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Abstract. *This study aims to investigate the science education majors' experiences of career guidance, vocational self-concept, and self-perceived employability, as well as the relationships among these variables in the Taiwanese context based on the developmental-contextual model of career development. Data were collected from a questionnaire survey of 336 science education majors in the selected Taiwanese universities. It was found that the science education majors' experiences of career guidance directly and indirectly influenced their self-perceived employability vis-à-vis the effect on their vocational self-concept. The findings suggest that the science education departments of universities in Taiwan may provide sufficient and appropriate career guidance and vocational information for science education majors to promote their vocational self-concept and employability.*

Keywords: *career guidance, science education majors, self-perceived employability, vocational self-concept.*

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EXAMINING THE EXPERIENCES OF CAREER GUIDANCE, VOCATIONAL SELF-CONCEPT, AND SELF-PERCEIVED EMPLOYABILITY AMONG SCIENCE EDUCATION MAJORS IN TAIWAN

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Introduction

The primary objectives of science education are to improve the scientific literacy of individuals and prepare them for being global citizens, as well as to cultivate scientific professionals as the basis for developing science and technology of the countries and to facilitate the national social and economic development (Chiu & Liu, 2011). The results of The Programme for International Student Assessment (PISA) announced by Organization for Economic Cooperation and Development (OECD) showed that, in recent years, the scientific performance of Taiwanese students has been poorer than that of the students in other Asian areas, including Shanghai, Republic of Singapore, and Hong Kong (OECD, 2012). Therefore, the development of science education in Taiwan is noteworthy. Moreover, in Taiwan, the individuals responsible for cultivating scientific literacy and competence of elementary school students and high school students are mainly college graduates who major in science education (Ministry of Education, 2008). The career development of these science education majors would determine the development of science education in Taiwan. Therefore, relevant issues are worthy of investigation.

After graduating from universities, individuals face many important career choices. In addition, in the contemporary society with multiple values, it seems more difficult for individuals to make appropriate career choices. Career guidance aims to promote the adequate career development of individuals. Therefore, the career guidance offered by universities to students becomes one of the key factors affecting their personal career development (Zunker, 2006). Thus, it is necessary to investigate whether Taiwanese universities can provide adequate career guidance for the science education majors to help them make their adequate career choices.

From the perspective of the development course, college students are at the critical stage of career development. They are at the transition stage of getting rid of trial-and-error in life, which involves the self-inspection, role trial and employment exploration, and they also may face the pressure of



job searching (Herr & Cramer, 1996). Super (1990) suggested that the vocational self-concept of individuals has an essential effect on their career development. Mature vocational self-concept can help individuals understand, perceive and affirm themselves in the process of career development and further make adequate career decisions. Therefore, this study intends to examine the development of vocational self-concept of science education majors in Taiwan.

Adequate and sufficient employability of individuals is critically required for the national economic development. Most importantly, it also enables individuals to develop competitive competences and a good career in the global society (Gracia, 2009). The employability of college students reflects how their professional and general competences they receive in higher education institutions meet the needs of employment market and further determines their personal career development. As a result, the development of students' employability has become one of the key educational objectives of higher education institutions (Harvey, 2001). Therefore, it is necessary to explore the employability of science education majors in Taiwan.

Four specific objectives are investigated in this study:

- To examine the experiences of career guidance that science education majors in Taiwan receive in universities.
- To explore the vocational self-concept of science education majors in Taiwan;
- To assess the self-perceived employability of science education majors in Taiwan;
- To examine the relationships between the experiences of career guidance, vocational self-concept, and self-perceived employability among science education majors in Taiwan.

