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The Role of Learning Environments in Shaping Prospective Teachers' Thinking Styles

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Abstract: Prospective teachers' thinking styles might impact their attitudes and behaviors in the teaching profession. However, there is limited knowledge regarding the influence of the learning environments in teacher training programs on the thinking styles of prospective teachers. This research aimed to investigate the correlation between these two factors, using a constructivist learning environment theory and a threefold model of thinking styles as the theoretical framework. Questionnaires were administered among 1,062 year 4 prospective teachers (aged $22.74 \pm .65$) from a teacher training program in Chinese mainland. Demographics including gender and subject taught were controlled for. Stepwise multiple linear regressions were run and findings indicated that peer morale and constructive learning in learning environment significantly contributed to these prospective

teachers' creativity-favoring (Type I) thinking styles, whereas assignment and assessment positively predicted their norm-favoring (Type II) thinking styles. Implications for key stakeholders of teacher educations were discussed and suggestions for future studies were provided.

Keywords: learning environments; thinking styles; prospective teachers

Introduction

Thinking styles encompass a favoured approach to thinking and the expression or utilisation of one or more abilities (Sternberg & Grigorenko, 1997). Over decades, thinking styles have garnered special interest across different fields (e.g., identity development, organisational and vocational psychology, and teacher education). However, most existing studies have focused on socialisation of thinking styles among adolescents or students (Doménech-Betoret & Gómez-Artiga, 2014; Hammad & Awed, 2022; Kuan, 2023), whereas relatively little research attention has been given to teachers' thinking styles development.

Sternberg (1997) argued for self-government theory, he proposed that individuals have preferred styles of dealing with daily tasks, similar to how different sectors in government have differing functions. Sternberg (1997) brought forward 13 thinking styles, including, for example, the legislative (solving problems in one's own fashion), executive (preferring following command), judicial (being inclined to offering judgment), liberal (looking for novel approaches to solving problems), and conservative (conforming to conventional rules) styles. Following this mental self-government theory and drawing on empirical evidence, Zhang and Sternberg (2005) constructed a threefold model of thinking styles. Grounded in this model, all existing thinking styles can fall into three types: Type I, Type II, and Type III. Type I styles (e.g., legislative and liberal styles) are more creativity-favouring, suggesting an inclination toward tasks that feature high autonomy and level of the cognitive complexity. Conversely, Type II styles (e.g., executive and conservative styles) exhibit a preference for norms, indicating a proclivity towards authoritative, structured approaches and lower levels of cognitive complexity. Type III styles, such as external and internal styles, represent an oscillating pendulum, displaying features akin to either Type I or Type II styles. Over almost twenty years, Zhang and Sternberg's (2005) threefold model has been intensively and extensively examined relative to various constructs such as identity development, occupational commitment, creativity, and academic performance (Fan, 2020; Kuan, 2023; Li & Li, 2021).

Many prior studies (Kuan, 2023; Li & Li, 2021; Muhammad et al., 2020; Zhang, 2004) have consistently indicated that Type I styles are in strong association with desirable outcomes such as creativity and optimism, whereas Type II styles are more connected with undesirable outcomes such as conservativeness and pessimism. For example, through a thorough review of then existing studies over decades in the literature, Zhang (2015) found that Type I styles were more favourable than Type II styles in that the former were consistently found to be positive predictors of such variables as high intelligence, creativity, and benign developmental outcomes. Most recently, Liu et al.'s (2023) study among 530 Chinese college students found that thinking styles of interconnection (featuring Type I styles) had a significant positive impact on these participants' creativity.

Learning environments, particularly those of the university-based teaching training programs, are the starting point of one's teaching career. It is widely acknowledged that learning environments play a central role not only in fostering prospective teachers' teaching expertise, but also in contributing to the development of the teaching profession as a whole (Çetin et al., 2022). Albeit variations in constructivism (e.g., radical constructivism and social constructivism), learning is universally held as an

active process of knowledge construction (Fan & Zhang, 2013). Accordingly, constructivist learning environments should feature learner centeredness, knowledge-centeredness, assessment-centeredness, and community-centeredness (De Corte et al., 2004; Tekin-Sitrava et al., 2022). In line with these four centeredness, Fan and Zhang (2013) summarised four emerging educational principles for constructivist learning environments. These four principles are: constructivist learning, student autonomy, interaction and cooperation, and clear goals and coherence of curricula.

