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Development and Validation of the Career-related Teacher Support Scale: Data from China

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Response to Reviewers:	Dear Professor Jerome Rossier, Greetings from Madison, U.S. We are grateful thanks for the conditional acceptance of our manuscript "Development and Validation of the Career-related Teacher Support Scale: Data from China". As required, we have added the English version of the Career-related Teacher Support Scale in Appendix 1 in the manuscript with a note reminding that only the Chinese version of the scale was validated. Thank you for your kind attention. We are looking forward to the publication. Yours sincerely, The authors

Running Head: CAREER-RELATED TEACHER SUPPORT SCALE

Development and Validation of the Career-related Teacher Support Scale:

Data from China

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Abstract

Support from teachers is essential to students' career preparation and planning, but few instruments assess their career-related support. We describe the development and validation of the *Career-related Teacher Support Scale* (CRTSS) among Chinese technical college students ($N = 1,674$). Exploratory and confirmatory factor analyses indicate: (a) three types of perceived career-related teacher support; (b) best fit for a bi-factor model with a general factor and three sub-factors, with (c) the general factor explaining more common variance than sub-factors; (d) measurement invariance across genders; (e) good reliability and validity. Implications for researchers, policy makers, teachers and students are discussed.

Résumé

Développement et validation de l'échelle de soutien des enseignant·e·s en matière de carrière : Données de la Chine

Le soutien des enseignant·e·s est essentiel pour la préparation et la planification de la carrière des étudiant·e·s, mais peu d'instruments permettent d'évaluer cet élément. Nous décrivons le développement et la validation de l' « échelle de soutien des enseignants en matière de carrière (CRTSS) » dans une population d'étudiant·e·s universitaires dans des instituts techniques chinois ($N = 1\ 674$). Les analyses factorielles exploratoires et confirmatoires indiquent : (a) trois types de soutien perçus en matière de carrière ; (b) que le modèle plus adapté est bi-factoriel avec un facteur général et trois sous-facteurs, (c) le facteur général expliquant mieux la variance que les sous-facteurs ; (d) l'invariance des mesures entre les genres ; (e) une bonne fiabilité et validité. Les implications pour les chercheur·e·s, les organes décisionnels, les enseignant·e·s et les étudiant·e·s sont discutées.

Zusammenfassung

Entwicklung und Validierung der berufsbezogenen Lehrerförderungsskala:

Daten aus China

Die Unterstützung durch Lehrkräfte ist für die Berufsvorbereitung und -planung von Schülerinnen und Schülern von wesentlicher Bedeutung, aber nur wenige Instrumente bewerten ihre berufsbezogene Unterstützung. Wir beschreiben die Entwicklung und Validierung der berufsbezogenen Lehrerförderungsskala (Career-Related Teacher Support Scale, CRTSS) unter chinesischen Fachhochschulstudenten (N = 1.674). Explorative und konfirmatorische Faktoranalysen führten zu folgenden Ergebnissen: (a) drei Arten der wahrgenommenen laufbahnbezogenen Unterstützung durch Lehrkräfte; (b) beste Eignung eines Modells mit einem allgemeinen Faktor und drei Unterfaktoren, wobei (c) der allgemeine Faktor mehr Varianz als die Unterfaktoren erklärt; (d) Messinvarianz zwischen den Geschlechtern; (e) gute Reliabilität und Validität. Implikationen für Forschende, politische Entscheidungstragende, Lehrende und Studierende werden diskutiert.

Resumen

Desarrollo y validación de la Escala de Apoyo Docente al Desarrollo de la Carrera:

Datos procedentes de China.

El apoyo del profesorado es esencial para la preparación y planificación de la carrera del alumnado pero existen pocos instrumentos que evalúen el apoyo relacionado con la carrera. Se describe el desarrollo y validación de la Escala de Apoyo Docente al Desarrollo de la Carrera (CRTSS) entre estudiantes chinos de la escuela técnica (N= 1,674). Los análisis exploratorios y confirmatorios indican: (a) tres tipos de apoyo percibidos en relación con la carrera; (b) mejor encaje para un modelo bi-factor con un factor general y tres subfactores, con (c) el factor general que explica más la varianza común que los sub factores; (d) una medida de la invarianza entre géneros; (e) buena fiabilidad y validez. Se realiza una discusión de las implicaciones para investigadores, legisladores, profesorado y estudiantes.

Keywords: Bi-factor model, Career-related teacher support, *Career-related Teacher Support Scale*, Chinese technical college students, Measurement, Reliability, Validity

Development and Validation of the Career-related Teacher Support Scale:

Data from China

Introduction

Teacher support for students' general and educational development has been the focus of attention in previous studies (e.g., Metheny, McWhirter, & O'Neil, 2008), but teacher support in schools specifically for students' *career development* has received relatively limited attention. This may be because career development is often thought to be the sole responsibility of career guidance personnel, rather than a duty of all teachers (Zhang, Yuen, & Chen, 2018). However, in reality the number of such career professionals has always been limited, and students therefore often report insufficient help from career counselors and professionals (Mortimer, Zimmer-Gembeck, Holmes, & Shanahan, 2002; Zhang, Yuen, & Chen, 2019). This situation has meant that it has become common practice for many schools and colleges to encourage that all teachers become involved in providing support for students' career path planning (Zhang et al., 2019).

In order to monitor the quality and effectiveness of career-related support provided by teachers, it is necessary to have access to a valid and reliable assessment tool. The study reported here was designed to develop a scale that can be used in future to assess these specific types of support. Development of such a scale can contribute much to research and practice in this field and may ultimately provide new insights into ways of strengthening of this type of support in schools.

Literature Review

Teacher Support and Career Development

According to Social Cognitive Career Theory (SCCT; Lent, 2012; Lent, Brown, & Hackett, 1994), teacher support is viewed as one of the proximal supports that enriches learning experience, enhances self-efficacy and contributes to individual's career selection

and action. This interpretation has been supported by empirical research, because teacher support has been linked to a wide range of positive educational and career outcomes (Di Fabio & Kenny, 2015; Gushue & Whitson, 2006). For example, when students perceive more teacher support, they develop stronger career goals and expectations (Bonneville-Roussy et al., 2013; Kenny & Bledsoe, 2005; Kenny et al., 2010). They also develop better career decision-making self-efficacy (Di Fabio & Kenny, 2015; Gushue & Whitson, 2006) and career decision-making satisfaction (Kozan, Di Fabio, Blustein, & Kenny, 2013). Strong teacher support has also been associated with students' better career exploration and talent development (Gushue & Whitson, 2006; Perry, Liu, & Pabian, 2010; Reis & Renzulli, 2004).

Teachers' general support for students has received increased attention from researchers over the past two decades, particularly in America. From this work, it has been found that support for secondary school students tends to require that (a) teachers are willing to invest time and energy to helping students, (b) teachers are able to give encouragement, information and advice, (c) teachers show genuine interest in each student's aspirations, (d) teachers are available to respond and provide feedback to students when they seek help or advice, and (e) teachers are proactive in encouraging students to become more autonomous (Deci & Ryan, 1987, 2000; Farmer, 1985; Metheny et al., 2008; Will & Shinar, 2000).

It can be seen from the above list that these forms of teacher support embrace emotional support, instrumental support, informational support, feedback and validation, and support for autonomy (Deci & Ryan, 1987; Will & Shinar, 2000). *Emotional support* refers to the availability of a caring and accepting person who can listen empathically when an individual is having problems. *Instrumental support* involves giving practical help and advice when necessary. *Informational support* is providing knowledge that is useful for a given task or challenge (e.g., where to find information on a particular job). *Feedback and validation* involve assurance that an individual is doing well in a particular task and that he or she is

valued and worthy. *Support for autonomy* represents helping an individual become more independent.

It is probable that the nature of teacher support may vary according to the educational setting in which it is provided. For example, teacher support given to regular education students in secondary schools may be different from that given to vocational school/college students. Research shows that regular education students at Grade 9 value most any teacher feedback on self (e.g. [encourages me] “My work is well done, but I can do better next time”), while vocational education students also at Grade 9 appreciated most any teacher feedback on self-regulation (e.g. “Telling me when I'm going well, and what I should improve, and the best way to do it”) (Carvalho, Martins, Santana, & Feliciano, 2014.).