Theoretical Background and Research Hypotheses

The Developmental-Contextual Model of Career Development as the Study Framework

The development of employability is the key part of individuals' career development outcomes. The processes resulting in career development have been described, on the one hand, in terms of individual differences in aptitude and personality and, on the other hand, in terms of socio-structural conditions (Rojewski, 2005; Schoon & Parsons, 2002). According to the "personality" approach, career development is the reflection of individual personality traits. However, this approach ignores the role of environmental and social factors in determining the quality and sequencing of the developmental progression, and does not address the constraints imposed by social contexts (Schoon & Parsons, 2002). The contextual approach conceptualizes career development within a system of social factors. According to this perspective, career aspirations are constrained by objective forces beyond an individual's control, and career development is predicted entirely by the immediate contextual conditions within which it happens to exist at the time (Vondracek, Silbereisen, Reitzle, & Wiesner, 1999). However, the process of career development must be examined by utilizing both approaches to provide the most complete understanding of the complexity of the career development of individuals. A useful meta-theory that synthesizes both the individual and contextual stances was conceptualized by Vondracek, Lerner, and Schulenberg (1986), who formulated the developmental-contextual model of career development. Drawing on life-span development theories and contextualist perspectives, this approach conceptualizes development as "the interaction between a developing individual and the multiple contextual systems" (Vondracek, Lerner, & Schulenberg, 1986, p.5) and stresses the mutual embeddedness of the individual and contexts. Therefore, one must consider the individual and the larger contexts, as well as the interactive relationships between them, to understand how developmental trajectories unfold. Thus, the developmental-contextual model of career development was applied as the framework of this study.

The person works as an active producer of the development. The developing individuals who are embedded in an interconnected set of contexts provide feedback for themselves or work as the basis for their own development (Vondracek, 1998).

Levels of contexts contribute to individuals' development. The contexts consist of multiple systems, including proximal and distal systems. Proximal systems include the immediate settings in which the developing individuals are situated. Distal systems are the environment which the individual cannot control. The set of proximal contexts has a direct impact on individuals' career development, while the distal systems have an indirect impact that is mediated by the more proximal contexts (Vondracek, Lerner, & Schulenberg, 1986).

The dynamic interaction between the individual and the contexts lead individuals' development. There is a dynamic and integrated relationship among multiple levels of the interaction between individuals and their contexts.



Variables from any of these levels might contribute to individuals' development without single level of analysis operating separately (Bronfenbrenner & Ceci, 1994; Vondracek, Lerner, & Schulenberg, 1986).

In short, according to the developmental-contextual model of career development, one must examine the individual-level and contextual factors, as well as the integrated relationships between them to understand how the employability of science education majors in Taiwan develop.

The Relationships among the Experiences of Career Guidance, Vocational Self-concept, and Self-perceived Employability

Guided by the developmental-contextual model of career development, the present study investigated the relationships among the experiences of career guidance, vocational self-concept, and self-perceived employability of science education majors in Taiwan. In the study, science education majors' experiences of career guidance were selected as the contextual-level factor affecting their self-perceived employability, and their vocational self-concept was posited as the individual-level factor contributing to their self-perceived employability.

The Ministry of Education of Taiwan encourages the universities in Taiwan to provide students with career guidance, including issues of self-awareness, guidance for **further education and employment, and career planning** (Ministry of Education, 2012). Although some theoretical literature has demonstrated that career guidance indeed influences students' career development, most of the empirical studies on the relevant issues have tended to focus on high school students and emphasize their needs for career guidance (e.g., Williams, 2006), rather than focusing on undergraduate students' general experiences of career guidance that universities provide. Recently, a few studies have indicated that culturally responsive career guidance could promote the career development of Native American students (e. g., Alliman-Brissett & Turner, 2005), and that appropriate career guidance, including academic guidance and job-related guidance which universities provide could facilitate undergraduates' employability (e.g., Chiu, Wang, & Tsay, 2007). Furthermore, previous studies have shown that the sufficient career guidance that vocational high schools or training centres provide for students have an essential effect on their vocational self-concept (e.g., Wu, 2012).

Vocational self-concept is an individual's perception of his/her self related to work or occupations (Super, 1990). The development of individuals' vocational self-concept is the key indicator of their future career maturity (Super, 1990). Employability is an individual's ability to attain sustainable employment appropriate to their qualification (Rothwell, Herbert, & Rothwell, 2008), and employability is one part of individuals' career development outcomes. Some studies have suggested that vocational self-concept is an important determinant of individuals' career development (Garg et al, 2007; Patton & Creed 2007; Wu & Cheng, 2013).

