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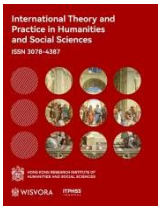

Exploring the Relationship between Secondary Vocational Students' Perceived Psychological Needs and Autonomous Learning Motivation

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Abstract

This study examines the relationship between secondary vocational students' perceived psychological needs and their autonomous learning motivation. Drawing on Self-Determination Theory (SDT), the research investigates how the basic psychological needs influence students' autonomous motivation. Using a mixed-methods approach, the study first employs qualitative research to explore the perceived psychological needs and manifestations of autonomous learning motivation among secondary vocational students. Subsequently, quantitative research is conducted to validate the qualitative findings and further explore the relationships between these variables. The results of reveal that vocational students perceive relatedness and competence as significant psychological needs that influence their autonomous learning motivation, while autonomy is not perceived as a prominent need. The study also identifies three dimensions of autonomous learning motivation among vocational students: interest in learning, post-graduation development, and passing school exams. Multiple regression analysis shows that perceived psychological needs have a significant positive predictive effect on autonomous learning motivation, with peer influence in the class having the highest explanatory power. The findings contribute to the cross-cultural application of SDT and provide practical insights for teachers to stimulate students' autonomous learning motivation by addressing their psychological needs.

1. Introduction

Autonomous motivation, as a key concept within Self-Determination Theory (SDT), has garnered increasing attention in recent years. According to SDT, autonomous motivation encompasses intrinsic motivation, identification regulation, and integration regulation. Intrinsic motivation refers to engaging in activities "for one's own sake" or for the inherent interest and enjoyment they provide. Identification motivation is when individuals consciously identify with or personally endorse the value of an activity, experiencing a relatively high degree of volition or willingness to act; integration motivation occurs when individuals not only recognize and identify with the value of the activity but also find it to be consistent with their other core interests and values (Deci & Ryan, 2000).

Autonomous motivation has been considered by many research papers (Cheon et al., 2020; Vansteenkiste et al., 2020) as one of the most important types of motivation for successful learning. The characteristics of autonomous motivation are evident because it originates from individuals with autonomous motivation engage in learning activities with a full sense of willingness, volition, and awareness of choice. Controlled motivation reflects behavior that

learners persist in due to external pressure, and it does not reflect behavior generated by personal willingness or choice, hence its learning outcomes are comparatively poorer than those driven by autonomous motivation (Mouratidis et al., 2021). For a variety of reasons, there is a need for more research to better understand how autonomous motivation is formed in order to promote students' more autonomous learning.

2. Literature Review

SDT posits that people have a tendency to learn, and that there are three basic psychological needs that can sustain this tendency: the need for autonomy, competence and relatedness (Ryan et al., 2019; Ryan & Deci, 2020). Autonomy involves initiative and a sense of ownership in one's actions, supported by interest and the experience of value. Competence is a sense of mastery, a feeling of being effective and growing. Finally, relatedness involves a sense of belonging and connection, which is satisfied by the communication of respect and caring.

Existing research papers have discussed the positive correlation between the three basic psychological needs and autonomous motivation. For instance, a study on Greek junior high school students found a positive relationship between the satisfaction of the three psychological needs and autonomous motivation (Mouratidis et al., 2015), indicating that the more students feel they have met their needs for autonomy, competence, and relatedness, the stronger their autonomous motivation is. This perspective has been supported by findings that show how physical education teachers can promote the motivation for autonomous participation in learning among Greek elementary school students by satisfying their psychological needs during everyday teaching processes (Rutten et al., 2012). Other papers have directly demonstrated that psychological needs can directly predict autonomous motivation (Jang et al., 2009; Joe et al., 2017; Zamarripa et al., 2021), although the predictive power of each of the three needs for autonomous motivation is not the same. For example, some studies have found that the association between middle and elementary school students' perceived support from mathematics teachers and their effort in homework is mediated by autonomous motivation for homework, suggesting that relatedness has the strongest predictive power for autonomous motivation (Chen et al., 2021; Gråstén et al., 2021).

The individual relationships between each psychological need and autonomous motivation have also received attention, but there is no complete consensus. First, regarding the discussion of the relationship between autonomous motivation and autonomy, some studies have found that the satisfaction of autonomy can generate autonomous motivation. For example, in a study involving Lithuanian primary and secondary school students, researchers found that a high level of satisfaction of the need for autonomy leads to autonomous motivation, regardless of whether the need for competence is met (Raiziene et al., 2018). However, there are also studies that present opposing views. For instance, in a study on Turkish high school students, researchers found that there was no statistically significant difference in the positive prediction of autonomy for autonomous motivation (Durmaz & Akkuş, 2016). The reason for this discrepancy: although measures of autonomy support provided by teachers can promote students' academic performance (Feng et al., 2019), not all of these measures are effective (Admiraal et al., 2022). Secondly, in the discussion of the relationship between autonomous motivation and relatedness, there is also controversy. For example, for elementary school students, relatedness plays a very important role in their academic performance, and therefore close relationships with peers can help improve their motivation to learn (Furrer & Skinner, 2003). In contrast, although students feeling that their need for connection with teachers is met may participate in learning, empirical evidence has not

been found for its impact on the intrinsic motivation of secondary school physical education students (Xiang et al., 2017). Third, forming a unified conclusion about the relationship between autonomous motivation and competence is also difficult. Some studies have found a positive relationship between autonomous motivation and competence for subjects like reading and mathematics (Pollack et al., 2021), meaning that as competence increases or is frustrated, intrinsic motivation also correspondingly increases or weakens. However, there are also studies that suggest the positive relationship between the two can be affected by the subject matter. For example, a study on Chinese university students found that in the same course, competence frustration weakened students' intrinsic motivation. But there was a U-shaped curve relationship between competence frustration in a previous course and intrinsic motivation in a subsequent course. That is to say, if students' sense of competence frustration in the previous course was not too great, it would not have a direct impact on the intrinsic motivation for the subsequent course (Fang et al., 2017).

