



Examining a Subscale-Level Higher-Order Model of Workplace Learning among Higher Vocational Education Students in Shanghai, China

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Abstract

Workplace learning is central to higher vocational education, yet its measurement remains fragmented across studies. Drawing on workplace learning theory and prior measurement work, this study tested a subscale-level higher-order structure of workplace learning comprising three theoretically specified dimensions: supervisor support, peer support, and reflective practice. Survey data were collected from 385 final-year higher vocational education students in eight vocational colleges in Shanghai, China, all of whom had completed workplace learning placements. The analysis followed a two-stage model-testing strategy. First, item-level confirmatory factor analyses were conducted within each multidimensional scale as preliminary checks of the adapted instruments. Second, 15 subscale means were used as parcels to test the three-dimensional and higher-order workplace learning models. The three-factor parcel model fitted the data well and outperformed a one-factor alternative, $\chi^2/df = 1.583$, CFI = .971, TLI = .965, RMSEA = .039, SRMR = .039. The higher-order model provided an acceptable representation of workplace learning, with positive standardized second-order loadings for supervisor support, peer support, and reflective practice. Composite reliability and HTMT values supported construct reliability and discriminant validity, although several moderate standardized loadings suggest that some indicators could be refined in future work. The findings offer initial evidence for a subscale-level model of workplace learning.

Keywords

Workplace learning; Supervisor support; Peer support; Reflective practice; Higher vocational education

1. Introduction

Workplace learning has become a defining feature of Chinese higher vocational education (HVE) because it places students inside authentic work settings where occupational knowledge is learned through participation, interaction, and reflection. In HVE programs, workplace learning placements are expected to help students move beyond classroom knowledge and develop situated forms of professional judgment. Students encounter real work routines, unfamiliar organizational norms, social expectations, and problems that are often less structured than those presented in classroom tasks. In this setting, workplace learning involves students negotiating opportunities to participate, receiving guidance from others, observing workplace practices, and making sense of their developing competence (Billett, 2001, 2004; Eraut, 2004).

Although workplace learning is widely valued, the construct remains difficult to measure. Prior studies have used terms such as work-based learning, work-integrated learning, internship, placement, informal learning, and workplace learning in overlapping ways (Ferns et al., 2025; Nikolova et al., 2014; Steinberg et al., 2024; Zegwaard et al., 2023). These terms are not identical, yet they often refer to similar experiences in which students learn through participation in work. Some empirical studies treat workplace learning as a broad placement experience, while others examine selected elements such as supervision, feedback, peer interaction, or reflection (Ali et al., 2022; McBeath et al., 2018; Nuis et al., 2024; Zehr & Korte, 2020). This dispersion has produced useful evidence, but it has also made it harder to accumulate knowledge about the internal structure of student workplace learning. The field has many studies about what may support learning at work, but fewer studies that test how the core mechanisms of student workplace learning should be organized as a measurement model.

Scale validation studies in adjacent areas illustrate the value of clearer measurement. For example, the Learning Potential of the Workplace scale clarified workplace conditions that create opportunities for learning, and the Workplace Learning Inventory used multimethod validation to describe workplace learning experiences in health sciences education (Nikolova et al., 2014; Steinberg et al., 2024). These studies show that factor analytic work can help move workplace learning research from broad descriptive language to testable constructs. However, student workplace learning in HVE still needs a compact model that connects social support and reflective engagement in a way that can be measured across placement settings.

To specify such a model, the present study draws on three strands of prior measurement work that correspond to social guidance, peer-mediated support, and reflective engagement in workplace learning. Supervisor support captures guidance, feedback, availability, autonomy support, and relational assistance from more experienced workplace actors (Nuis et al., 2024). Peer support represents informational, emotional, instrumental, feedback-related, and companionship support from peers or co-workers who are more accessible in everyday workplace interaction (Mostafaei Alaei & Hosseinneshad, 2020). Reflective practice refers to learners' efforts to examine experience, question assumptions, remain open to new findings, and cross-check information in order to improve future action (de Groot et al., 2012; Dewey, 1933; Schön, 1983). Together, these dimensions provide a theoretically grounded basis for examining whether workplace learning can be represented as a higher-order structure.

The aim of this study is to examine whether workplace learning can be represented as a sub-scale-level higher-order construct comprising supervisor support, peer support, and reflective practice. Such a structure may help preserve the distinction between social support and reflective engagement while examining their common organization within workplace learning. The study addresses two research questions. First, are supervisor support, peer support, and reflective practice empirically distinguishable dimensions of workplace learning? Second, can these three dimensions be represented by a higher-order workplace learning factor?

2. Literature Review

2.1 Workplace Learning as a Social and Reflective Process

Workplace learning theory emphasizes that learning through work depends on both the opportunities afforded by the workplace and the way individuals elect to participate in those opportunities. Billett (2001, 2004) described this as a relationship between workplace affordances and individual engagement. From this perspective, learning is shaped by access to tasks, tools,

guidance, feedback, and social participation, but also by learners' agency, prior experience, and interpretive activity. Eraut's (2004) work on informal learning similarly shows that much occupational learning occurs through participation in everyday work, consultation with others, observation, and gradual refinement of practice.

For students in workplace placements, these ideas have particular relevance. Students often enter workplaces with limited practical experience and uncertain professional identities. Their learning therefore depends heavily on whether they can access meaningful guidance, supportive peer relations, and opportunities to reflect on real tasks. Qualitative work on internships has shown that students learn technical routines, organizational norms, professional interaction, and how to position themselves in a work community (Zehr & Korte, 2020).