Research Hypotheses

Based on the above-mentioned literature review, the model of research hypotheses of this study are shown in Figure 1. Overall, this study aims to test the four hypotheses: H1: The experiences of career guidance positively influence vocational self-concept; H2: Vocational self-concept positively influences self-perceived employability; H3: The experiences of career guidance positively influence self-perceived employability; H4: Vocational self-concept mediates the influence of the experiences of career guidance on self-perceived employability.

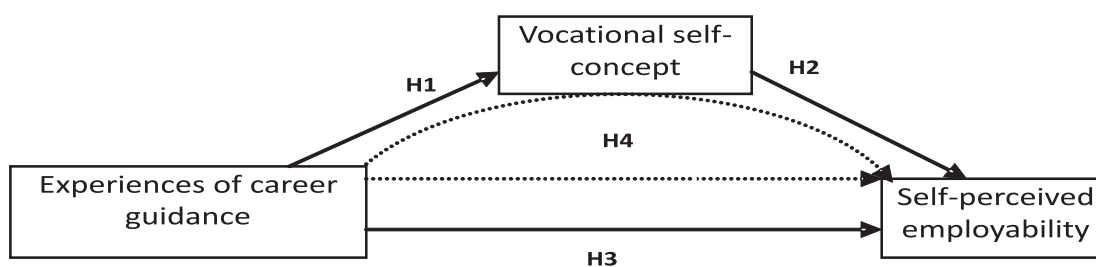


Figure 1: Research hypotheses.



Methodology of Research

Participants

For the purposes of the study, a questionnaire survey was used to collect data, and the study population consisted of science education majors in 12 selected universities in Taiwan. To collect useful and representative information, a stratified sampling method was used to select 12 universities according to their geographical location, including eastern, northern, central, and southern regions of Taiwan. Of the 12 universities, 4 universities located in the north, 1 in the east, 3 in the centre, and 4 in the south were sampled according to the proportion of universities in the four regions. Therefore, a stratified cluster sampling method was used for distributing the questionnaire surveys. Anonymous questionnaires were distributed to 348 participants in the 12 selected universities, and 96.5% (N=336) of the questionnaires were returned and usable. Of the participants, 158 are males (47.0%), and 178 are females (53.0%). Altogether, 35 participants (10.4%) obtained none professional technological certificate, 76 (22.6%) obtained one certificate, 91 (27.2%) obtained two certificates, 77 (22.9%) obtained three certificates, and 57 (16.9%) obtained at least four certificates.

Instruments and Data Analysis

In this study, the learning experiences of guidance, vocational self-concept, and self-perceive employability were examined from the perspective of individuals. The scales of the study were adapted primarily from various published sources (e.g., Rothwell, et al., 2008; Wu & Lou, 2012; Wu & Cheng, 2013). Each item of the scales was measured on a five-point Likert scale (1=strongly disagree to 5=strongly agree). A pilot study was conducted on all the scales, and the item analysis and principal component analysis via Direct Oblimin rotation were conducted. The Cronbach's α values for reliability in all scales were higher than 0.82, and the loadings of all items were greater than .50. Thus, all of the scales had good reliability and validity.

Experiences of career guidance were measured by a 17-item scale ($\alpha=0.96$) which assessed the participants' perception regarding the extent to which the career guidance their universities provided satisfied their needs. The scale included three subscales: (1) self-understanding ($\alpha=0.92$): the guidance that promoted the participants' self-understanding; (2) exploration of career paths ($\alpha=0.88$): the guidance that assisted the participants in their exploration of their career paths; and (3) career planning ($\alpha=0.92$): the guidance that promoted the participants' ability to plan career.

Vocational self-concept was measured using a 14-item scale ($\alpha=0.91$) to assess each participant's perceptions regarding self related to jobs or professions. The scale included three dimensions: 1.vocational orientation ($\alpha=0.81$): the level of the participants' understanding of their future vocational choices; 2.vocational information: the level of the participants' understanding of the occupations which they wished to enter in the future ($\alpha=0.87$); 3. self-awareness ($\alpha=0.83$): the level of the participants' understanding of their vocational interests, ability, and aptitude.