By reviewing existing research, this study gives rise to two questions. First, does SDT manifest similarly in specific populations? Analyzing the studies above, it can be seen that while the three basic psychological needs can predict the emergence of autonomous motivation, research on different groups can lead to varying conclusions. Cross-cultural researchers have questioned whether the motivation described by the basic needs theory is applicable to students in cultures with different cultural values, and have even explicitly stated that the fundamental claims of SDT do not apply to students from Eastern cultures (Jang et al., 2009). Different student groups, influenced by different cultures, perceive psychological needs differently. For example, compared to Chinese elementary school students, American elementary school students might perceive controlling teachers as more harmful (Vansteenkiste et al., 2020), which would affect their basic psychological needs and subsequently weaken their motivation. Therefore, it is necessary to discuss: For specific student groups, what basic psychological needs do they perceive? Can they predict autonomous motivation? And how do the former influence the latter?

Second, regarding the measurement of autonomous motivation. Many studies have used the "Relative Autonomy Index" (RAI) as an indicator to represent the degree of autonomous motivation in research (Vallerand et al., 1997), with the calculation formula being RAI = [(2 × intrinsic motivation) + identified regulation] - [introjected regulation + (2 × external motivation)]. It is evident that the calculation of this index requires the simultaneous measurement of both autonomous and controlled motivation. To measure these two types of motivation, many scales (Ryan & Connell, 1989; Vallerand et al., 1992; Goudas et al., 1995; Lonsdale et al., 2011) have been employed in various studies. However, the impact of this calculation on the "autonomous and controlled motivation" versus "pure autonomous motivation" is not the same, and it may affect the relationships between variables involved in the research. Therefore, it is worth considering the study of "pure autonomous motivation" in research (Wang et al., 2023). Existing research lacks attempts to construct measurement variables for pure autonomous motivation using SDT. Additionally, the practice of using existing motivational measurement tools without considering the differences between different populations (Kenneth et al., 2012) suggests a need for the development of measurement tools for autonomous learning motivation tailored to specific groups to uncover their unique characteristics.

In China, existing research has discussed the impact of factors such as gender, major, and academic performance on the learning motivation of vocational students (Zhang & Leng, 2017), but it has overlooked entrance examination scores. The results of large-scale exams can serve as a criterion for determining whether students can advance to a higher level of school (Cheng & Fox,

2017), and China's Zhongkao (high school entrance examination) exemplifies this point. Taking Shanghai as an example, the Shanghai Municipal Education Commission sets a cutoff score for admission to regular high schools based on the results of all students taking the Zhongkao—only students with a total score above this determined threshold have the opportunity to study in a regular high school. If a student's score falls below this mark, they must choose to enter a vocational school. In Shanghai, China, about 40% of junior high school graduates enter vocational schools, constituting a relatively large student population. Differences in entrance examination scores represent varying academic foundations among students, which can lead to differences in their learning performance. For instance, existing research has shown that vocational students perform lower than regular high school students in mathematics (Xie et al., 2020). However, not all students in vocational schools have poor grades; many students score above the cutoff for regular high schools but still choose to attend vocational schools. This is because there are two special educational tracks: "Vocational to Higher Education" (students study for three years in a vocational school and then for two years in a college, receiving both a college and a vocational diploma upon graduation) and "Vocational to Bachelor's Degree" (students study for three years in a vocational school and then for four years in an applied undergraduate program, receiving both an undergraduate and a vocational diploma upon graduation). Within such a diverse group with a wide range of entrance examination scores, will students' autonomous learning motivation differ as a result? There is a lack of empirical research on this group of students.

In addition, opinions vary on the performance of autonomous learning motivation among Chinese vocational students. Due to some students' poor learning foundations, which lead to a lack of engagement in their studies (Cui & Zhang, 2018), their autonomous learning motivation is affected. Research papers in China have been paid attention to the autonomous learning situation of this group, and it has been proven that there are issues such as low levels of learning motivation or passive learning (Zhang & Liang, 2015; Ding, 2018; Cui & Chen, 2019; Chen et al., 2022), with one study directly pointing out that 77% of vocational students do not study due to academic disengagement (Luo et al., 2018). Based on these views, it seems that most vocational students lack autonomous learning motivation. However, there are studies that contradict these conclusions, suggesting that the majority of vocational students enjoy learning and are able to study actively (Xiang et al., 2014). Furthermore, research has analyzed the reasons why vocational students study actively, such as a 2023 study of 10,660 vocational students in China that found 91.9% of vocational students have the desire to pursue further education, and students with higher academic self-efficacy are more willing to study actively for the sake of advancement, as this can help them find good jobs in the future (Li & Yang, 2023). In light of these contradictions, it is necessary to consider: What does autonomous motivation look like for vocational students in their studies? How should it be measured? According to SDT theory, it is also necessary to pay attention to the relationship between these students' perceived psychological needs and their autonomous learning motivation to help them study more actively and achieve their developmental goals. To answer this question, more empirical research is needed to explore these issues. Currently, research on these questions is insufficient, so this study focuses on the following three specific questions:(1)How do vocational students perceive the three psychological needs?(2)How is the autonomous learning motivation of vocational students structured?(3)What is the relationship between the psychological needs and autonomous motivation of vocational students?