Apart from possible differences in teacher support across educational settings (secondary school vs. vocational school students), there are also certain to be some differences between the types of support given for educational development and specifically for career development. For example, in a qualitative study in a Hong Kong community college, students were interviewed and identified five factors of ‘teacher care’ that had influenced their academic success—(a) teachers as transmitters of knowledge, (b) teachers as care-givers, (c) teacher’s ability to teach well, (d) teachers as advice-givers, and (e) teachers as role models (Lee & Yuen, 2019). Similarly, another study in Mainland China interviewed a population of technical college students and discovered six themes of career-related teacher support: (a) enhancement of self-improvement and self-exploration, (b) informational support, (c) instrumental support, (d) career-related role model, (e) emotional support and (f) support for autonomy (Zhang et al., 2019). Deeper exploration of the nature and value of career-related teacher support in Asia has been hampered to some extent by lack of a suitable assessment instrument that has been designed and validated for use in China. The

development of a scale that assesses career-related teacher support would benefit to future investigations.

Current Measures for Assessing Teacher Support

Scales for assessing *general* teacher support are readily available in English-speaking countries. Three types of instrument have been developed: (i) observation tools (such as the *Classroom Assessment Scoring System*: Pianta et al., 2008), (ii) teacher-report scales (e.g., van de Pol, Volman, & Beishuizen, 2011), and (iii) student-report scales (e.g., Deci, Connell, & Ryan, 1989; Harter, 1985; McWhirter, 1996; McWhirter et al., 2000; Metheny et al., 2008). The literature reveals that student self-report is used in 16 instruments related to teacher-support for students' academic performance. Among these scales, four are standalone instruments and 12 are subscales within more general instruments (Metheny et al., 2008).

The most frequently used tools in career development research are the *Teacher Support Scale* (TSS; McWhirter, 1996; McWhirter et al., 2000; Metheny et al., 2008), *Teacher Support Measurement* (TSM; Farmer et al., 1981), and the *Teacher Support Subscale of the Social Support Scale for Children and Adolescents* (SSSCA; Harter, 1985) (for a review see Zhang et al., 2018). Although these instruments have been used in numerous studies, issues have been raised concerning their scope, content, applicability in different cultural contexts, and psychometric properties. Some of these limitations are discussed in more detail below.

Limitations of Existing Instruments

The first limitation of existing measures for use in career development research is their restricted scope and content. These measures concentrate on teachers' *general* support for students' educational or personal development, rather than on specific support for *career development*. As the focus of career development is highly specific to students' vocational preparation, it is different from support related to students' educational and personal development (Gysbers & Henderson, 2000; Santana Vega, Feliciano Garcia, & Jimenez

Llanos, 2016; Yuen et al., 2003). For research and professional development purposes, it is therefore desirable that any instrument investigating teacher support should give specific attention to career-related support (Maellaro & Whittington, 2009).

Another area of concern relates to their suitability for use in different cultural contexts. All the instruments cited above were developed in the West, especially in the US, and are presented in English language. Some of the items may not be entirely appropriate for a different cultural setting and may be difficult to translate meaningfully into a different language. For example, there may be significant differences in the ways that teachers in the West and in the East interact with and support their students (Zhang, 2006). In Chinese schools and colleges classes are often large, and teachers tend to play a traditional role as disciplinarians rather than personal counsellors, and they may not see their duty as extending into the field of career guidance. Any instrument used to assess teacher support in such a context may need to contain different items to cover more accurately the types of support and interactions that are typically provided.

The third issue concerning existing scales relates to their psychometric properties. For example, the reliability (internal consistency) of some scales is not high—the *Teacher Support Measurement* has Cronbach's alpha ranging from only .65 to .70 (Farmer, 1985; Gushue, & Whitson, 2006; McWhirter et al., 1998) and the reliability of the *Teacher Support Subscale* of the SSSCA ranges from .69 to .77 (Kenny & Bledsoe, 2005; Kozan et al., 2013). Although an internal consistency from .60 to .70 is often acceptable for most research purposes, this figure does suggest the need for caution when interpreting results for individuals (George & Mallery, 2003). In addition, in the case of the popular *Teacher Support Scale* (TSS), confirmatory factor analysis suggests that the four-factor model (based on the dimensions of positive regard, invested, accessible, expectations) does not show a good data fit against the criteria of Hu and Bentler (1999). It has a comparative fit index

(CFI) of .89, a Tucker-Lewis index (TLI) of .88, and a root mean square error of approximation (RMSEA) of .09 (Metheny et al., 2008). Ideally, any new scale to assess teacher support for career development would have good construct and content validity and higher internal consistency. To sum, the majority of the existing measurements developed in Western context mainly focus on general teacher support for educational achievement and do not have strong psychometric properties.

Purpose of this Study

Students' competency in career planning and exploration is a significant life skill that must be supported by all teachers (Gysbers, Heppner, & Johnston, 2014; Yuen et al., 2003). As mentioned earlier, the shortage of career guidance professionals in schools in China calls for more involvement of classroom teachers in students' career development. The purposes of this study was, therefore, to develop a *Career-related Teacher Support Scale* (CRTSS) that could be used in future research and practice. Specifically, the study was designed to evaluate CRTSS using exploratory factor analysis (EFA) and confirmatory factor analysis (CFA), and to obtain evidence of reliability and validity of the instrument. The development process for CRTSS was conducted following the theoretical and empirical guidelines suggested by McCoach, Gable and Madura (2013).

Rationale for the Study

In order to identify a potential list of effective types of career-related teacher support, the authors drew upon extant literature on teacher support and social support. This exploratory study mainly focused on development of a scale covering three main types of teacher support that the literature indicated were most valued by students—enhancement of self-exploration, informational support, and emotional support. *Enhancement of self-exploration* refers to teachers' guidance in helping students recognize their own strengths, weaknesses and interests relevant to planning a career path, and to their personal fit in the

workplace. *Information support* refers here to the provision of career-related facts and figures as they relate to requirements of the workplace, the job market, employment prospects and a career path pertinent to a student's major study. *Emotional support* involves encouragement and positive expectations from teachers (Zhang et al., 2019).

The main reason for focusing on the first two types was because student self-knowledge (i.e. enhancement of self-exploration) and knowledge of the world of work (i.e. informational support) are two key aspects that previous studies have found to facilitate students' career preparation and readiness (Hirschi, 2009; Savickas, 2005; Savickas, 2012; Zikic & Klehe, 2006). The third type (emotional support) was included because students had previously highlighted it as important to them (Zhang et al., 2019), and emotional support was strongly linked with career outcomes in other studies (e.g., Hirschi, 2009; Zikic & Klehe, 2006).

Evidence of convergent validity of CRTSS was determined against the variable of *connectedness to teachers*. Connectedness to teachers refers to adolescents' effort made to relate positively with their teachers and concerns about earning teachers' respect and trust (Karcher, 2011). Previous research findings suggested a positive relationship between school connectedness and teacher support (such as getting along with teachers and feeling teachers care about you) (Joyce & Early, 2014; Yuen, 2011). Considering the significant role of teachers at school, it was hypothesized that positive associations may exist between measures of career-related teacher support (CRTSS total scale and three subscales) and a measure of connectedness to teachers.

Concurrent validity was determined against a measure of *career self-efficacy*. According to a study by Yuen (2011), there was positive relationship between connectedness to teachers and students' career development; and enhancement of connectedness to teachers could benefit student self-esteem. Moreover, evidence suggests that connectedness to

teachers has positive influence on career choice (Fouad, 2007). Based on prior findings, it was hypothesized that career-related teacher support (CRTSS total score and three subscale scores) would be positively associated with career exploration self-efficacy and talent development self-efficacy.