Evidence has indicated that learning environments are in strong connection with thinking styles. For example, Wilson and Fowler (2005) conducted a 13-week longitudinal study between two cohorts of students enrolled in a conventional course (with lectures and tutorials) and an action-based course (with project work and learning groups that represent constructivist learning and interaction and cooperation), respectively. Lately, Huang and Liu (2023) investigated 247 courses involving 69,823 learners in an online learning platform in China. They found that different learners have different learning styles (one type of thinking styles) as a function of their prior knowledge which, in turn, impacted their different perceptions of the online learning environments

The last decade has seen a growing body of studies investigating the relationship between learning environments and thinking styles from the perspective of Sternberg's (1997) theory on thinking styles. A good number of these studies have attended to the association between learning facilities and thinking styles (Fan & Zhang, 2013; Göloğlu Demir & Çetin, 2022; Xenofontos & Hizli Alkan, 2022). For example, in Zhang and He's (2003) study of 193 university students from Hong Kong, findings showed that those who reported to prefer Type I creativity-generating thinking styles were inclined to favour the use of computer and information technology. Consistent findings were reported in Santiago and Nakayama's (2006) study among 86 university students in the United States. The results indicated that the e-learners who were enrolled in an on-line computer science course showed a greater preference for the Type I legislative style than did those in traditional Health Science and Education courses. However, performance of the students in the education course was found to be positively related to their Type II executive style. Later, Fan's (2012) study in Mainland China indicated again that the research participants in a hypermedia instructional group (N=131) reported a significant increased use of the liberal Type I style, whereas those in a traditional instructional group (N=107) tended to increasingly use the Type II executive and conservative styles. Moreover, a most recent study (Cheng et al., 2023) among 297 preschool teachers in China found that the participants in different learning contexts featuring differentiated degrees of interpersonal sharing and internet sharing predicted differentiated degrees of Type II executive thinking styles and Type I legislative thinking styles.

A handful of studies have focused on the interaction and cooperation in learning environments relating to thinking styles. For example, Yu and Chen's (2012) study of 247 Hong Kong secondary school students suggested that the Type I liberal style was negatively correlated with student-centred teacher-student interrelationships, whereas the Type II conservative and executive styles were positively correlated with teacher-centred interrelationships. Zhu's (2013) study generated similar findings. The research participants were made up of 325 students and 146 teachers from secondary schools in Mainland China. The results revealed that the Type I legislative and liberal styles were likewise in positive associations with such teacher-student relationships as characterised by helpfulness and understanding. In contrast, the Type II executive and conservative styles were mainly connected with teacher-student relationships featured by dissatisfaction and strictness.

There are two comprehensive studies providing further evidence. In the first study, Zhang et al. (2012) compared the thinking styles of 408 Tibetan students and 920 Han Chinese students. These researchers found that Tibetan students, whose learning environments were predominantly

examination/instruction-oriented (i.e., traditional and rigorous assignment and assessment) and teacher-centred (i.e., less learner autonomy, less teacher-student interaction, and less student-student cooperation), scored significantly higher on the Type II thinking styles than did their Han counterparts whose learning environments were the opposite. In the second study, Fan and Zhang (2013) conducted a survey among 752 Chinese university students and found that Type I thinking styles were mainly positively associated with constructivist learning, learning facilities, and peer morale in the learning environments. Type II thinking styles, however, were mainly connected with goal-oriented curriculum and assignment and assessment.

Ample evidence has lent support to the argument for the role of learning environments in thinking styles. Among the aspects of learning environments, learning facilities, interaction and cooperation, and constructivist learning have been identified as major positive correlates with Type I thinking styles. By contrast, goal-oriented curriculum and assignment and assessment are mainly associated with Type II thinking styles.

Research Problem

Building on the review mentioned earlier, it was found that most prior studies have focused on the socialisation of thinking styles among the student populations, either at the school level of the university level. However, little research attention has been paid to the development of thinking styles among the teacher population. Thinking styles are significant in terms of impacting teachers' classroom instructions and management, teachers' identity development, teachers' commitment to the teaching profession, and so on (Kuan, 2023; Li & Li, 2021). In this connection, exploring the socialisation of teachers' thinking styles merits attention.