Self-perceived employability were measured with a 16-item scale ($\alpha=0.93$) that assessed the perception regarding the extent to which the participants' possessed the ability to attain sustainable employment appropriate to their qualification. The scale included three dimensions: 1. professional attitudes ($\alpha=0.90$): the extent to which the participants possessed professional attitudes required for employment; 2.professional knowledge and skills ($\alpha=0.83$): the extent to which the participants possessed the professional knowledge and skills required for the occupations that the participants wished to enter in the future; 3.career planning ($\alpha=0.90$): the extent to which the participants possessed the ability to plan career.

In this study, SPSS 19.0 was used as the statistic software. Descriptive statistics, one-sample t-test, dependent-sample one-way ANOVA, dependent-sample t-test, and path analysis of multiple regression analysis were employed to analyze the data.



Results of Research

The Experiences of Career Guidance

As seen in Table 1, the participants scored 3.84 on the experiences of career guidance scale, higher than the scale's median value (3), which suggests that the science education majors perceived that they were provided with the moderately appropriate level of career guidance by their universities ($M=3.84$, compared to 3, $t=32.93$, $p<0.001$). Of the three dimensions, the level of self-understanding was higher ($M=3.88$) than the level of exploration of career path ($M=3.82$), and the level of career planning ($M=3.83$) ($F=7.59$; $p<0.01$).

Table 1. Means, standard deviations and dependent-sample one-way ANOVA of the experiences of career guidance (N=336).

Dimensions	M	SD	F	Post hoc comparison
Experiences of career guidance	3.84	0.62		1>2; 1>3
Self-understanding	3.88	0.66	F=7.59**	1. Self-understanding 2. Exploration of career paths 3. Career planning
Exploration of career path	3.82	0.68		
Career planning	3.83	0.65		

** $p<0.01$

Vocational Self-concept

As seen in Table 2, the participants scored 3.91 on vocational self-concept scale, higher than the scale's median value (3), which suggests that science education majors had moderately high level of vocational self-concept ($M=3.91$, compared to 3, $t=36.16$, $p<0.001$). Of the three dimensions, the level of vocational orientation ($M=3.96$) was higher than the level of vocational information ($M=3.84$) and the level of self-awareness ($M=3.92$), and the level of vocational information was the lowest ($F=10.69$; $p<0.001$).

Table 2. Means, standard deviations and dependent-sample t-test of vocational self-concept (N=336).

Dimensions	M	SD	F	Post hoc comparison
Vocational self-concept	3.91	0.65	F=10.69***	1>2 ; 1>3; 3>2
Vocational orientation	3.96	0.60		1. Vocational orientation
Career information	3.84	0.84		2. Career information
Self-awareness	3.92	0.66		3. Self-awareness

*** $p<0.001$

Self-perceived Employability

As seen in Table 3, the participants scored 3.83 on the occupational aspiration scale, higher than the scale's median value (3), which suggests that science education majors had moderately high level of occupational aspirations ($M=3.83$, compared to 3, $F=60.30$, $p<0.001$). Of the three dimensions, the level of professional attitudes they possessed ($M=3.98$) was higher than the level of professional knowledge and skills ($M=3.72$) and the level of career planning ($M=3.82$), and the level of professional knowledge and skills was the lowest ($F=60.30$; $p<0.001$).



Table 3.7 Means, standard deviations and dependent-sample one-way ANOVA of self-perceived employability (N=336).

Dimensions	M	SD	F	Post hoc comparison
Self-perceived employability	3.83	0.579		1>2; 1>3;3>2
Professional attitudes	3.98	0.57	F=60.30***	1. Professional attitudes 2. Professional knowledge and skills 3. Career planning
Professional knowledge and skills	3.72	0.71		
Career planning	3.82	0.68		

*** $p < 0.001$

*The Relationships between the Experiences of Career Guidance,
Vocational Self- concept, and Self-perceived Employability*

This study used path analysis of multiple regression analysis to examine the relationships between the experiences of career guidance, vocational self-concept, and employability among science education majors in Taiwanese universities.