To better explore the psychological needs and the manifestation of autonomous learning

motivation among vocational students, and to enhance the relevance of SDT to this group, this study employs a mixed-methods approach. Firstly, qualitative research methods are utilized. An open-ended questionnaire is administered, in which students are asked to write down the reasons why they engage in learning. Subsequently, these textual materials are subjected to thematic analysis to categorize the responses and develop items. In the second phase, quantitative research methods are applied: The items generated from the qualitative phase are compiled into a student questionnaire. The questionnaire is then distributed, and the collected data are analyzed to investigate the relationships between variables. The mixed-methods approach allows for a comprehensive understanding of the research questions, combining the in-depth insights from qualitative data with the broader patterns revealed by quantitative analysis.

3. Stage One: Qualitative Research

3.1 Participants

A total of 118 secondary vocational school students participated in this study. They came from four classes in four different majors at a key secondary vocational school in Shanghai, China. Most of the students were between the ages of 16 to 18, with approximately 50% being female and about 50% having not achieved the score required to attend a regular high school on their middle school exit examination. All participants were students at the school and had been studying there for more than a semester.

3. 2 Instrument

An open-ended questionnaire was used to ask students to respond to this question " Why do vocational school students study?". Since SDT defines motivation as the reason or rationale for behavior (Deci & Ryan, 2000), the use of "why" is intended to uncover students' motivations for autonomous learning. Considering that questions posed in the first or second person might make vocational students feel anxious and hide their true thoughts, third person perspective was used. The questionnaire suggests that students provide at least three reasons for their answer, which is beneficial for providing ample information for subsequent analysis. However, responses with fewer than three reasons or more than three are also acceptable.

3.3 Data collection and analysis

Qualitative data were collected through written statements from participants in response to the question "Why do vocational students study?" To delve into the characteristics of this group of vocational students, this paper aggregates the results from all 118 participants to establish a broader database for analysis and to enhance the credibility of the findings. Specifically, participants were asked to respond to the following question: "Why do vocational school students study? Please list three or more reasons that come to your mind." Considering the educational background of vocational students, this open-ended question does not specify a word count requirement. To encourage students to speak freely, the open-ended questionnaire was also conducted anonymously.

All written reports were collected in paper form from the participants during a class meeting, where they were guided by their teacher to fill out the reports uniformly. The content of the self-reports was then transcribed into electronic text for analysis. These reports reflect the forms in which participants perceived their psychological needs to be met and the manifestations of their autonomous learning motivation. 118 reports were collected, which included a total of 394 items, as some students did not list three reasons, but each report contained at least one reason.

The results reflect content related to the satisfaction of basic psychological needs and the motivation for autonomous learning.

This study employed thematic analysis to examine the 118 self-reports. The thematic analysis was used to derive themes. 394 items were read and then conducted preliminary coding. Subsequently, these codes were refined and grouped to form themes. Finally, these themes were reviewed, named, and defined. Since the aim was to analyze the students' perceived psychological needs and the manifestations of autonomous motivation, we constructed a coding system that aligned with the definitions of the three basic psychological needs in SDT and the definition of autonomous motivation. This system was used to categorize and organize the 394 specific items, ultimately resulting in two sets of coding systems, corresponding to the students' perceived psychological needs and autonomous learning motivation, respectively.

3.4 Results

As shown in Tables 1 and 2, the themes emerging from the open-ended questionnaire were categorized according to our research questions 1 and 2: students' perceptions of basic psychological needs, and the manifestations of autonomous learning motivation. It can be observed that students perceived two types of psychological needs that promote autonomous learning motivation: relatedness (peer influence in the class and teacher-student relationship) and competency (receiving learning support). Although the number of variables representing the two types of psychological needs differs, students reported two variables representing relatedness and one variable representing competency, this does not necessarily indicate that the former has a greater impact on autonomous learning motivation than the latter. This relationship requires further validation through subsequent quantitative research.

3.4.1 Secondary Vocational Students' Perceived Psychological Needs

In the variable of ***Peer influence*** in the class, most students described how the learning status of other classmates stimulated their own learning. Students tend to study when they find that the majority of their peers are engaged in learning, when someone becomes a role model due to their good academic performance, and when they feel the sense of academic competition. The ***Teacher-Student Relationship*** variable refers to students studying because of their positive relationship with teachers. When students perceive the charisma of the teacher and receive kindness from them, they tend to like the teacher and establish a good relationship with them. This positive teacher-student relationship becomes one of the reasons for students to study actively. The ***Receiving Learning Help*** variable indicates that when students encounter difficulties in learning and receive help from teachers, classmates, friends, and other sources, they are motivated to study. As previously mentioned, many secondary vocational students have a relatively weak academic foundation upon enrollment, leading to insufficient learning capabilities. Various forms of assistance enhance students' ability to cope with learning difficulties, thereby encouraging them to study actively and autonomously.

Table 1 Themes of psychological basic needs

Categories	Theme	Description of the theme
	Peer influence in the classroom	In the class, the majority of students are studying.
		Taking high-achieving students as role models.
		Feeling the sense of academic competition.
		Will learn the content taught by teachers with whom they have a good relationship.