Much extant research (Li & Li, 2021; Meihami, 2022; Saini et al., 2022; Yu & Chen, 2012) has highlighted the development of in-service teachers' thinking styles, arguing that these teachers are mostly influenced by a myriad of factors (e.g., work-family conflict, work/school context, and teachers' own professionalism). The socialisation of pre-service teachers' thinking styles, however, is under-documented in the literature. Recently, some researchers have begun investigating thinking styles among prospective teachers (Güner & Erbay, 2021; Juniati & Budayasa, 2022; Saini et al., 2022). Findings have indicated that pre-service training is a critical period where prospective teacher may have shaped or reshaped their preferred approaches to dealing with daily activities or teaching-related tasks, that is, their thinking styles. Unfortunately, more empirical evidence is still warranted to further support these findings.

It is also important to note that, in addition to family background, SES, or individual motivators, learning environments characterising the university-based teacher training program might also play an equally significant role in the socialisation of thinking styles among prospective teachers (Clarke et al., 2010; Güner & Erbay, 2021; Li & Li, 2021). However, the literature is limited in such research and more should be done to explore the relationship between prospective teachers' learning environments and their thinking styles.

Research Focus

Most prior studies have mainly focused on how the thinking styles of the general student population are influenced by their learning environments. Research on learning environments specific to prospective teachers, by contrast, is limited. Furthermore, learning environments in existing studies are mostly manifested through one or more specific courses that last for at most one semester. An in-

depth understanding of the association between thinking styles and learning environments calls for research examining the latter from a holistic perspective.

Thus, this study focused on exploring the role of learning environments in shaping prospective teachers' thinking styles. Zhang and Sternberg's (2005) threefold model of thinking styles and Fan and Zhang's (2013) theorisation of constructivist learning environments were drawn upon.

Research Aim and Research Questions

The principal goal of this study was to explore whether or not, and to what extent if yes, prospective teachers' thinking styles would be influenced by the learning environments of the teacher training program. Therefore, the main research question for this study was: Are prospective teachers' perceived learning environments predictive of their thinking styles, and, if yes, to what extent? To address this research question, a hypothesis grounded in the literature review was made: The way prospective teachers perceive their learning surroundings would have a substantial effect on their thinking styles. Specifically, the existence of constructivist features in learning environments such as conducive learning spaces, constructivist learning approaches, and student autonomy was anticipated to be indicative of Type I thinking styles, marked by cognitive complexity and autonomy. Conversely, the lack of constructivist elements, such as curriculum with explicit goals and specific assignment and assessment methods, was expected to be associated with Type II thinking styles, characterised by conformity and cognitive simplicity.

Research Methodology

General Background

This study was the baseline part of a big study using a simple two-wave prospective panel design within a 1-year interval. This study was carried out among year 4 prospective teachers from the Program of Free Education for Future Teachers (PFEFT). PFEFT was jointly launched by the Ministry of Education, the Ministry of Finance, and the Ministry of Human Resources in the People's Republic of China. The principal goal of the PFEFT was to entice top high school graduates into the teaching profession and to teach in hard-to-staff schools. An attractive package of monetary benefits was provided for enrolled students, including a monthly stipend, free accommodation, free textbooks and supplementary materials, as well as tuition exemption. In return, enrolled students must teach in their hometowns, mostly in rural areas, for at least 6 years (The Ministry of Education of the People's Republic of China, 2018).

Albeit with good intentions and strong economic incentives, the PFEFT is not without problems. For example, Wang and Gao's (2013) study revealed a conflict between PFEFT students' desire for social transformation (e.g., improving family financial status and passion for upward mobility) and the reality of constraints (e.g., low salary and disadvantaged working conditions). In Zhou's (2010) study of 1,800 PFEFT students, over 80% of the research participants demonstrated their strong desire to break the 10-year work contract and leave for other occupations. Therefore, findings from this research may offer some practical suggestions with respect to the PFEFT and the reported problems.

It should be noted that permission for the present research was granted by the Human Research Ethics Committee for Non-Clinical Faculties, the University of Hong Kong. All the participants were aged above 18, whose participation in the present research was legitimised through their endorsement on a consent form (see Appendices 1 and 2 for English and Chinese versions, respectively). This consent form provided the participants with a thorough knowledge about their benefits and rights upon participation,

as well as about the intent and the duration of the present research. Moreover, the participants were reassured of safety concerns (e.g., how the inventories would be stored and how their responses would be kept confidential). Finally, it was also articulated that participation in the present research was totally voluntary; as such, the participants' decision to withdraw at any time would cause no consequence at all.