Moreover, as previous reviews have suggested possible inconsistent effects of teacher support across genders (Zhang et al., 2018), it was also intended that in this study measurement invariance (MI) of CRTSS across genders would be evaluated. An evaluation of the MI is essential as it could examine whether CRTSS yields different profile for males vs. females (Cheung & Rensvold, 2002).

Methodology

Item Generation and Revision

Generating items for the scale attempted to address three main types of teacher support: *enhancement of self-exploration, informational support, and emotional support*. Reference was also made to existing scales such as TSS (Metheny et al., 2008) and SSSCA (Harter, 1985) to identify items and content that could be suitable.

Initially, 49 items were created and then underwent revision several times, based on comments from a panel of five experts selected by reference to their ongoing relevant research or their work experience. Disagreements were discussed until a consensus was reached. Later, two focus group interviews were conducted with one cohort of students from the Program for Senior Skilled Workers (高级技工学生, $N = 10$) and another cohort from the Program for Preparatory Technicians (预备技师学生, $N = 13$) (aged 19 to 21, with 39% female) to clarify the suitability of the content of the initial draft items. Students were asked to consider if there were any ambiguous items, or any that were too wordy or difficult to understand? Feedback from students was then used for item revision.

General Method

Two studies were conducted. In Study One ($N = 462$) an exploratory factor analysis (EFA) was used to obtain the best factor solution and to select items. In Study Two ($N = 1,212$) confirmatory factor analysis (CFA) was used to identify the best model from correlational and bi-factor models. After identifying a bi-factor model as the best fit, ancillary bi-factor measures were employed to further clarify the dimensionality of CRTSS and to determine the model-based reliability of the total CRTSS and its subscales. Finally, measurement invariance was assessed across genders, and evidence of convergent and concurrent validities of CRTSS was obtained.

Study One: Exploratory Factor Analysis

The purpose of Study One was to refine the items in the scale and to assess the scale structure using exploratory factor analysis.

Method

Participants

The 474 participants were enrolled in two technical colleges (技师学院) in China: Shenzhen ($N = 320$, 68%) and Zhuhai ($N = 154$, 32%). From this group, 462 completed the questionnaires and provided usable data (97.5%; ages ranged from 15 to 24; mean age = 18.3 years, $SD = 1.7$). The sample comprised 64.5% male students, with 91.3% coming from the Program for Senior Skilled Workers.

Measure

The 49-item draft Chinese version of CRTSS was used to evaluate students' perceived teacher support for career development under categories of enhancement of self-exploration, informational support and emotional support. The scale used a 5-point Likert-type response mode ranging from 1 (never) to 5 (always). Higher scores indicated more perceived career-related teacher support.

Procedure

Data were collected by teachers during class periods and all participants were volunteers. Before data collection, participants were informed that their answers were confidential and would only be used for research purposes. They then signed a consent form. Assessments were completed within 15 minutes and all data were later analyzed using Mplus 7.4 (Muthén & Muthén, 1998-2015).

Results

The Full Information Maximum Likelihood Method was used to address any missing values (Schlomer, Bauman, & Card, 2010). An exploratory factor analysis (EFA) was conducted using maximum likelihood with the Geomin oblique rotation. Maximum likelihood was used because the data were normally distributed, with skewness of all items from $-.85$ to $.50$, and kurtosis from -1.06 to $-.07$. Byrne (1998) suggested that absolute values of skewness less than 1 and those of kurtosis less than 7 indicating a normal distribution of the data. The Geomin oblique rotation was used because it was assumed that there were across-factor loadings and cross-factor correlations on each factor (Browne, 2001).

To determine the number of identifiable factors the following criteria were used: a) initial eigenvalues total (> 1) and b) the result of a parallel analysis (PA) (Horn, 1965; O'Connor, 2000). PA is considered one of the most accurate ways to determine the number of factors extracted from a data set (Hinton, McMurray, & Brownlow, 2014). Results of the PA showed that the first three eigenvalues of the sample correlation matrix were larger than average and their 95 percentile eigenvalues, which suggested that there were three factors underpinning the scale (Table available upon request). Thus, a three-factor structure solution for CRTSS was accepted, consistent with the proposed conceptual framework comprising *enhancement of self-exploration, informational support, and emotional support*.

The criteria for item retention included (a) a factor loading higher than .50, and (b) a cross-factor loading lower than .30. Ultimately, thirty-three items were removed due to low factor loadings ($< .50$) or high cross factor loadings ($> .30$). The remaining 16 items had factor loadings ranging from .59 to .86 and cross loadings lower than .23 (Table 1).

The Cronbach's alphas of all three subscales proved to be very acceptable (ranging from .90 to .92; Table 2). Correlations across the three subscales indicated that all three were significantly intercorrelated with moderate coefficients ranging from .42 to .50 ($p < .05$). With these initial indications of a useful scale, the 16-item three-factor instrument was deemed acceptable. A further confirmation of the scale structure was sought in Study Two.

Study Two: Confirmatory Factor Analysis and Construct Validity

The objectives for Study Two were to use a new sample of technical college students to (i) cross-validate the underlying three-factor structure of the 16-item CRTSS using confirmatory factor analysis; and (ii) provide evidence of convergent and concurrent validities of CRTSS.

Method

Participants

A total of 1,212 students completed the *Career-related Teacher Support Scale* (age range 15 to 25 years; mean age = 18.5, $SD = 1.7$). The students came from four technical colleges in four cities in Guangdong Province, China (Shenzhen: 46.2%; Guangzhou: 21.5%; Zhuhai: 17.5%; and Zhongshan: 14.8%). Of the total respondents, 82% completed the pencil-and-paper form of the instrument and 18% completed an identical online version. The paper and pencil sample comprised 56.6% male respondents.

Of this sample, 278 participants also completed a questionnaire *Connectedness to Teachers* (see below). All participants were from Shenzhen and 60.8% were male (age range 16 to 22; mean age = 18.6, $SD = 1.5$). Another 640 participants (age range 15 to 24; mean age

= 18.8, $SD = 1.8$) completed questions from the *Career Exploration Self-Efficacy Subscale* and *Talent Development Self-Efficacy Subscale* (see below). These participants came from three technical colleges in Shenzhen (37%), Guangzhou (38%), and Zhuhai (25%). This sample was mainly male (63.3%).

Measures

The 16-item *Career-related Teacher Support Scale* (CRTSS) was used to measure student perceived career-related teacher support. Within the CTTS there were 6 items in the enhancement of self-exploration subscale, 5 items covering informational support, and 5 items dealing with emotional support. Participants were asked to rate their perceived career-related teacher support, using a 5-point Likert-type scale from 1 (never) to 5 (always). The internal consistency for the three subscales and the total scale was found to be the same, $\alpha = .92$.

Connectedness to Teachers (CT) was measured using a six-item subscale from *Hemingway: Measure of Adolescent Connectedness* (Karcher, 2011). Connectedness was measured on a 5-point Likert-type scale from 1 (not at all) to 5 (very true). The factor structure of this subscale was evaluated in this sample using CFA, and results indicated an acceptable model fit after deleting item 2 (a negative item) with a very low factor loading (.11) ($CFI = .992$, $SRMR = .021$, $RMSEA = .046$, and a 90% CI ranging from .000 to .104) (Quintana & Maxwell, 1999; Hu & Bentler, 1999). Cronbach's alpha for CT was .79.

The 6-item subscale *Career Exploration Self-efficacy* from the *Career and Talent Development Self-Efficacy Scale* (Fan, Hao, & Yuen, 2013; Yuen, Gysbers, Chan, Lau, & Shea, 2010) was used to measure student competencies related to the exploration of career paths, goals, and the relationships between career path and study life. Participants were asked to rate their confidence in completing performances described in the various items using a 6-point Likert-type response mode (1 = extremely lacking in confidence, to 6 = extremely

confident). The factor structure was examined using CFA with data from a sample of 646 technical college students. Results indicated a good model fit (Hu & Bentler, 1999) with CFI = .980, SRMR = .024, RMSEA = .072, and a 90% CI ranging from .050 to .096. The internal consistency for this subscale was .84.