Psychological basic needs	Teacher-student relationship	Do not want to damage relationship with the teacher and therefore study. May study due to perceiving the teacher's kindness towards me. May study because I like a humorous and witty teacher May study because I like a good-looking teacher
	Receiving help	May study because of receiving help from students May study because of receiving tutoring from teachers May study because of receiving help from friends If some kind of help is available when encountering learning difficulties, students will engage in studying.

3.4.2 The manifestations of autonomous learning motivation among vocational high school students

According to SDT, ***autonomous learning motivation*** refers to the self-regulated drive to engage in learning activities that stems from intrinsic interest, personal values, and a sense of volition. This type of motivation contrasts with controlled motivation, as it reflects a genuine internalization of learning goals and a willingness to engage in learning for its inherent satisfaction or alignment with personal aspirations. The autonomous learning motivation of vocational high school students can be represented by three variables: "interest in learning," "post-graduation development," and "passing school exams." ***Interest in learning*** refers to vocational students who study because they are interested in the curriculum or topics, or who are willing to learn in a relaxed and enjoyable classroom atmosphere. This aligns with the concept of intrinsic motivation as a form of autonomous motivation in SDT. ***Post-graduation development*** refers to vocational students who are willing to study in order to graduate smoothly, gain opportunities for college admission, and secure good jobs. ***Passing school exams*** refers to students who study in order to pass various exams at school, including mid-term and final exams. They proactively learn because they need to pass the exams, thus willing to study the content taught by teachers that is related to the exams. It should also be noted that although both "post-graduation development" and "passing school exams" mention exams, there is a distinction between the two. The exams mentioned in the latter are those taken by students in vocational schools with questions set by their teachers, while the former refers to exams organized by external bodies. For example, the college entrance examination, which vocational students can take, is organized by the Shanghai Education Administrative Department, not the school itself.

Table 2 Themes of autonomous learning motivation

Categories	Theme	Description of the theme
Autonomous	Learning interest	Learning interesting courses. Topics that spark interest. May study under a relaxed and lively classroom atmosphere.
	Post-graduation	If there is a possibility of taking the college entrance examination for professional advancement in the future, students will study.

learning motivation	development	Students will study in order to find a good job in the future. Students study to graduate smoothly and obtain a diploma. Students will study in order to pass vocational college entrance examination
	Passing school exams	Passing the mid-semester exam. Passing the final exam. When students know that a certain exam is very important, they will study to pass it. Students will study the content that teachers mention and is related to the exam.

4. Stage Two: Quantitative Research

4.1 Participants and procedures

540 participants were drawn from different classes of a secondary vocational school in Shanghai. There were 201 girls (37.2%) and 339 boys (62.8%) among the participants. The number of students from the first, second, and third grades were 177 (32.8%), 246 (45.6%), and 117 (21.7%) respectively. All students had been studying at the school for more than half a year. Two measures were taken to reduce potential social desirability bias. On one hand, the survey was conducted anonymously, with no collection of any personal identification information. On the other hand, we emphasized that the survey data would be used solely for research purposes. We also highlighted the importance of providing genuine answers.

4.2 Instruments

Students' perception of their basic psychological needs was measured using a self-developed scale. The items of this scale were adapted from the conclusions of qualitative research and included three dimensions: peer influence in the class, teacher-student relationship, and receiving help, comprising a total of 12 items.

Autonomous learning motivation was also measured using a self-developed scale. The items of this scale were adapted from the conclusions of qualitative research and included three dimensions: interest in learning, post-graduation development, and passing school exams, comprising a total of 11 items.

In this study, all items used were based on a 7-point Likert scale, ranging from 1 point (strongly disagree) to 7 points (strongly agree).

4.3 Data analysis

Step 1: check for missing values in the data. To ensure data quality, this study deleted questionnaires with more than one incomplete item, resulting in the removal of 15 data points, and retained 540 questionnaires for analysis.

Step 2: validate the structural validity and reliability of the constructs “Perceived Psychological Needs” and “Autonomous Learning Motivation”. This analysis, together with the results of qualitative research, addressed the first and second research questions. Confirmatory factor analysis (CFA) was conducted using Mplus 8. Factor loadings, composite reliability scores, and fit statistics were analyzed to ensure the construct validity of the measurements. Due to the higher-order factor in the concept of autonomous learning motivation, a second-order CFA was performed on the measurement model. Various fit indices were used to assess the structural

relationships of the proposed model. In addition to the relative variance test, the following fit indices were prioritized in model evaluation: comparative fit index (CFI), root mean square error of approximation (RMSEA), and standardized root mean square residual (SRMR). According to Wang (2014), a CFI of 0.9 or higher, an RMSEA of 0.1 or lower, and an SRMR of 0.08 or lower are considered acceptable for model fit. To validate the internal consistency of the two constructs, the Cronbach's alpha coefficient was used as the criterion: an alpha greater than 0.7 is considered to indicate acceptable internal consistency (Wu, 2010).

Step 3: using SPSS 27 for multiple regression analysis, explore the relationship between perceived psychological needs and autonomous learning motivation. This analysis addressed the third research question. The students' perception of the satisfaction of their psychological needs was used as the independent variable (predictor), while their demonstrated autonomous learning motivation was considered the dependent variable.