The assumptions of the regression model were checked. Because the zero-order correlations coefficient between the independent variables was 0.58, the Variance Inflation Factor (VIF) values were 1.49, and tolerance statistics were 0.67, there was no evidence to suggest that the data suffered from multicollinearity. The Durbin-Watson statistic was also between 1 and 2 (1.99), implying that errors in the regression were independent (Tabachnick & Fidell, 2007). Standardized residuals were examined to detect the presence of outliers. Four cases were determined to have standardized residuals between 2.82 and 2.93. Because none of those four cases had a Cook's distance (a measure of the overall influence of a case on the model) greater than 1 and the sample size was large, none of them had undue influence on the regression model (Field, 2005). The assumptions of normality, linearity, and homoscedasticity were checked by considering standardized residual scatter plots to examine whether the residuals were normally distributed around the predicted scores of self-perceived employability. It was discovered that the residuals had a linear relationship with the predicted scores of self-perceived employability. Overall, all assumptions were therefore met (Tabachnick & Fidell, 2007).

The regression results showed that the experiences of career guidance had a positive effect on the vocational self-concept ($\beta=0.58$), and explained 33% of the variance of the vocational self-concept (Table 4). Additionally, the experiences of career guidance and vocational self-concept both had positive effects on self-perceived employability ($\beta=0.31$ and $\beta=0.63$, respectively), and explained 71% of the variance of self-perceived employability (Table 5).

Table 4. Multiple regression coefficients for the effect of the experiences of career guidance on vocational self-concept (N=336).

Predictors	R ²	F	B	β
Experiences of Career guidance	0.33	301.98***	0.56	0.58

*** $p < 0.001$ **Table 5. Multiple regression coefficients for the effect of the experiences of carer guidance and vocational self-concept on self-perceived employability (N=336).**

Predictors	R ²	F	B	β
Experiences of career guidance	0.71	757.91***	0.29	0.31
Vocational self-concept			0.60	0.63

*** $p < 0.001$

Overall, all of the first three hypotheses concerning the relationships among the variables were supported at the 0.001 significance level (H1: the experiences of career guidance \rightarrow vocational self-concept, $\beta=0.58$; H2: vocational self-



concept → self-perceived employment, $\beta=0.63$; H3: the experiences of career guidance → self-perceived employment, $\beta=0.31$). The results showed that, the participants' experiences of career guidance positively affected their vocational self-concept; the participants' vocational self-concept positively affected their self-perceived employability.

In order to investigate whether the indirect effect of career guidance on self-perceived employability through vocational self-concept was significant, the Sobel test was used in this study (Baron & Kenny, 1986). The test results showed that vocational self-concept significantly mediated the influence of the experiences of career guidance on self-perceived employability ($Z=14.14 \geq 1.96$, $p < 0.001$). That is, the fourth hypothesis of the study was supported at the 0.001 significance level (H4: the experiences of career guidance → vocational self-concept → self-perceived employment). Therefore, all of the analysis results suggested that the science education majors' experiences of career guidance both significantly directly and indirectly affected their self-perceived employability vis-à-vis the effect on their vocational self-concept. The relationships among these variables are shown in Figure 2. The estimates of the direct and indirect effects of the experiences of career guidance and vocational self-concept on science education majors' self-perceived employability are shown in Table 6. Of the two predictors, the experiences of career guidance had the greater impact on science education majors' self-perceived employability (estimate=0.68).

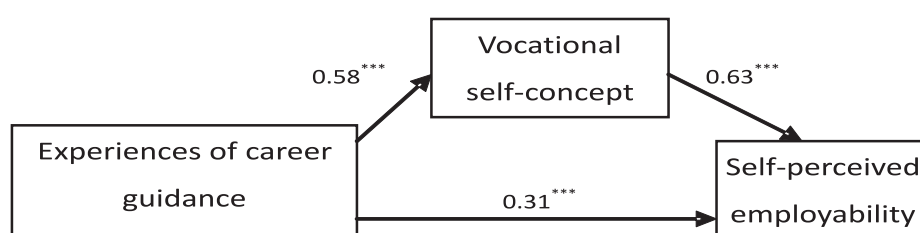


Figure 2: Results of testing the hypotheses.

Table 6. Estimates of the direct and indirect effects of the experiences of career guidance and vocational self-concept on self-perceived employability.