Participants and Procedure

Participants were 1,062 (358 males and 704 females) year 4 prospective teachers, aged $22.74 \pm .65$ years, from the PFEFT (as noted above) in Mainland China. By then, all these participants had obtained their teaching certificates awarded by the Ministry of Education. Data were collected during June 1st-15th, 2023, upon the participants' completing their training in the PFEFT. They were invited to respond to a set of paper-and-pencil inventories either through class units or regular faculty meetings. On average, participants took approximately 10 minutes. As a result, 1,062 of the 1,136 returned copies were found valid for further analyses. The valid response rate reached 93%, much better than acceptable according to Nulty (2008). The profile of the participants can be seen in Table 1.

Table 1

Profiles of Participants

Demographic		N	%
Gender	Male	358	33.7
	Female	704	66.3
Subject taught	humanities and social	620	58.4
	Sciences	442	41.6
Total		1,062	100

Instrument

To measure university-based learning environments, the Inventory for Students' Perceived Learning Environment (ISPLE) was adopted in the present research (Fan, 2014; Fan & Zhang, 2013). This inventory helped to collect retrospective data on eight dimensions of university-based learning environments: 1) goal-oriented curriculum; 2) student autonomy; 3) assignment and assessment; 4) teacher-student interaction; 5) student-student cooperation; 6) peer effect; 7) learning facilities; and 8) constructivist learning. Each dimension was measured by four statements. The participants' responses were rated on a seven-point Likert scale, where "1" represented "not at all well", and "7", "extremely well". High scores in the eight dimensions indicated highly constructivist learning environments. Two sample items were: 1) "The teaching helps me to think about the evidence underpinning different views" (constructivist learning); and 2) "The courses are well organised in a way that makes sense to me" (goal-oriented curriculum). The ISPLE demonstrated good reliability and validity. For example, in Fan and Zhang's (2013) study conducted in Shanghai and Nanjing in Mainland China, the theoretically proposed eight-factor structure was confirmed, while reliability ranged from .63 (learning facilities) to .79 (student-student cooperation).

Thinking styles were evaluated by the Thinking Styles Inventory-Revised II (TSI-R2) (Sternberg et al., 2007). In this study, only two Type I (i.e., the legislative and liberal; 5 items each) thinking styles and two Type II (i.e., the executive and conservative; 5 items each) thinking styles were selected totalling 20 items. Reasons were twofold: on the one hand, the four styles form two contrast pairs and are thus more comparable than all the 13 styles put together; on the other hand, the shortened inventory could help maintain the participants' concentration and thus ensure the validity of their responses. The

participants indicated the degree to which they agreed with all the items following a 7-point Likert scale, with “1” denoting “not at all” and “7” implying “extremely well”. Two sample items were: 1) “I like situations where I can use my own ideas and ways of doing things” (liberal); and 2) “When faced with a problem, I like to solve it in a traditional way” (conservative). The TSI-R2 has demonstrated sound internal consistency in previous studies across cultures with Cronbach’s alphas well above .80 (Kuan, 2023; Sternberg & Grigorenko, 1997)

Data Analysis

Data were analysed using SPSS and AMOS. First of all, data were cleaned to deal with missing data, outliers, and multicollinearity (Berry, 2000). For data accuracy, descriptive statistics of all the items were calculated in terms of means and ranges. For missing data, means of series were set a priori as replacements. Secondly, the two utilised inventories were validated. Internal consistency was checked with Cronbach’s alpha coefficients. Using AMOS, confirmatory factor analysis (CFA) was run to test validity. Thirdly, to estimate demographic differences in the key variables, one-way MANOVA was performed. In *post hoc* analyses, Bonferroni correction (α/n) was employed to control the family-wise error rate, as suggested by many researchers (Berry, 2000). To explore the relationships among the key variables, zero-order correlations and multiple hierarchical regressions were executed.

Research Results

Psychometric Properties

The seven-factor model of the ISPLE fitted the data well, $\chi^2(329, N=1,062) = 1294.27, p < .001$. Modifications were performed post hoc as suggested, where error covariance of three pairs of items (i.e., Items 1 and 2; Items 7 and 8; Items 21 and 22) were set free to reduce the χ^2 values. This re-specified model yielded better fitting results, $\chi^2(326, N=1,062) = 1048.27, p < .001$, GFI=.95, RMSEA=.05, CFI=.95, and NFI=.93 (see Figure 5.1). Cronbach’s alpha coefficients were: .85 (goal-oriented curriculum), .76 (student autonomy), .84 (assignment and assessment), .85 (teacher-student interaction), .90 (peer morale), .78 (learning facilities), and .86 (constructivist learning). These CR values indicated sound reliabilities.