The 6-item subscale *Talent Development Self-Efficacy* from the *Career and Talent Development Self-Efficacy Scale* (Fan et al., 2013; Yuen et al., 2010) was used to measure student capabilities related to academic subjects and extra-curricular activities. It uses a 6-point Likert-type response mode (1 = *extremely lacking in confidence* to 6 = *extremely confident*). The factor structure of this subscale was assessed using CFA on responses from a sample of 646 technical college students in this study. Results supported a good model fit (Hu & Bentler, 1999) with CFI = .985, SRMR = .019, RMSEA = .070, and a 90% CI ranging from .043 to .100. The internal consistency for this subscale was .84 in this study. For all scales used in this study, the higher scores indicated better performances in relevant aspects measured.

Procedure

All data (pencil-and-paper and online surveys) were collected by teachers during class periods. Before filling out the questionnaires, consent forms from students were obtained. For the online survey, students were asked to open the specified web page on their smartphones and complete the online questionnaires. Participants were informed that (i) their answers were confidential, that there were no right or wrong answers; (ii) their answers would only be used for research purposes; (iii) they could withdraw from the survey at any time they want without any liability. The assessments were completed within 30 minutes. All data were analyzed using Mplus 7.4 (Muthén & Muthén, 1998-2015).

Results

Preliminary Analysis

The Maximum Likelihood Estimation Method (ML) was used to assess the goodness of fit of the CRTSS as the data were normally distributed: The skewness of items ranged from -.56 to .46, and the kurtosis ranged from -.05 to -1.14 (Byrne, 1998). The Full Information Maximum Likelihood Method was used to compensate for any missing values (Schlomer et al., 2010).

Confirmatory Factor Analysis (CFA)

The aim of CFA was to find the best factor solution for CRTSS. On the basis of correlation results in Study One, the coefficients across inter-factors were larger than .30 (ranging from .42 to .54; Table 2) and the ratio of the first eigenvalue to the second was larger than 3 ($8.13/2.17 = 3.75$), which suggested a possible bi-factor model (Cho et al., 2015, p. 554; Reise, Morizot, & Hays, 2007). Two competing models were then compared—a correlational model comprising three factors and a bi-factor-orthogonal model comprising one general factor and three specific group factors. The correlational model allows each indicator to load on its respective factor and enables each factor to associate with others. The bi-factor model is a model in which each item regresses to its respective subscale and at the same time loads on the general career-related teacher support factor, and each factor does not associate with each other.

The structural equation modeling (SEM) was conducted. The fit indices (including their cut-off value) for each model are reported here: (a) CFI and TLI $>.90$; (b) RMSEA ($<.08$) with corresponding 90% confidence intervals; (c) the standardized root mean-square residual (SRMR $<.08$; Browne & Cudeck, 1993; Hu & Bentler, 1999; Marsh, Hau, & Grayson, 2005; Marsh, Hau, & Wen, 2004; Schermelleh-Engel, Moosbrugger, & Müller, 2003); (d) the Bayesian information criterion (BIC) values; and (e) the Akaike Information Criterion (AIC) values. For the comparisons of the non-nested models (i.e. the correlational model and the bi-factor-orthogonal model), increases of more than 10 units of the AIC and BIC values suggest

a lack of empirical support for the goodness of fit (Burnham & Anderson, 2004). For the comparisons of the nested models (i.e. the correlational model and models examining the configural invariance, the metric invariance and scalar invariance), an increase of CFI equal or greater than .01 suggests that the models are significantly improved (Cheung & Rensvold, 2002).

As indicated in Table 3, the bi-factor model was retained as the best fit (Figure 1) because it showed significant decreases of AIC ($\Delta AIC = 355.30$) and BIC ($\Delta BIC = 289.01$) values more than 10 units, when comparing with the correlational model (Burnham & Anderson, 2004). In this bi-factor model each item significantly loaded on the general factor and/or the specific factors (Table 1).

Ancillary Bi-Factor Measures

As the bi-factor model was selected, the ancillary bi-factor indices were assessed, which aimed to provide more nuanced evidence of the model-based reliability of CRTSS's total scale score and subscale scores, and the dimensionalities of CRTSS. For model-based reliability, omega coefficients were assessed considering omega (ω), omega subscales (ω_s) (Reise, 2012; Rodrigue, Reise, & Haviland, 2016a, 2016b). Omega for total score (ω) refers to the proportion of total score variance that can be attributed to all common factors (i.e. variance of the general factor plus all group factors). Omega subscale (ω_s) refers to the proportion of the systematical variance of the total and the corresponding subscale score variance that can be attributed to variance of the general factor and the corresponding factor. Higher omegas for total score and subscale score represent better reliability of the total scale and subscales. In this analysis, ω was .97, indicating that 97% of the total CRTSS score variance was due to the combination of the general factor and the three specific factors. Furthermore, the ω for the three subscales all equaled to .97, which suggested that each factor explained 97% of the reliable variance.

To determine dimensionality, the explained common variance (ECV), the individual item explained common variance (I-ECV), the percent of uncontaminated correlations (PUC), Omega Hierarchical (ω_H) and Omega Hierarchical subscale (ω_{HS}) were measured. First, the ECV is a ratio value that represents the percentage of common variance (i.e. variance of both the general and group factors) that is attributable to the general factor (Rodriguez et al., 2016a). A larger ECV value (such as .70 and above) indicates a strong general factor and that the common variance is essentially unidimensional (Rodriguez et al., 2016a). The ECV for the general CRTSS factor was found to be .64, suggesting that 64% of the common variance was attributable to a general CRTSS factor, whereas 36% was spread among the three group CRTSS factors.

Second, the I-ECV is a type of ECV computed at the item level, identifying the percent of item common variance attributable to the general CRTSS factor. I-ECV larger than .80 or .85 indicates that an item reflects the general factor more than the group factors (Rodriguez et al., 2016b). I-ECV values of the 16 items ranged from .46 to .82, with two items had I-ECV values larger than .80.

Third, PUC is another important form of diagnostic information that helps justify whether the bi-factor model is unidimensional or multidimensional (Rodriguez et al., 2016a). Higher PUC (such as .70) indicates less bias in structural coefficients, thus the instrument can permissibly be treated as unidimensional (Rodriguez et al., 2016a). The PUC value was .71 in this study.

Fourth, other indices for determination of dimensionality are ω_H and ω_{HS} , where ω_H refers to the proportion of total score variance that can be attributed to individual differences of the general factor. The higher ω_H , the more variance of the general factor. Additionally, ω_H higher than .80 suggests that the majority of the reliable variance is attributed to a single general factor (Rodriguez et al., 2016a). ω_{HS} refers to the proportion of subscale score

variance that can be attributed to a corresponding factor after partitioning variance of the general factor. Lower ω_{HS} suggests that a higher proportion of the CRTSS score variance can be attributed to the general factor (Rodriguez et al., 2016a). The ω_H in this study was .82, suggesting that 82% of the total CRTSS variance was attributed to the general factor. When comparing the values of ω (.97) and ω_H (.82), it was found that 84% ($.82/.97 = .84$) of the reliable variance in the *Career-related Teacher Support* total score was attributed to the general factor, and only 16% ($1-.84 = .16$) was attributed to the three subscales. The ω_{HS} for enhancement of self-exploration, informational, and emotional subscales were .10, .11 and .10 respectively, indicating that the three subscales contributed to 10% to 11% of the reliable systematic variance, after controlling for variabilities attributed to the general CRTSS factor.

Measurement Invariance

The configural, metric, and scalar invariances of this bi-factor CRTSS model were assessed across genders. The configural invariance means that the constructs of the measurement (such as the number of items in each factor) are equal across groups (Cheung & Rensvold, 2002). If the configural invariance is identified, the metric invariance will then be tested. The metric invariance means that all factor loading parameters are equal across groups (Cheung & Rensvold, 2002). Similarly, the scalar invariance will be assessed if the metric invariance exists. The scalar invariance means that all item intercepts are equal across groups (Cheung & Rensvold, 2002). The abovementioned models are the nested models to be examined step by step. The criteria for assessing the relative fit indexes of two nested models are the following: (a) the overall model fit should be acceptable (Little, 1997), and (b) an absolute value of ΔCFI between the two nested models should be smaller than or equal to 0.01 (indicating that the null hypothesis of invariance should not be rejected; Cheung & Rensvold, 2002).