Casual path	Direct effect	Indirect effect	Total effect
Vocational self-concept → self-perceived employability	0.63	-	0.63
Experiences of career guidance → self-perceived employability	0.31	$0.58 \times 0.63 = 0.37$	0.68

Discussion

The results of this study provided empirical support for the hypotheses of the relationships among Taiwanese science education majors' experiences of career guidance, vocational self-concept, and self-perceived employability based on the developmental-contextual model of career development. The results demonstrated that the experiences of career guidance, as a proximal contextual factor, directly and indirectly influenced the self-perceived employability vis-à-vis the effect on vocational self-concept at the individual level, which directly influenced the self-perceived employability.

The results of this study empirically indicated that the appropriate career guidance had a strong impact on the vocational self-concept and self-perceived employability among the science education majors in Taiwan. It suggests that it is critically important to provide career guidance for science education majors, including the guidance of self-understanding, exploring career paths, and career planning. However, it is noteworthy that although specialists in career guidance suggest that adolescents should be provided with proper career guidance (Zunker, 2006), most of the universities in Taiwan tend to emphasize their students' academic performance and ignore to offer sufficient and proper career guidance to their students (Wu, 2012).

The study found that the science education majors in Taiwan perceived that they were provided with the moderately appropriate level of career guidance. Specifically, for these science education majors, the guidance of self-understanding was more appropriate and the guidance of exploring career paths and career planning were



less sufficient. Although the ability of self-understanding is basic for individuals' career development, the knowledge and skills of exploring career paths and career planning are particularly essential for undergraduates, who are at the transition stage of career (Super, 1990). Thus, the counseling and guidance departments of Taiwanese universities may pay attention to the issue.

It was found that the Taiwanese science education majors held the moderately high level of vocational self-concept. Specifically, the science education majors possessed relatively clear and concrete vocational orientation; that is, they would be relatively sure of their future occupational choices. However, the science education majors perceived that they possessed less sufficient information about their future occupations. The possible explanation of this result may be that the curriculum and teaching of the science education departments in Taiwanese universities might emphasize the learning of professional knowledge and skills of science education rather than providing the sufficient information about the occupations they may enter in the future (Shan, 2010). The acquisition and possession of vocational information are crucial to the individuals' occupational preparation (Winch, 2004). Vocational information can allow individuals to determine whether his/her career choices will be appropriately suited to his/her vocational interests, personality characteristics, and career development (Grotevant & Durrett, 1980). Individuals have been found to limit their vocational choices by selectively eliminating various possible occupations based on inadequate or incorrect vocational information (Brown, 2007). Thus, in order to facilitate the employment of Taiwanese science education majors, the science education departments of Taiwanese universities may provide sufficient information about the occupations which the students are prepared for.

The study found that the Taiwanese science education majors' vocational self-concept, which was affected by their experiences of career guidance, had a significant effect on their self-perceived employability. This result obviously supports the concept that a developing individual, interacting with contextual systems, plays a crucial role in career development (Super, 1990; Vondracek et al., 1986). In this study, the Taiwanese science education majors held moderately high level of vocational self-concept. This result also supports the positive effect of the career guidance of universities on Taiwanese science education majors' vocational self-concept.

Conclusions

The study aimed to explore the relationships between the experiences of career guidance, vocational self-concept, and self-perceived employability among the science education majors in Taiwan based on the developmental-contextual model of career development. The results demonstrated that the science education majors' experiences of career guidance directly and indirectly influenced their employability vis-à-vis the effect on their vocational self-concept.

According to the results of the study, in order to promote the Taiwanese science education majors' employability, the universities may have to provide them with sufficient and appropriate career guidance, especially the career guidance of exploring career paths and career planning to further facilitate their vocational self-concept. In addition, the science education departments of universities in Taiwan may offer more sufficient vocational information about the occupations which the science education majors will enter after graduating in order to facilitate their vocational self-concept, such as occupational characteristics, occupational fringe benefits, occupational qualifications, and occupational ethics.

In this study, the use of only one reporter for all variables may not collect data that reflect the responses of people contributing to the participants' experiences of career guidance, vocational self-concept, and self-perceived employability. Additionally, this limitation also raises the possibility of common method variance. To provide the full understanding of science education majors' career development and minimize the inflated method variance, it is necessary for future studies to include multiple informants in the theoretical model.

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