As for the TSI-R2, original results of the CFA were: $\chi^2(164, N=1,062) = 1120.28, p < .001$, GFI=.90, RMSEA=.07, CFI=.92, and NFI=.91. Out of theoretical connections, we slightly modified this model following Meyers et al.’s (2013) approach by freeing the error covariance of four pairs of items to reduce χ^2 values. Better fits were resulted, $\chi^2(160, N=1,062) = 844.01, p < .001$, GFI=.92, RMSEA=.06, CFI=.94, and NFI=.93. The TSI-R2 had sound internal reliability with Cronbach’s alpha coefficients were .84 for the legislative style, .91 for the liberal style, .82 for the executive style, and .89 for the conservative style.

Demographic Difference and Correlation

Statistically significant differences in learning environments and thinking styles were found grounded in the two demographics (e.g., gender and subject taught). For brevity’s sake, gender-based differences were took as an example: learning environments ($F_{7, 1054} = 4.71$; Wilk’s $\lambda = .97$; $p < .001$; partial $\eta^2 = .03$) and thinking styles ($F_{4, 1057} = 9.36$; Wilk’s $\lambda = .97$; $p < .001$; partial $\eta^2 = .03$). In terms of learning environments, the female participants tended to score higher than did their male counterparts on six scales: goal-oriented curriculum, student autonomy, teacher-student interaction, peer morale, learning facilities, and constructivist learning. These results were in line with existing findings (e.g., Fan & Zhang, 2013). Regarding thinking styles, the male participants scored higher on the Type I liberal style ($M_{\text{difference}} = .23$; $t_{1060} = 3.29$; $p = .001$), but lower on the Type II executive style ($M_{\text{difference}} = -.16$; $t_{1060} = -2.67$;

$p=.007$). Similar results had been reported in previous studies (e.g., Fan & Zhang, 2013; Sternberg & Grigorenko, 1995).

Table 2 shows that, as expected, learning environments on the whole were in strong positive associations with thinking styles. In comparison, learning environments were in stronger relations with Type I styles than with Type II styles. The associations were found between Type I styles and three dimensions of learning environments: constructivist learning, learning facilities, and peer morale. These findings were compatible with the results in the relevant literature (Fan & Zhang, 2013).

Table 2

Pearson Correlation Coefficients Between Learning Environments and Thinking Styles

	1	2	3	4	5	6	7	8	9	10	11
1. Goal-oriented	1.00										
2. Student autonomy	.59*	1.00									
3. Assignment and	.44*	.39*	1.00								
4. Teacher-student	.52*	.44*	.40*	1.00							
5. Peer morale	.48*	.49*	.41*	.55*	1.00						
6. Learning facilities	.37*	.35*	.35*	.40*	.40*	1.00					
7. Constructivist learning	.55*	.54*	.46*	.51*	.51*	.57*	1.00				
8. Legislative (I)	.34*	.24*	.36*	.40*	.38*	.51*	.44*	1.00			
9. Liberal (I)	.30*	.25*	.27*	.28*	.41*	.26*	.42*	.58*	1.00		
10. Executive (II)	.33*	.25*	.41*	.34*	.34*	.35*	.33*	.44*	.22*	1.00	
11. Conservative (II)	.23*	.24*	.26*	.26*	.24*	.21*	.25*	.14*	.00	.58*	1.00

Note. I=Type I styles; II=Type II styles; * $p < .05$ (2-tailed); Listwise $N=1,062$.

Multiple Regression

As it can be seen in Table 3, the results of multiple regressions indicated that, in general, learning environments uniquely contributed to 11-35% of the variance in thinking styles. Based on β coefficients, learning environments had a larger impact on Type I styles than on Type II styles. Six scales of learning environments significantly contributed to the Type I legislative style; and so, did two scales to the Type I liberal style.