Results (shown in the last three rows in Table 3) suggested that the model fit indexes of all measurement invariance models were acceptable. The Δ CFIs (ranged from .000 to -.003) between the two nested models were smaller than .01, which indicated that configural, metric, and scalar invariances existed in the bi-factor CRTSS model across genders. These results suggested that all items in this scale held the same meanings and functions for males and females.

Convergent Validity

The convergent validity of the CRTSS was assessed by examining the associations of the latent variable scores of the general CRTSS factor, the three specific sub-factors of the CRTSS, and connectedness to teachers in a sample of 278 technical college students. As hypothesized, the general CRTSS factor was associated with connectedness to teacher ($r = 0.28, p < .001$), as was the emotional support sub-factor ($r = 0.36, p < .001$). No significant relationships were found between connectedness to teachers and the other two specific CRTSS sub-factors (i.e. enhancement of self-exploration and informational support).

Concurrent Validity

The concurrent validity of CRTSS was evaluated by examining the correlations among the latent variable scores of the general CRTSS factor, the three specific sub-factors, and the two selected validation variables: talent development self-efficacy (TD-SE) and career exploration self-efficacy (CE-SE) in a sample of 640 technical college students. Results showed that the scores of the emotional support factor and the general CRTSS factor were significantly associated with CE-SE ($r = .22$ & $.25, p < .001$) and TD-SE ($r = .22$ & $.25, p < .001$), while again the other two specific factors (enhancement of self-exploration and informational support) failed to do so. Results provided evidence of the concurrent validity of CRTSS.

Discussion

This two-part study in a Chinese setting was an attempt to develop an instrument that measure the career-related support from teachers. CRTSS was designed for this purpose and its psychometric properties were investigated using data from students in four technical colleges in Guangdong Province. Findings showed that the 16-item CRTSS did embody the three factors on which it was constructed (*enhancement of self-exploration, informational support, and emotional support*) and had good evidence of reliability and validity. In addition, the structure of CRTSS was best represented by a bi-factor model with a general factor of career-related teacher support and three group factors. Moreover, measurement invariance across genders (i.e. configural, metric, and scalar invariances) has been confirmed, demonstrating equal responses to the items by male and female populations.

The three-factor structure of CRTSS was identified and confirmed with the theoretical framework proposed by the authors. Although more specific for career development, it is consistent with the categories of social support (Harter, 1985; Will & Shinar, 2000) as well as teacher support for academic development (Farmer, 1985; Metheny et al., 2008). Notably, however, a bi-factor structure of CRTSS was identified and results from ancillary bi-factor measures indicated that the general career-related teacher support factor explained more common variance than the three group factors. Identified bifactor structure for CRTSS suggests that the three subscales actually measure aspects of a general CRTSS factor rather than each measuring distinctly separate factors.

This result is significant as it provides unique value of evaluating career-related teacher support in two ways. Conceptually, the results suggested that CRTSS is more likely to be unidimensional rather than multidimensional, which helps to simplify the concept of career-related teacher support. Practically, researchers could use the total (or average) score of the 16-item CRTSS when evaluating perceived career-related teacher support. Even so, the total (or average) score of each subscale could still be used as latent variable in a structural

equation modeling context separately for different research purposes as they have good evidence of reliability (McDermott et al., 2017).

Measurement invariance existed across genders, indicating that responses from males and females were reflecting the same ability when evaluating the types of perceived career-related teacher support. This result is important as it provides a measure without any bias across genders for future research and practice.

The reliability was confirmed by the Cronbach's alpha of each subscale higher than .90. The good evidence of construct validity (i.e., convergent and concurrent validities) was supported through positive associations of the general factor and a subfactor (i.e. emotional support) with validity variables (connectedness with teachers, career exploration and talent development self-efficacy) being revealed. These findings were consistent with previous research where teacher support was positively related with career decision-making self-efficacy ((Di Fabio & Kenny, 2015; Gushue & Whitson, 2006). As there was limited research on the relationship of teacher emotional support and career self-efficacy, more research is expected in a future study.

Implications

Developing CRTSS has contributed to teacher support and career development literature and practices by providing a psychometrically sound tool that can be used for evaluation of this type of support in a Chinese setting. More work on this topic could now be done using this instrument.

The scale can be used for practical purposes in counseling and career guidance with an individual student or small groups. An individual's total CRTSS score is a sufficiently reliable and valid indication of his or her feelings about the level of overall career-related teacher support received, and individual items might indicate where specific support is felt to

be lacking (McDermott et al., 2017; Rodriguez et al., 2016a). But even so the score of each subscale could also reveal useful information in individual cases (McDermott et al., 2017).

This study may provide teachers with a better understanding of how they can actively support their students in identifying their own strengths, interests and talents, exploring the requirements and situations of the job market), in making career decisions and planning (e.g., selecting relevant subjects to study and skills to acquire) (Bowers & Hatch, 2005). Teacher education and professional development programs could gain insights from the framework provided by CRTSS. Knowledge of the types of career-related teacher support that appears to be most useful should be included in all teacher training.

Limitations

Several limitations must be acknowledged in this study. First, the construction of the items in the instrument was influenced mainly by the extant literature, and this led to a focus on only three types of perceived support (Zhang et al., 2019). There may be other important forms of teacher support that are being overlooked. Further studies could focus on other types support such as instrumental support for students' detailed career planning and advice on study path.

The second limitation refers to the psychometric properties of CRTSS. For the purpose of obtaining more evidence of the reliability and validity of CRTSS, test-retest reliability and discriminant validity, which were not considered here, are worthy of exploration in the future. Additionally, the convergent and concurrent validities were evaluated using two different subgroups in this study, which may generate some variance in results. Furthermore, at the moment psychometric data have only been obtained in a Chinese setting. The instrument needs to be evaluated in other settings using cross-sectional and longitudinal designs to provide further validation evidence.

Conclusion

This study developed a scale titled Career-related Teacher Support Scale (CRTSS) in a Chinese setting. It is a 16-item scale embodying three factors, namely, enhancement of self-exploration, informational support and emotional support. A bi-factor model was found to have the best fit to the data, with a general factor and three group factors. The general factor explains more common variance, indicating CRTSS unidimensional. Measurement invariance across genders was found. Reliability, convergent and concurrent validities were assessed against suitable criterion measures. Evidence revealed that CRTSS is a valid and reliable instrument with sound reliability and validity.

References

- Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review*, 84(2), 191-215.
- Bandura, A. (1997). *Self-efficacy: The exercise of control*. Macmillan.
- Bonneville-Roussy, A., Vallerand, R. J., & Bouffard, T. (2013). The roles of autonomy support and harmonious and obsessive passions in educational persistence. *Learning and Individual Differences*, 24, 22-31.
- Bowers, J., & Hatch, P. A. (2005). *The ASCA national model: A framework for school counseling programs*. American School Counselor Association.
- Browne, M. W. (2001). An overview of analytic rotation in exploratory factor analysis. *Multivariate Behavioral Research*, 36(1), 111-150.
- Browne, M. W., & Cudeck, R. (1993). Alternative ways of assessing model fit. *Sage Focus Editions*, 154, 136.
- Burnham, K. P., & Anderson, D. R. (2004). Multimodel inference understanding AIC and BIC in model selection. *Sociological Methods & Research*, 33, 261-304.
- Byrne, B. M. (1998). *Structural Equation Modeling with LISREL, PRELIS, and SIMPLIS: Basic Concepts, Applications, and Programming*. L. Erlbaum Associates.
- Carvalho, C., Martins, D., Santana, L. E., & Feliciano, L. (2014). Teacher feedback: Educational guidance in different school contexts. *Procedia-Social and Behavioral Sciences*, 159, 219-223.
- Cheung, G. W., & Rensvold, R. B. (2002). Evaluating goodness-of-fit indexes for testing measurement invariance. *Structural Equation Modeling*, 9, 233-255.