4.4 Results

4.4.1The results of psychological needs

The means, standard deviations, skewness, and kurtosis coefficients for the three psychological need variables are presented in Table 3. The means for each item range from 4.46 (E17) to 5.72 (F24). It can be observed that the scores for most items are above the midpoint, indicating that students are able to perceive the psychological needs expressed in the items as being satisfied. The skewness coefficients for each item range from -1.18(C9) to -0.32 (E17), and the values of the kurtosis coefficients range from -0.36 (E17) to 1.19 (C9) , which basically conforms to the normal distribution. According to existing research, when absolute values of skewness coefficients are less than 2 and kurtosis coefficients are less than 7, the use of ML estimation is robust (West et al., 1995; Finney & Distefano, 2013). Therefore, it is acceptable to use ML estimation in subsequent CFA analyses.

Table 3 Descriptive statistics of psychological needs

Item	Mean	Std.	Skewness	Kurtosis
C9	5.69	1.40	-1.18	1.19
C10	5.28	1.59	-0.70	-0.32
C11	5.54	1.46	-1.01	0.60
E16	4.91	1.59	-0.62	-0.08
E17	4.46	1.64	-0.32	-0.36
E18	5.13	1.47	-0.76	0.45
E19	5.18	1.50	-0.78	0.37
F21	5.10	1.61	-0.76	0.12
F23	5.35	1.54	-0.87	0.28
F24	5.72	1.41	-1.17	1.12

The CFA results (see Table 4) indicate Chi-square (32, N = 540) = 93.761($p < .001$), CFI = 0.983, RMSEA = 0.060 (95% CI = [0.046, 0.074]), SRMR = 0.026. The model fit indices are ideal, and the internal consistency is greater than 0.8 for all factors, indicating that the psychological need factor model has good reliability and validity. This conclusion provides data support for the rationality of the perceived psychological need structure of vocational school students as identified through interviews.

Table 4 Results of CFA and internal consistency of psychological needs

Construct	Standardized factor loading

mca (Cronbach's alpha =0.89)	
C9	0.87
C10	0.88
C11	0.83
mh(Cronbach's alpha =0.894)	
E16	0.83
E17	0.66
E18	0.92
E19	0.90
mde(Cronbach's alpha =0.839)	
F21	0.65
F23	0.90
F24	0.87

Note. mca = Peer influence in the classroom, mh= Receiving help ,mde= teacher-student relationship.

4.4.2 The results of Autonomous learning motivation

The means, standard deviations, skewness, and kurtosis coefficients for the items of the Autonomous Learning Motivation Scale are presented in Table 5. The average scores for each item range from 5.20 (D13) to 6.14 (A1). It can be observed that the scores for most items are above the median, indicating that students generally agree with the autonomous learning motivations described in the items. The skewness coefficients for the items range from -1.98(A3) to -0.81(D13), and the absolute values of the kurtosis coefficients range from 0.18(D13) to 4.83(A3), which basically conforms to the normal distribution, which is also appropriate to use ML estimation in the CFA process. The fact that the skewness and kurtosis values are within acceptable ranges suggests that the data for the Autonomous Learning Motivation Scale are normally distributed enough to justify the use of ML estimation, which is a common method for parameter estimation in CFA. This method assumes that the data are normally distributed, and the values reported here support the use of this estimation technique.

Table 5 Descriptive statistics of autonomous learning motivation

Item	Mean	Std.	Skewness	Kurtosis
A2	6.14	1.15	-1.90	4.51
A3	6.13	1.19	-1.98	4.83
A4	6.11	1.16	-1.87	4.57
B5	5.38	1.52	-0.95	0.59
B6	5.42	1.52	-1.07	0.90
B7	5.79	1.29	-1.33	2.11
B8	5.56	1.46	-1.08	0.73
D13	5.20	1.70	-0.81	-0.18
D14	5.61	1.51	-1.34	1.48
D15	5.61	1.38	-1.12	1.05

The CFA results showed Chi-square (32, N = 540) = 255.504($p < .001$), CFI = 0.926, RMSEA = 0.114 (95% CI = [0.101, 0.127]), SRMR = 0.077. The model fit indices were not ideal, considering according to modification indices to revise the model. The initial model was refined based on modification indices (MIs) exceeding 3.84. This threshold indicates parameters whose release would significantly improve model fit. Under the dual constraints of theoretical justification and alignment with students' actual conditions, the two items with the largest

modification indices (MIs) were sequentially allowed to covary in the model. After revision, the indicators for the model (see Table 6) were as follows: Chi-square (30, N = 540) = 121.534(p < .001),CFI = 0.969, RMSEA = 0.075 (95% CI = [0.062, 0.089]), SRMR = 0.056. The model fit was good, and the internal consistency was all greater than 0.7, indicating that the second-order factor model of autonomous learning motivation has good reliability and validity overall. This conclusion provides data support for the rationality of the structure of autonomous learning motivation among vocational school students as identified in interviews.

Table 6 Results of CFA and internal consistency of autonomous learning motivation

Construct	Standardized factor loading
Autonomous learning motivation (Cronbach's alpha =0.87)	1
mint (Cronbach's alpha =0.87)	
A2	0.72
A3	0.87
A4	0.90
mps(Cronbach's alpha =0.87)	
B5	0.79
B6	0.78
B7	0.85
B8	0.67
mde(Cronbach's alpha =0.78)	
D13	0.69
D14	0.88
D15	0.66

Note. mint= Learning interest, mps= Post-graduation development, mde= Passing school exams.

4.4.3 The results of multiple regression analysis

Using multiple regression analysis to explore the relationship between the psychological needs of secondary vocational students and their autonomous learning motivation. The three variables (interest in learning, post-graduation development, and passing school exams) are used as independent variables, while autonomous learning motivation is used as the dependent variable.