Consistent with anticipations, the scales of learning environments that are more characterised by constructivism were found to be the major positive contributors to Type I styles. Peer morale and constructive learning, for example, were the strongest positive contributors to the Type I liberal style ($\beta=.26$ and $.26$, respectively), whereas learning facilities were the strongest positive contributor to the Type I legislative style ($\beta=.33$). By contrast, the less constructivist scales were in stronger positive associations with Type II styles. Task and assessment, for example, had the strongest positive impact on the Type II executive style ($\beta=.26$) and on the Type II conservative style ($\beta=.13$). The only exception was the negative relationship, though minor in strength, between student autonomy and the Type I legislative style ($\beta=-.13$).

Table 3*Predicting Thinking Styles from Learning Environments*

Learning environments	Thinking styles			
	Legislative (I)	Liberal (I)	Executive (II)	Conservative (II)
R^2_{total}	.36	.25	.25	.12
$R^2_{\text{gender+taught subject}}$	.01	.01	.01	.01
$R^2_{\text{learning environments}}$	.35	.24	.24	.11
F	64.18***	39.24***	38.53***	15.84***
df	9, 1052	9, 1052	9, 1052	9, 1052
$\beta_{\text{goal-oriented curriculum}}$			.08*	
$\beta_{\text{student autonomy}}$	-.13***		.07*	
$\beta_{\text{assignment and assessment}}$	.11***		.26***	.13***
$\beta_{\text{teacher-student interaction}}$	.12***		.09*	.10**
$\beta_{\text{peer morale}}$	.10**	.26***	.10**	
$\beta_{\text{learning facilities}}$	.33***		.17***	
$\beta_{\text{constructivist learning}}$	.15***	.26***		

Note. R^2_{total} =variability in thinking styles explained by demographic factors (gender; taught subject) and learning environments; $R^2_{\text{gender+taught subject}}$ =contribution of demographic factors (gender; taught subject) to thinking styles; $R^2_{\text{learning environments}}$ =the unique contribution of learning environments to thinking styles; I= Type I styles; II=Type II styles; legislative=legislative thinking style; liberal=liberal thinking style; executive=executive thinking style; conservative=conservative thinking style; * $p<.05$, ** $p<.01$; *** $p<.001$.

Discussion

In line with the hypothesis asserting that prospective teachers' perceived learning environments would statistically contribute to their thinking styles, the results of the study indicated that the prospective teachers' perceived learning environments were significantly related to their thinking styles.

In concert with findings obtained previously (Fan, 2012; Fan & Zhang, 2013; Zhang & He, 2003), constructivist aspects of learning environments (particularly learning facilities, constructivist learning, and peer morale) were major positive contributors to the Type I legislative and liberal thinking styles, while less constructivist aspects (particularly assignment and assessment) were primary positive contributors to the Type II executive and conservative thinking styles (Wilson & Fowler, 2005). The current findings lent essential support to the argument for an environment-style congruence that students tend to "develop or strengthen the kind of intellectual styles that...the learning environment requires" (Zhang, 2013, p. 154). Based on this congruence, the prospective teachers would have a tendency to be open-minded and to deal with tasks or problems from multi-lateral perspectives (liberal thinking style) when: 1) teacher educators placed heavy emphasis on knowledge construction and encouraged critical or lateral thinking; or 2) classmates and friends showed strong interest in knowledge building and applying proactively what they have learned. Likewise, when the prospective

teachers perceived their learning environments as providing affluent facilities for learning on their own (e.g., resourceful libraries for independent knowledge building, or well-equipped labs for knowledge application), they would be comfortable with and confident in making use of these facilities to deal with unstructured tasks (the legislative thinking style). However, given that high achievers in the Program of Free Education for Future Teachers (PFEFT) were generally defined by high scores in examinations, as is the case elsewhere in Mainland China, assignment and assessment would more often than not demand rote learning, memorisation, or systemic review that characterise Type II thinking styles. Therefore, the prospective teachers who took seriously the outcomes of assignment and assessment would tend to rigidly adhere to detailed instructions (the executive thinking style) or existing rules that guarantee satisfying scores (the conservative thinking style). Similar findings could also be found in Santiago and Nakayama's (2006) study.

One unexpected finding needs explanation: the student autonomy allowed in the prospective teachers' learning environments was negatively related to the Type I legislative thinking style. There is a great possibility that assignment and assessment in the PFEFT were highly examination- and score-oriented, so the prospective teachers would have to compromise their preference for creativity and cognitive complexity (the legislative thinking style) and take advantage of the available autonomy to prepare for examinations by means of memorization or adherence to so-called focal points for examinations. In so doing, those prospective teachers might have, as a matter of fact, turned away from the legislative thinking style to the opposite (i.e., the executive thinking style) which was found in significant positive relationship with student autonomy.