Cho, S., Wilmer, J., Herzmann, G., Williams McGugin, R., Fiset, D., Van Gulick, A. E., ...

Gauthier, I. (2015). Item response theory analyses of the Cambridge Face Memory Test (CFMT). *Psychological Assessment, 27*, 552-566.

Cohen, S., & Wills, T. A. (1985). Stress, social support, and the buffering hypothesis. *Psychological Bulletin, 98*(2), 310-357.

Cohen, S., & Wills, T. A. (1985). Stress, social support, and the buffering hypothesis. *Psychological Bulletin, 98*(2), 310-357.

Deci, E. L., & Ryan, R. M. (1987). The support of autonomy and the control of behavior. *Journal of Personality and Social Psychology, 53*(6), 1024-1037.

Deci, E. L., & Ryan, R. M. (2000). The “what” and “why” of goal pursuits: Human needs and the self-determination of behavior. *Psychological Inquiry, 11*(4), 227-268.

Deci, E. L., Connell, J. P., & Ryan, R. M. (1989). Self-determination in a work organization. *Journal of Applied Psychology, 74*(4), 580-590.

Di Fabio, A., & Kenny, M. E. (2015). The contributions of emotional intelligence and social support for adaptive career progress among Italian youth. *Journal of Career Development, 42*(1), 48-59.

Fan, W., Hao, D., & Yuen, M. (2013). Psychometric properties of the Career and Talent Development Self-Efficacy Scale when used with Chinese university students. *Asian Journal of Counselling, 20*(1), 59-84.

Farmer, H. S. (1985). Model of career and achievement motivation for women and men. *Journal of Counseling Psychology, 32*(3), 363-390.

Farmer, H., Keane, J., Rooney, G., Vispoel, W., Harmon, L., Lerner, B., ... Maehr, M. (1981). *Career motivation and achievement planning (C-MAP)*. Measure available with scoring manual and interpretive materials from Helen S. Farmer, Department of Educational Psychology, University of Illinois.

- Fouad, N. A. (2007). Work and vocational psychology: Theory, research, and applications. *Annual Review of Psychology*, 58, 543-564.
- George, D., & Mallery, P. (2003). Reliability Analysis. In *SPSS for Windows, Step by Step: A Simple Guide and Reference* (14th ed., pp. 222-232). Allyn & Bacon.
- Gushue, G. V., & Whitson, M. L. (2006). The relationship among support, ethnic identity, career decision self-efficacy, and outcome expectations in African American high school students: Applying social cognitive career theory. *Journal of Career Development*, 33(2), 112-124.
- Gysbers, N. C., & Henderson, P. (2000). *Developing and managing your school guidance program* (3rd ed.). American Counseling Association.
- Gysbers, N. C., Heppner, M., & Johnston, J. A. (2014). *Career counseling: Holism, diversity, and strengths* (4th ed.). American Counseling Association.
- Harter, S. (1985). *Manual for the Social Support Scale for Children*. University of Denver.
- Hinton, P. R., McMurray, I., & Brownlow, C. (2014). *SPSS explained*. Routledge.
- Hirschi, A. (2009). Career adaptability development in adolescence: Multiple predictors and effect on sense of power and life satisfaction. *Journal of Vocational Behavior*, 74(2), 145-155.
- Horn, J. L. (1965). A rationale and test for the number of factors in factor analysis. *Psychometrika*, 30, 179-185.
- Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling*, 6, 1-31.
- Joyce, H. D., & Early, T. J. (2014). The impact of school connectedness and teacher support on depressive symptoms in adolescents: A multilevel analysis. *Children and youth services review*, 39, 101-107.

- Karcher, M. J. (2003). The Hemingway: Measure of adolescent connectedness: Validation studies (ERIC no. ED477969). Retrieved from <http://schoolconnectedness.com>
- Karcher, M. J. (2011). *The Hemingway: Measure of Adolescent Connectedness (Adolescent Version 5.5 and Child "Pre-Adolescent" Version 5): A Manual for Scoring and Interpretation*. San Antonio, TX: University of Texas, College of Education and Human Development. Retrieved from www.adolescentconnectedness.com
- Kenny, M. E., & Bledsoe, M. (2005). Contributions of the relational context to career adaptability among urban adolescents. *Journal of Vocational Behavior*, 66(2), 257-272.
- Kenny, M. E., Walsh-Blair, L. Y., Blustein, D. L., Bempechat, J., & Seltzer, J. (2010). Achievement motivation among urban adolescents. *Journal of Vocational Behavior*, 77(2), 205-212.
- Kozan, S., Di Fabio, A., Blustein, D. L., & Kenny, M. E. (2013). The role of social support and work-related factors on the school engagement of Italian high school students. *Journal of Career Assessment*, 22(2), 345-354.
- Lee, Q. A., & Yuen, M. (2019). The role of teacher care in determining academic success of community college students: a case study from Hong Kong. *Pastoral Care in Education*, 1-14.
- Lent, R. W. (2012). Social cognitive career theory. In S. D. Brown & R. W. Lent (Eds.), *Career Development and Counseling: Putting Theory and Research to Work* (pp.115-143). Wiley.
- Lent, R. W., Brown, S. D., & Hackett, G. (1994). Toward a unifying social cognitive theory of career and academic interest, choice, and performance. *Journal of Vocational Behavior*, 45, 79-122.
- Lent, R. W., Brown, S. D., & Hackett, G. (2000). Contextual supports and barriers to career choice: A social cognitive analysis. *Journal of Counseling Psychology*, 47, 36-49.

- Little, T. D. (1997). Mean and covariance structures (MACS) analyses of cross-cultural data: Practical and theoretical issues. *Multivariate Behavioral Research, 32*, 53-76.
- Maellaro, R., & Whittington, J. L. (2009). Management development for well-being and survival: developing the whole person. In Cooper, C. L., Quick, J. C., and Schabracq, M. J. *International Handbook of Work and Health Psychology*, 295-327.
- Marsh, H. W., Hau, K. T., & Wen, Z. (2004). In search of golden rules: Comment on hypothesis-testing approaches to setting cutoff values for fit indexes and dangers in overgeneralizing Hu and Bentler's (1999) findings. *Structural equation modeling, 11*(3), 320-341.
- Marsh, H. W., Hau, K.-T., & Grayson, D. (2005). Goodness of Fit in Structural Equation Models. In A. Maydeu-Olivares & J. J. McArdle (Eds.), *Multivariate applications book series. Contemporary psychometrics: A festschrift for Roderick P. McDonald* (pp. 275-340). Lawrence Erlbaum Associates.
- McCoach, D. B., Gable, R. K., & Madura, J. P. (2013). *Instrument Development in the Affective Domain: School and Corporate Applications*. Springer.
- McDermott, R. C., Levant, R. F., Hammer, J. H., Hall, R. J., McKelvey, D. K., & Jones, Z. (2017). Further examination of the factor structure of the Male Role Norms Inventory-Short Form (MRNI-SF): Measurement considerations for women, men of color, and gay men. *Journal of Counseling Psychology, 64*(6), 724-738. Doi:10.1037/cou0000225
- McWhirter, E. H. (1996). *Teacher Support Scale (TSS)*. Unpublished measures.
- McWhirter, E. H., Hackett, G., & Bandalos, D. L. (1998). A causal model of the educational plans and career expectations of Mexican American high school girls. *Journal of Counseling Psychology, 45*(2), 166-181.