First, mean analysis and normality tests were conducted on all independent and dependent variables to check whether regression analysis is suitable. The results are shown in Table 7. The Shapiro-Wilk test revealed significant non-normality in the distribution of scores of alm (W = 0.945, p < 0.001, N = 540), mca(W = 0.900, p < 0.001, N = 540), mh(W = 0.948, p < 0.001, N = 540) and mde(W = 0.924, p < 0.001, N = 540). However, the judgment of normality should be made in conjunction with the absolute values of skewness and kurtosis. The skewness and kurtosis of the three independent variables and one dependent variable are all between -3 and 3, which indicates that the data of each variable conform to the normal distribution (Tabachnick & Fidell, 1989). Subsequently, a correlation analysis was conducted on the four independent variables (see Table 8). The three independent variables of psychological needs are moderately correlated with each other (0.57≥ r ≥0.32). All independent variables show a moderate correlation with the dependent variable (0.55≥ r ≥0.45).

Table 7 Descriptive statistics of one dependent variable and three independent variables

Item	Mean	Std.	Skewness	Kurtosis
alm	5.69	0.91	-0.93	1.82
mca	5.50	1.35	-0.91	0.57
mh	4.92	1.35	-0.66	0.59
mde	5.39	1.32	-0.81	0.56

Note. alm=autonomous learning motivation, mca=Peer influence in the classroom, mh=Receiving help, mde=teacher-student relationship.

Table 8 Correlation analysis between one dependent variable and three independent variables

	alm	mca	mh	mde
alm	1			
mca	0.55**	1		
mh	0.48**	0.48**	1	
mde	0.45**	0.32**	0.57**	1

Note. **p<0.01. alm=autonomous learning motivation, mca=Peer influence in the classroom, mh=Receiving help, mde=teacher-student relationship.

Finally, the regression results are presented in Table 9. Before analyzing the regression results, it is necessary to address the issue of multicollinearity in the model. Previous research (Wu, 2010) suggests that when the tolerance is less than 0.1, the VIF (Variance Inflation Factor) value is greater than 10, and the CI (Condition Index) value is greater than 30, there may be a problem of multicollinearity among the predictive variables. The indicators of the current model meet the above criteria, which is consistent with the analysis of moderate correlation between variables; therefore, there is no multicollinearity issue among the independent variables in the model. Analyzing the results of the regression model reveals that the three psychological need factors have a significant positive predictive effect on autonomous learning motivation, explaining 40.1% of the variance. Their beta weights and significance levels are as follows: peer influence in the class (β=0.40, $p < 0.001$), receiving help (β=0.16, $p <0.001$), and teacher-student relationship (β=0.23, $p <0.001$). It can be observed that peer influence in the class has the highest explanatory power for autonomous learning motivation, while receiving help has the lowest explanatory power.

Table 9 Results of Multiple Regression Analysis

independent variable	B	Beta	t	Tolerance	VIF	CI
constant	2.83		18.14**			
mca	0.27**	0.40	10.58**	0.77	1.31	9.81
mde	0.16**	0.23	5.64**	0.67	1.48	13.42
mh	0.11**	0.16	3.55**	0.58	1.74	10.73
$R=0.633$, $R^2=0.401$, Adj.$R^2=0.398$, $F=119.539$**						

Note. dependent variable = autonomous learning motivation. **p<0.01. mca=Peer influence in the classroom, mh=Receiving help, mde=teacher-student relationship.

5. Discussions and conclusions

This study focused on the autonomous learning motivation of Chinese secondary vocational school students and explored the relationship between the students' perceived psychological needs and their autonomous learning motivation. Theoretically, the results of this study contribute to

understanding the cross-cultural application of SDT. Practically, the findings are beneficial in helping front-line teachers consider how to stimulate students' autonomous learning motivation from the perspective of meeting psychological needs.

5.1 The perceived psychological needs of secondary vocational school students

Based on the qualitative research findings， the emergence of autonomous learning motivation among secondary vocational school students is influenced by three variables: peer influence within the class, teacher-student relationships, and the receipt of help. The first two variables reflect the primary interpersonal relationships of secondary vocational students, indicating their perceived psychological need for relatedness. The third variable represents the manifestation of competency. As previously mentioned, many secondary vocational students have a weak educational foundation, leading to insufficient learning capabilities. Various forms of learning assistance enhance students' learning abilities, satisfying their psychological need for competence.

This study did not find that students perceived a psychological need for autonomy, which is a point of divergence from SDT and one of the innovative aspects of this research. Although many studies have suggested that the simultaneous satisfaction of the three psychological needs can positively predict autonomous learning motivation (Joe et al., 2017) and encourage students to enjoy the curriculum and actively participate in classes (Domville et al., 2019), this study contradicts these conclusions and has been supported by some research findings. For example, Durmaz and Akku (2016) found that students' autonomy did not have a statistically significant predictive effect on their intrinsic motivation to learn mathematics. The reason may be that not all teaching methods aimed at supporting student autonomy are equally effective (Admiraal et al., 2022). The absence of autonomy in this study may be due to the following four reasons.

First, students may not easily perceive autonomy. Students tend not to believe that they are more autonomous in the course learning process, and while autonomy itself may be enhanced, students' perception of autonomy does not necessarily increase (Henri et al., 2018).

Second, teacher-centered classrooms limit the development of autonomy among secondary vocational students. Chinese students do not have sufficient choice in their school learning; they cannot choose what to learn, how to learn, or with what tools, and are passively receptive to their teachers' instruction (Gu, 2015). The current secondary vocational classroom teaching is dominated by teacher-centered learning methods (Ni, 2019), which is not conducive to developing students' autonomy in the learning process (Vazquez, 2015).