Conclusions

The principal objective of this study was to explore the role of learning environments in prospective teachers' thinking styles. The findings indicated that prospective teachers' learning environments were significantly associated with their thinking styles. Specifically, constructive parts of learning environments were positively connected with Type I styles, whereas less constructive aspects were relatively in stronger positive relationships with Type II styles. Therefore, we can conclude with confidence that this principal objective has been accomplished. Theoretically, the findings from this study have enriched our understanding of contextual factors (i.e., learning environments) in the socialisation of thinking styles. This study has also provided empirical evidence suggesting that Fan and Zhang's (2013) configuration of constructivist learning environments could hold true for teacher training programs. Finally, evidence generated from this study has done justice, at least partially, to the robustness and reliability of Zhang and Sternberg's (2005) threefold model of intellectual styles.

Apart from theoretical contributions, this study had three practical implications. First, for those interested researchers, this study provided two inventories with improved validity and reliability measuring perceived learning environments and thinking styles. For example, two scales of the Inventory for Students' Perceived Learning Environments (ISPLE) were aggregated to overcome multicollinearity.

Second, for teacher educators, the implication was provided from two aspects. One was that teacher educators should cultivate constructivist learning environments in or outside classrooms, where building, sharing, and applying tacit knowledge, rather than instilling or memorising explicit knowledge, were emphasised and practiced. Given their modelling role for prospective teachers, teacher educators must walk the talk, demonstrating how to give feedback, how to interact with colleagues and students, how to encourage and respond to improvised questions in class, or how to think and teach creatively. The other is that teacher educators should be mindful of prospective teachers' potential style

differences arising from personal (e.g., demographic factors) and environmental factors (e.g., class, faculty, or dorm). Then teacher educators could allow for diverse styles, use diverse instructional approaches and evaluation methods, and, in particular, encourage Type I thinking styles among prospective teachers that may breed Type I teaching styles in their future teaching career.

Third, for prospective teachers, they were expected to make the most of available resources for teacher preparation (e.g., library, micro-teaching labs, and discussion forums) and to participate in activities that involved the peer sharing, knowledge construction, and knowledge application.

Limitations of Research

Despite the contributions and implications, this study could benefit from some enhancements. First, this study relied too heavily on self-report data. However, self-report data have long been criticized for their credibility, in that respondents to self-report questionnaires may tend to give socially desirable answers or even lie, while respondents to interviews may lack adequate introspective ability or strong verbal skill. Second, generalizability of this study is limited because of the sampling bias. This weakness manifests itself in two aspects. On the one hand, all the prospective teachers of the present research were recruited from one single Program of Free Education for Future Teachers (PFEFT) university; as such, the representativeness of the sample is a bit questionable. On the other hand, the participants of this study were dominated by females (66.3%) so much so that results generated might be distorted and generalizability might be affected. Thus, interpretation of the findings from this study should be careful with such gender bias taken into account. Third, this study was situated in the Chinese mainland characterized by the Confucius heritage. Therefore, a caveat is cast on understanding the current findings if without a full account possible thinking style differences across varying cultures of regions.

Suggestions for Future Research

To overcome the first limitation as mentioned the above, two remedies are recommended for future research. One remedy is to collect data from multiple sources. For example, to measure the construct of teaching styles, data can be collected from both first-year teachers and their students; to measure the construct of work environments, data can be collected from first-year teachers, their superiors, and, at the same time, their colleagues. The other remedy is to use multiple methods in addition to self-report questionnaires and interviews. These methods include, for example, observation, videotaping, reflective journal, and intervention. In so doing, researchers are able to triangulate emerging findings for improved credibility and reliability.

As regards the second limitation concerning the sampling bias of this study, it is suggested that, for future studies, participants can be selected from other PFEFT universities or non-PFEFT universities with teacher training programs. In addition, internet-based methods such as online survey and email survey can be employed to minimise the attrition rate.

In addition, it is suggested that future studies can explore further the mediating or moderating roles of other constructs (e.g., SES, gender, and motivation) in the relationship between learning environments and teachers' thinking styles. Also, cross-lagged effect of learning environments on thinking styles can be examined to identify the casual relations between the two constructs so much so that we could better understand whether it is teachers' thinking styles that impact their perceived learning environments or the reverse.

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