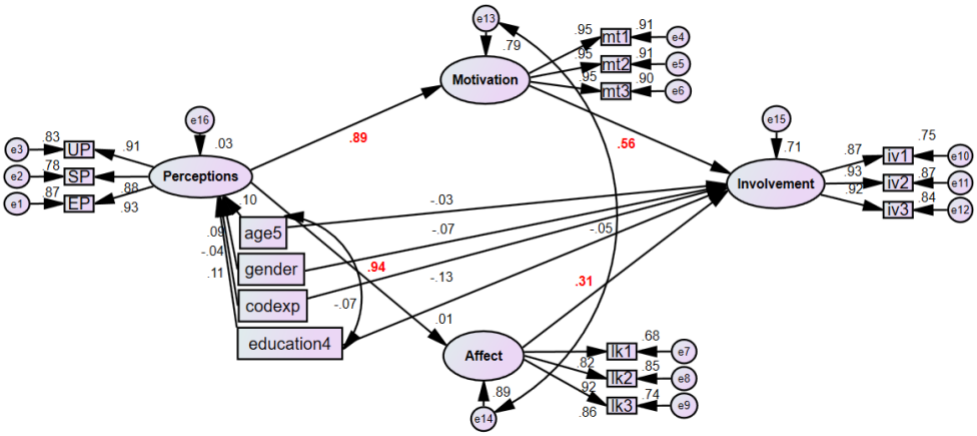

Figure 1. Theoretical Model

5. Discussion

Parents' role in children's education is critical; however, their perceptions and consequent emotional and behavioral outcomes regarding programming education is less known in the literature. Leutner's (2014) study attempted to explore how positive emotions and interest influence the cognitive processing and multimedia learning results. However, he did not provide empirical evidence to support his proposition. Indeed, past studies predominately focused on perceptions (Zainal et al., 2011; Rozell & Gardner III, 2000) and few of them rigorously tested the relationships among cognition, emotion and behavior in a comprehensive way. This study contributes to the current literature by providing empirical results showing the dynamics of cognitive-behavioral mechanism via positive emotions. Specifically, mediation analyses were conducted to examine how parents' affect and motivation influence the relationship between perceptions and involvement. The results found that affect as well as motivation can strengthen the relationship between perceptions and involvement. It yields a significant insight about the importance of emotion and motivation in affecting people's behavioral involvement as a consequence.

This study also found that parents' demographics are associated with perceptions and involvement. Parents' gender is related to perceptions ($\beta = .09$, $p < .05$). Mothers tend to have better perceptions than fathers do. It concurred with Kong et al. (2018a) research which indicated that mothers have higher expectations on what children can learn through programming. Parents' gender is also associated with involvement ($\beta = -.07$, $p < .01$). More fathers tend to involve in children's technology

education, because more of them have programming experience than female counterparts in this study. Knowing the different roles that both parents might play, we advocate the proactive involvement of both parents in children's programming learning, that is, we encourage mothers to provide more emotional support and fathers to provide more instructional support in order to achieve optimal learning experience for their children. In addition, parents' age is related to perceptions ($\beta = .10$, $p < .05$). Older parents have more positive perceptions than younger parents do. Researchers suggested that older adults can function effectively when the given tasks allow them to draw upon their expertise (Rybash, Roodin, & Hoyer, 1995). Parents' education level also influences perceptions ($\beta = .11$, $p < .01$). This result is in line with the literatures suggesting that parents' education level is positively related to their educational expectation on children (e.g. Overstreet et al., 2005). However, there is no relationship between parents' education level and involvement. We argue that parents' social ranking like education level cannot predict parental involvement while psychological motivators and life context might be better predictors. Finally, programming experience influences involvement ($\beta = -.13$, $p < .000$), because parents self-perceived knowledge can contribute to their involvement in children's education.

5.1 Practical Implication

This study found that without perceptions, motivation and affect can hardly be nurtured. Thus, we should increase parents' understanding of programming education to stimulate their motivation of encouraging children to learn programming. Conducting programming workshops is an effective way to enhance perceptions. Kong et al. (2018a) reported that parent's understanding, support, and expectation of programming education increase significantly after workshops. Therefore, educational practitioners are encouraged to design programming workshops that can strengthen parents' understanding and expectation in programming education. It is also crucial to raise parents' motivation in programming through positive interventions. Despite that a single workshop may only generate a situational interest of programming (Teague, 2002), Mitchell (1993) argued that a learning environment with high situational interest will bring positive changes to one's long-term interest over time. In fact, we suggested that a series of workshops should be provided for parents since a single positive experience is insufficient to maintain their interest. More importantly, workshops should be designed in a way that provokes the intrinsic motivation in parents such that they can form habits of supporting children in their learning. Researchers found children can program in a more systematic way with fewer errors if parents are motivated to involve when children are writing programs (Lin & Liu, 2012). Last but not least, findings of this study also provided a general implication that parents' attitudes, emotions, and behaviors are of great importance because their influences are not limited to programming learning, but are profound in all other learning areas, such as science and math, etc.

5.2 Limitations and Future Research Direction

This study has three limitations that we need to address in the future. First, the data might be sample specific. Parents who participated in the coding fair might have greater interest in programming than parents who did not show up. In the future, more general parent samples should be tested for generalizability purposes. Second, this study adopted four validated scales to conduct a mediation analysis with multiple mediators. However, there might be other existing models that can fit our data adequately well. In the future, we should explore more alternatives by comparing our hypothesized model with other potential models. Third, self-reporting data of this study might cause common-method bias, which might inflate relationships between study variables. Ratings from various sources can be used to avoid this problem. For instance, observations from multiple raters of how parents interact with children in the future coding fair can be included for results validation. Moreover, qualitative data such as parent interviews and group discussions are encouraged to comprehend the interpretation of quantitative results.

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