Third, the emphasis on examination-oriented educational experiences. In previous school education, especially at the junior high school level, teachers have emphasized the importance of exams, suggesting that achieving high scores is more important than learning how to learn. This has led students to form the concept of studying to pass exams. This situation was also reflected in the qualitative research conducted in this study. If learners come from an exam-oriented system where student grades are considered more important than effective learning, it becomes particularly difficult for teachers to guide learners to emphasize autonomy in the learning process (Basri, 2023).

Fourth, cultural differences. Pennycook (2014) and others argue that autonomy is a Western concept and may not be suitable for Asian classrooms. However, this does not prevent Asian scholars from exploring how to cultivate student autonomy. For example, Humphreys and Wyatt (2014) developed, piloted, and evaluated an autonomous learning journal that includes tasks with a focus on autonomous support to foster students' autonomy in learning English. This research demonstrated that socially mediated autonomous support can help Vietnamese university learners better control their learning.

The above four points explain the reasons for the absence of autonomy among secondary vocational students. However, do secondary vocational students have autonomy without being aware of it? How do they express their autonomy? These questions require further research to answer.

According to three variables above, some methods should be given to improve the level of autonomous learning motivation in secondary vocational school students. It is a good point to

start to improve classroom assessment, which has core – peer assessment. Teachers need to leverage peer evaluation mechanisms during instructional processes. Specifically, educators may implement a "Peer Mentorship Program" to enhance the structured nature of peer-guided learning among students. Furthermore, a "Collaborative Learning Log" template should be systematically designed to improve the clarity of peer-directed learning objectives. Finally, teachers ought to collaboratively develop and operationalize a "Peer Support Points System" with students, establishing explicit assessment protocols to optimize the effectiveness of peer-assisted learning interventions. During the implementation of all kinds of peer assessment tasks, teachers should proactively monitor students' learning needs and provide timely scaffolding and guidance to help them address challenges beyond their current capacity. Crucially, teachers must exercise patience and employ encouragement-oriented strategies, consciously refraining from overemphasizing academic performance metrics as the sole evaluative criterion. Simultaneously, cultivating constructive teacher-student rapport through this collaborative process should be prioritized, as it forms the pedagogical foundation for sustainable peer learning ecosystems.

5.2 The specific manifestations of autonomous learning motivation among secondary vocational students.

According to qualitative analysis, it was found that the autonomous learning motivation of secondary vocational students manifests in three forms: interest in learning, post-graduation development, and passing school exams. This structure was supported by quantitative research. Autonomous motivation includes intrinsic motivation, identification motivation, and integration motivation. Since integration motivation is less common among adolescents and is less frequently used in related research (Jian & Cheng, 2013), this study does not distinguish between identification motivation and integration motivation. Based on SDT and interviews with secondary vocational students, this study established a scale for measuring autonomous learning motivation. The data obtained from the scale verified the reliability and validity of the structure of autonomous learning motivation among secondary vocational students. This scale also provides a reference for other research on measuring autonomous learning motivation and represents another innovative point of this study.

Firstly, it can be observed that secondary vocational students possess intrinsic learning motivation, which is manifested in their interest in the courses and content they study, as well as their willingness to learn in an interesting learning environment. This finding supports previous research on stimulating the learning interest of secondary vocational students (Guo, 2004; Huang, 2006; Shao, 2015), which mentioned the cultivation of learning interest but lacked data support. Because secondary vocational students have an interest in learning, it is necessary for teachers to stimulate their learning interest. Additionally, existing research on the learning interest of secondary vocational students has found that male students have significantly higher learning interest than female students (Zhang & Liang, 2015). The findings of this study are contrary to those of Zou (2011), who found that secondary vocational students lack learning interest and do not enjoy either professional courses or cultural courses. There may be two reasons for this discrepancy. On the one hand, Zou's research was conducted more than a decade ago, which is a significant time gap from this study. On the other hand, this study focused on secondary vocational students in Shanghai, while Zou's research was conducted with students in Beijing. The difference in research subjects may lead to differences in conclusions.

Secondly, post-graduation development serves as a manifestation of students' autonomous learning motivation. Secondary vocational students place particular emphasis on their development after graduation and are motivated to study for reasons such as securing a good job, entering university, and so on. Learning for personal development has become a life philosophy for some secondary vocational students due to two main reasons. On the one hand, career education in China influences students. Various career development guidance activities in China have a significant promotional effect on student development (Fang et al., 2015). For example, vocational interest tests help students form concepts about their future development (Luo, 2019), and career planning courses encourage students to think about how they will develop after

graduation (Jing, 2018). Students gradually develop a perspective that values future development and sees the importance of learning for their future, thereby forming autonomous learning motivation. On the other hand, the group of secondary vocational students faces discrimination. Zhang (2015) pointed out several aspects of discrimination against vocational school students in China. First, vocational education is often considered inferior to general education because it primarily trains general laborers. Second, the technical and skilled talents trained in vocational education are often not regarded as talents because they do not have a high level of education. Third, in terms of values, technical and skilled talents in China have a low social status and income, and their labor contributions are not valued. Due to this discrimination, secondary vocational students feel the need to study harder in order to obtain a higher level of education and secure good jobs. This concept of learning for personal development has gradually been accepted by secondary vocational students and has prompted them to develop learning motivation.