- McWhirter, E. H., Rasheed, S., & Crothers, M. (2000). The effects of high school career education on social–cognitive variables. *Journal of Counseling Psychology, 47*(3), 330-341.
- Metheny, J., McWhirter, E. H., & O’Neil, M. E. (2008). Measuring perceived teacher support and its influence on adolescent career development. *Journal of Career Assessment, 16*(2), 218-237.
- Moore, J. L. (2006). A qualitative investigation of African American males’ career trajectory in engineering: Implications for teachers, school counselors, and parents. *Teachers College Record, 108*(2), 246-266.
- Mortimer, J. T., Zimmer-Gembeck, M. J., Holmes, M., & Shanahan, M. J. (2002). The process of occupational decision making: Patterns during the transition to adulthood. *Journal of Vocational Behavior, 61*(3), 439-465.
- Muthén, L., & Muthén, B. O. (1998–2015). Mplus Version 7.4. Available from: <http://www.statmodel.com..>
- O’Connor, B. P. (2000). SPSS and SAS programs for determining the number of components using parallel analysis and Velicer’s MAP test. *Behavior Research Methods, Instruments, & Computers, 32*, 396-402.
- Perry, J. C., Liu, X., & Pabian, Y. (2010). School engagement as a mediator of academic performance among urban youth: The role of career preparation, parental career support, and teacher support. *The Counseling Psychologist, 38*(2), 269-295.
- Pianta, R. C., Paro, L., & Hamre, B. K. (2008). *Classroom assessment scoring system (CLASS) Manual: Pre-K*. Brookes.
- Quintana, S. M., & Maxwell, S. E. (1999). Implications of recent developments in structural equation modeling for counseling psychology. *The Counseling Psychologist, 27*(4), 485-527.

- Reis, S. M., & Renzulli, J. S. (2004). Current research on the social and emotional development of gifted and talented students: Good news and future possibilities. *Psychology in the Schools, 41*(1), 119-130.
- Reise, S. P. (2012). The rediscovery of bi-factor measurement models. *Multivariate Behavioral Research, 47*(5), 667-696.
- Reise, S. P., Morizot, J., & Hays, R. D. (2007). The role of the bi-factor model in resolving dimensionality issues in health outcomes measures. *Quality of Life Research: An International Journal of Quality of Life Aspects of Treatment, Care and Rehabilitation, 16*, 19-31.
- Rodriguez, A., Reise, S. P., & Haviland, M. G. (2016a). Applying bi-factor statistical indices in the evaluation of psychological measures. *Journal of Personality Assessment, 98*(3), 223-237.
- Rodriguez, A., Reise, S. P., & Haviland, M. G. (2016b). Evaluating bi-factor models: Calculating and interpreting statistical indices. *Psychological Methods, 21*(2), 137-150.
- Santana Vega, L. E., Feliciano Garcia, L., & Jimenez Llanos, A. B. (2016). Perceived family support and the life design of immigrant pupils in secondary education. *Revista de Educación, (372)*, 35-62.
- Sarason, I. G., Sarason, B. R., Shearin, E. N., & Pierce, G. R. (1987). A brief measure of social support: Practical and theoretical implications. *Journal of Social and Personal Relationships, 4*(4), 497-510.
- Savickas, M. L. (2005). The theory and practice of career construction. In R. W. Lent & S. D. Brown (Eds.), *Career development and counseling: Putting theory and research to work* (pp. 42-70). John Wiley & Sons.
- Savickas, M. L. (2012). Career construction theory and practice. In S. D. Brown & R. W. Lent (Eds.), *Career Development and Counseling: Putting Theory and Research to Work*

(pp. 147-183). Wiley.

- Schermelleh-Engel, K., Moosbrugger, H., & Müller, H. (2003). Evaluating the fit of structural equation models. *Methods of Psychological Research Online*, 8, 23-74.
- Schlomer, G. L., Bauman, S., & Card, N. A. (2010). Best practices for missing data management in counseling psychology. *Journal of Counseling psychology*, 57(1), 1.
- Tardy, C. H. (1985). Social support measurement. *American Journal of Community Psychology*, 13(2), 187-202.
- van de Pol, J., Volman, M., & Beishuizen, J. (2011). Patterns of contingent teaching in teacher-student interaction. *Learning and Instruction*, 21(1), 46-57.
- Will, T.A. & Shinar O. (2000). Measuring perceived and received social support. In Cohen, S., Underwood, L.G., & Gottlieb, B. H. (Eds.), *Social Support Measurement and Intervention : A Guide for Health and Social Scientists:* (86-135). Oxford, U.K. : Oxford University Press.
- Yuen, M. (2011). Fostering connectedness and life skills development in children and youth: International perspectives. *Asian Journal of Counselling*, 18(1), 1-14.
- Yuen, M., Gysbers, N. C., Chan, R. M., Lau, P. S., & Shea, P. M. (2010). Talent development, work habits, and career exploration of Chinese middle-school adolescents: Development of the career and talent development self-efficacy scale. *High Ability Studies*, 21(1), 47-62.
- Yuen, M., Lau, P. S. Y., Leung, T. K. M., Shea, P. M. K., Chan, R. M. C., Hui, E. K. P., & Gysbers, N. C. (Eds.). (2003). *Life skills development and comprehensive guidance program: Theories and practices*. University of Hong Kong Faculty of Education Life Skills Development Project.

- Zikic, J., & Klehe, U. C. (2006). Job loss as a blessing in disguise: The role of career exploration and career planning in predicting reemployment quality. *Journal of Vocational Behavior, 69*(3), 391-409.
- Zhang, J., Yuen, M. & Chen, G. (2019). Supporting the career development of technical college students in China: The roles played by teachers. *International Journal for Educational and Vocational Guidance*. DOI: 10.1007/s10775-019-09398-z
- Zhang, J., Yuen, M., & Chen, G. (2018). Teacher Support for Career Development: An Integrative Review and Research Agenda. *Career Development International, 23* (2): 122-144. <https://doi.org/10.1108/CDI-09-2016-0155>
- Zhang, Q. (2006). Immediacy and out-of-class communication: A cross-cultural comparison. *International Journal Of Intercultural Relations, 30*(1), 33-50.

Table 1
Career-related Teacher Support Scale: factor loadings from the EFA (Study One, N = 462), CFA and I-ECV (Study Two, N = 1212).

Factors and Items	EFA			CFA ^a				I-ECV
				F1	F2	F3	G	
Factor 1: enhancement of self-exploration								
My teacher will oftenb:								
1. Help me identify my strengths and weaknesses.	0.75	-0.03	0.12	0.52	0	0	0.45	0.64
2. Help me develop my career values.	0.84	0.03	0.01	0.67	0	0	0.50	0.49
3. Help me explore my career interests.	0.86	-0.01	0.08	0.72	0	0	0.51	0.46
4. Help me develop my professional skills.	0.81	0.08	0.01	0.70	0	0	0.51	0.50
5. Guide me to explore the outside world of work (e.g., professional categories, characteristics, and requirements of the profession, career paths, etc.).	0.59	0.23	-0.08	0.47	0	0	0.57	0.75
6. Help me analyze which job position is suitable for me.	0.64	0.07	0.00	0.45	0	0	0.54	0.75
Factor 2: informational support								
7. Explain to me the prospects of my profession.	0.01	0.69	0.16	0	0.44	0	0.82	0.61
8. Explain to me possible career paths of related positions.	-0.04	0.75	0.16	0	0.33	0	0.84	0.62
9. Explain to me the requirements of some job positions.	0.07	0.83	0.00	0	0.06	0	0.81	0.72
10. Give me tips and tricks for workplace situations.	0.02	0.83	0.03	0	-0.14	0	0.83	0.78
11. Provide me with employment information.	0.09	0.76	-0.02	0	-0.10	0	0.82	0.82
Factor 3: emotional support								
12. Hope that I can have good career prospects.	0.00	0.10	0.72	0	0	0.44	0.60	0.82
13. Believe that I am qualified for the work they assign to me.	-0.02	0.16	0.73	0	0	0.65	0.54	0.58
14. Believe that I can successfully finish the tasks (e.g. finish homework, organizing activities, and participating competitions)	0.06	-0.02	0.86	0	0	0.72	0.55	0.50
15. Believe that I can make good plans for my future.	0.05	0.00	0.86	0	0	0.64	0.56	0.62
16. Give me a lot of confidence for my career development.	0.01	0.06	0.82	0	0	0.55	0.57	0.73

Note. a. All factor loadings in the CFA were significant ($p < .001$) except TS32; b. The Chinese version of CRTSS is showed in Appendix 2. I-ECV: the individual item explained common variance; G: general factor.