Finally, passing exams is also a manifestation of autonomous learning motivation. In this context, exams primarily refer to those organized by the school, such as end-of-term exams. According to SDT, exams are considered a controlling motivation rather than an autonomous one, but this study holds a different view. Viewing passing exams as a form of autonomous motivation is because Chinese students have already integrated the concept of passing exams into their personal philosophy of life. The historical existence of the imperial examination system in China, which lasted for over two thousand years, has made the exam culture an important part of Chinese culture, and it still influences Chinese society today. The educational system that combines selection and education continues to exist in contemporary China, with both public and private schools focused on preparing students to perform well in the national college entrance examination (O'Sullivan & Cheng, 2022). Chinese students begin taking exams as early as four years old, starting with kindergarten entrance exams. Throughout their educational journey, from kindergarten to university, students are subjected to numerous exams at the school, municipal, provincial, and national levels (Cheng, 2008). The importance of exams is deeply ingrained in the hearts of Chinese students, including those in secondary vocational schools. The high stakes associated with exams lead to exam anxiety, which has various negative impacts on Chinese middle school students (Ding & Wang, 2002; Mo et al., 2009; Cai et al., 2010). Despite the utilitarian orientation of traditional Chinese exam culture, which has led to various problems such as an exam-oriented education (Li & Liu, 2022), students have subtly internalized the belief that exams are important during the continuous process of taking exams, leading them to study in order to pass exams. It is worth noting that while the "post-graduation development" mentioned earlier also includes passing exams, these exams refer to those that are not administered or organized by the school.

5.3 The relationship between psychological needs and autonomous learning motivation

This study found that the three variables of psychological needs have a significant positive predictive effect on autonomous learning motivation. Among them, the influence of peers in the class has the highest predictive power for autonomous learning motivation (0.40), followed by teacher-student relationships (0.23), with the predictive power of receiving help being the lowest (0.16). Firstly, the study's findings support the view that peer relationships and teacher-student relationships positively influence autonomous learning motivation, consistent with the following research findings. For example, Furrer and Skinner (2003) found that when students' needs for relatedness are met, they are more likely to engage in learning actively and achieve good academic performance. Similarly, Opdenakker (2012) and others discovered that an increase in students' autonomous learning motivation may be related to teacher encouragement. Additionally, Henry and Thorsen (2018) also found that intimate contact between teachers and students at the establishment of their relationship directly affects students' learning motivation. Then, the study also supports the view that students' perception of the satisfaction of their need for competence promotes autonomous learning motivation. Regarding the relationship between competence and motivation, previous research has found a close reciprocal relationship between students' intrinsic motivation and beliefs about competence (Logan & Medford, 2011). Finally, there is also

research that finds the satisfaction of both competence and relatedness needs promotes the emergence of autonomous learning motivation. For instance, Gråstén and others (2021) directly pointed out that the satisfaction of competence and social relatedness needs in physical education classes is an element that promotes students' autonomous participation in class. The conclusions of this study also resonate with this finding.

The findings on the relationship between psychological needs and autonomous learning motivation offer insights for teachers' instructional practices. First, secondary vocational teachers should be adept at leveraging the power of the class, encouraging students to actively support each other in learning, especially in creating a strong learning atmosphere. It is important to make students feel the sense of competition and cooperation with their peers, thereby enhancing their sense of belonging and stimulating their autonomous learning motivation. Second, teachers need to care for and love their students, making them feel the friendliness from the teachers, and thus establishing good teacher-student relationships. Such positive relationships are beneficial for students to have greater trust in their teachers' guidance and to accept their learning suggestions. Therefore, teachers need to proactively approach and engage with students, identify their psychological needs, and satisfy them in a timely manner. Third, teachers should consider the varied learning foundations of students and provide timely learning support. Many secondary vocational students recognize the importance of exams and learning and hope to achieve something during their studies. However, due to their weak foundations, they face various learning difficulties. As teachers, it is necessary to identify these difficulties and offer help promptly, which can involve encouraging peer assistance and also providing personal guidance. In the information age, teachers can also use methods such as flipped classrooms and online communication to guide students.

5.4 Limitations

There are two limitations to this study. The first limitation is that systematic biases may affect the research results. Especially, sample selection bias may influence the scores of various variables. The participants in this study were recruited from a nationally renowned secondary vocational school in Shanghai. Consequently, the academic performance of the surveyed students is relatively higher compared to the overall secondary vocational student population, potentially leading to elevated scores across all measures, especially when compared to students from rural vocational schools. It is recommended that future research employ stratified sampling to control for demographic variables. The perceived psychological needs reported by students may differ from their actual perceptions during learning. Students might not be able to articulate these differences in writing because they are inherently difficult to capture. Classroom observations and teacher-student interviews could help clarify these issues. The second limitation concerns the generalizability of the research results to all secondary vocational schools in Shanghai and even across the entire country. Future research should consider selecting more representative samples from different educational regions. These, above two kinds of adjusting, are good for enhancing the generalizability of the findings. Finally, the interaction effects among the psychological need variables and their combined impact on autonomous learning motivation should be explored. I hope future papers can pay more attention to the independence of the dimensions of autonomous learning motivation, particularly the relationship between “post-graduation development” and “passing school exams”.

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The author of this manuscript, He Yang, declare that I have no financial or personal relationships with other people or organizations that could inappropriately influence our work. In addition, I confirm that the manuscript has not been published elsewhere, and it is not under consideration by another journal. I also certify that all the research presented in this manuscript was conducted in accordance with ethical standards and applicable regulations.

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