Table 2
Descriptive statistics, reliability coefficients, and correlations of the 16-item Career-related Teacher Support Scale Subscales – Study One (N = 462) and Study Two (N = 1212).

	Study one					Study two		
	1	2	Mean	SD	Alpha	Mean	SD	Cronbach's Alpha
1. Enhancement of self-exploration	-	-	18.28	5.41	.92	16.44	4.98	.90
2. Informational support	.54*	-	17.14	4.48	.92	16.27	4.67	.92
3. Emotional support	.42*	.54*	18.71	4.58	.92	16.87	4.83	.91

Note. * $p < .05$.

Table 3

Measurement model indices of fit.

Model	Chi-square	<i>df</i>	CFI	Δ CFI	TLI	RMSEA	RMSEA 90% CI	SRMR	AIC	BIC
Correlational	732.29***	101	0.955		0.947	0.072	0.067 0.077	0.044	43766.08	44026.18
Bi-factor-orthogonal	350.99***	88	0.981		0.975	0.050	0.044 0.055	0.052	43410.77	43737.18
Configural invariance ^a	492.40***	176	0.978	-.003	0.969	0.055	0.049 0.061	0.051	42252.16	42902.08
Metric invariance ^a	515.64***	204	0.978	.000	0.974	0.051	0.045 0.056	0.054	42219.40	42727.15
Scalar invariance ^a	539.45***	216	0.977	-.001	0.975	0.050	0.045 0.056	0.055	42219.21	42666.03

a. The total sample size was 1185, with 686 males and 499 females.

Note. CFI: comparative fit index; RMSEA: root mean square error of approximation; SRMR: standardized root mean square residual. TLI: Tucker-Lewis index.

*** $p < .001$.

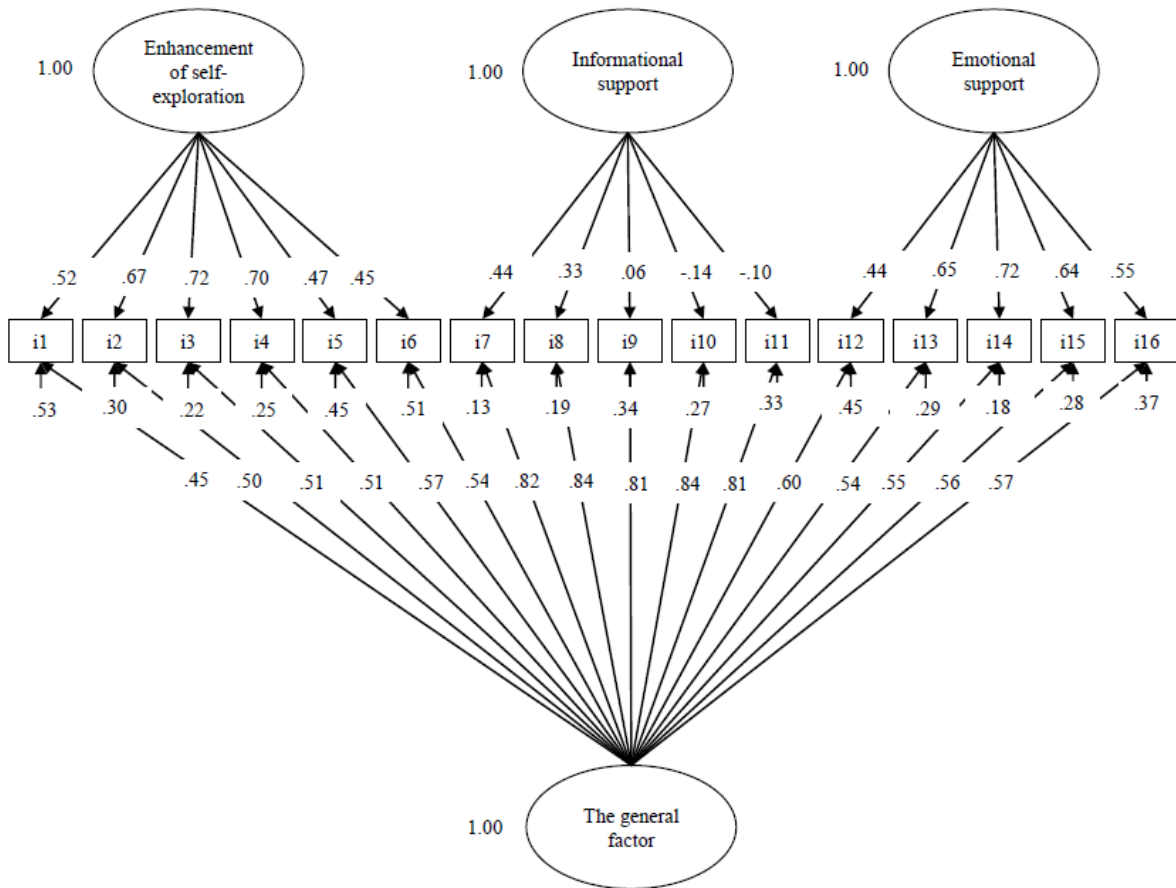


Figure 1. The bi-factor model of the Career-related Teacher Support Scale

Appendix 1. *Career-related Teacher Support Scale – English Version*

Each item is started with a sentence of “My teachers at my school/college/university...”. The answers are:

1. Never; 2. Rarely; 3. Sometimes; 4. Often; 5. Always.

Factor 1: enhancement of self-exploration

My teachers at my school/college/university ...

1. Help me identify my strengths and weaknesses.
2. Help me develop my career values.
3. Help me explore my career interests.
4. Help me develop my professional skills.
5. Guide me to explore the outside world of work (e.g., professional categories, characteristics, and requirements of the profession, career paths, etc.).
6. Help me analyze which job position is suitable for me.

Factor 2: informational support

My teachers at my school/college/university ...

7. Explain to me the prospects of my profession.
8. Explain to me possible career paths of related positions.
9. Explain to me the requirements of some job positions.
10. Give me tips and tricks for workplace situations.
11. Provide me with employment information.

Factor 3: emotional support

My teachers at my school/college/university ...

12. Hope that I can have good career prospects.
13. Believe that I am qualified for the work they assign to me.
14. Believe that I can successfully finish the tasks (e.g. finish homework, organizing activities, and participating competitions)
15. Believe that I can make good plans for my future.
16. Give me a lot of confidence for my career development.

Note. The English Version of Career-related Teacher Support Scale hasn't been validated. Only the Chinese version was validated in this study.

Appendix 2. *Career-related Teacher Support Scale – Chinese Version*

教師對學生職業發展的支持量表

請閱讀每道題。每道題均以“我學校的老師.....”開始。圈出最能描述你的老師對你的支援的頻率。答案為：1. 從不；2. 很少；3. 有時；4. 經常；5. 總是。

因素一：職業探索上的支持

我學校的老師.....

- 1 幫助我分析我的優勢與(或)不足。
- 2 幫助我探索我的職業價值觀。
- 3 幫助我探索我的職業興趣。
- 4 幫助我探索我的職業能力。
- 5 引導我探索外面的職場世界（如：職業類別、行業特點與需求、職業發展路徑等）。
- 7 幫助我分析什麼崗位適合我。

因素二：資訊上的支援

我學校的老師.....

- 30 向我講解與本專業相關的職業的發展前景。
- 31 向我介紹相關職業的發展路徑。
- 32 向我講解某些工作崗位的要求。
- 33 給我講解步入職場的注意事項。
- 34 向我提供就業相關的資訊。

因素三：情感上的支持

我學校的老師.....

- 64 希望我有良好的職業發展。
- 65 相信我能勝任其交給我的工作。
- 66 相信我能出色完成任務（如：完成作業、策劃活動、參與比賽等）。
- 67 相信我能規劃好自己的未來。
- 68 在我的職業發展道路上，老師給了我很大的自信心。