This study focuses on HVE students because their workplace learning placements occupy a distinctive position between schooling and employment. HVE programs are designed to cultivate occupational competence, but students' actual learning at work depends on the quality of placement environments and on students' own engagement with those environments. A student may spend several months in a workplace and still learn little if the placement offers limited guidance, few meaningful interactions, or no opportunity to review experience. Conversely, even routine tasks can become educationally valuable when supervisors explain workplace expectations, peers help interpret problems, and students critically examine what has happened.

For this reason, a measurement model of workplace learning should capture mechanisms rather than merely recording whether a placement occurred or how long it lasted. A mechanism-based model is more useful for both researchers and institutions because it identifies features that can be studied, compared, and improved. The three dimensions examined here represent such mechanisms: vertical support from supervisors, horizontal support from peers, and students' reflective processing of experience.

2.2 Supervisor Support

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and students' reflective processing of experience.

2.2 Supervisor Support

Peer support represents assistance, encouragement, information, and feedback from fellow students or co-workers who occupy comparable positions in the workplace learning environment. Unlike supervisors, peers are usually more accessible and less evaluative. Students may turn to peers when they need quick clarification, practical advice, reassurance, or a shared interpretation of workplace routines. Prior work on peer support shows that peers can provide both practical and emotional resources in learning contexts (Mostafaei Alaei & Hosseinneshad, 2020). In workplace placements, these resources are often embedded in ordinary interaction rather than formal training.

Much day-to-day learning at work occurs through informal exchange. Students often learn how to handle minor problems, interpret tacit rules, and judge whether their difficulties are common by talking with peers. Research on work-integrated learning also suggests that peer support and a sense of belonging can strengthen students' confidence and well-being during work terms (McBeath et al., 2018). Peer support should therefore be treated as a distinct pathway of workplace learning. It differs from supervisor support because it operates through horizontal relationships, shared experience, and everyday accessibility rather than formal authority.

2.4 Reflective Practice

Reflective practice captures the learner's deliberate effort to examine experience, question assumptions, and translate learning into improved future action. Its conceptual roots can be traced to Dewey's (1933) account of reflective thought, Schön's (1983) work on professional reflection, and Raelin's (2001) account of public reflection as a basis for learning. In workplace learning, reflection is not simply private thinking after an event. It involves reviewing what happened, considering alternative interpretations, using feedback, and checking one's understanding against evidence from work situations and interaction with others (de Groot et al., 2012).

Reflective practice should be treated as a separate dimension because it captures what learners do with workplace experience. Supervisor support and peer support describe resources students receive through relationships. Reflective practice describes how students process those resources and connect them to their own developing competence. Without reflection, guidance and interaction may remain fragmented experiences rather than becoming usable learning. In a workplace learning model, reflective practice therefore represents the interpretive work through which students examine tasks, feedback, and workplace events and use them to adjust future action.

2.5 Proposed Model

Workplace learning in this study is treated as a higher-order construct composed of supervisor support, peer support, and reflective practice. The three dimensions are expected to be related because they occur within the same placement experience, but they refer to different aspects of learning at work. Supervisor support reflects guidance, feedback, and access to workplace tasks through a role relationship that carries instructional and evaluative authority. Peer support reflects more horizontal forms of assistance, including clarification, reassurance, and shared interpretation of everyday workplace situations. Reflective practice refers to students'

own cognitive and behavioral work in examining experience and using it to adjust future action.

This structure preserves the distinction between social support and reflective engagement while allowing them to be examined as parts of a broader workplace learning construct. Supervisor support and peer support describe relational resources available in the workplace, whereas reflective practice describes how students process workplace experience. On this basis, the proposed model specifies three related but distinguishable dimensions of workplace learning and represents them within a higher-order structure.

3. Methodology

3.1 Research Design

This study used a quantitative cross-sectional design to test a prespecified subscale-level measurement model of workplace learning. It examined whether supervisor support, peer support, and reflective practice could be treated as distinct but related dimensions and represented by a higher-order workplace learning factor.

3.2 Participants and Procedure

The dataset contained 385 valid responses from final-year students enrolled in eight higher vocational colleges in Shanghai, China. All respondents had completed workplace learning placements involving participation in authentic workplace tasks. The sample included 218 female students (56.6%) and 167 male students (43.4%). Placement duration was mainly longer than six months ($n = 224$, 58.2%) or three to six months ($n = 157$, 40.8%), with four respondents reporting one to three months (1.0%).

Participation in this study was voluntary. The online questionnaire included an information statement explaining the purpose of the study, participants' rights, confidentiality arrangements, and the academic use of the data. Data were collected in April 2026 through the Wen Juan Xing online survey platform.

3.3 Measures

The study used prior instruments adapted for the Chinese HVE workplace learning context. Permission to use and adapt the original instruments was obtained where required. The English-language instruments were translated into Chinese using a translation and back-translation procedure. Before the pilot test, the questionnaire was reviewed by four vocational education experts from Malaysia and China to assess face validity and content validity.

Supervisor support was measured with 21 items covering autonomy support, emotional support, networking support, trust and availability, similarity, and empathy. The dimensional structure follows the mentoring support scale validated by Nuis et al. (2024), with wording adapted to students' workplace learning experience.

Peer support was measured with 22 items covering informational support, emotional support, instructional or instrumental support, validation/feedback, and companionship support. The scale structure was adapted from the Peer Support Questionnaire developed by Mostafaei Alaei and Hosseinneshad (2020).

Reflective practice was measured with 14 items covering individual reflection, reflection in social interaction, openness to new findings, and cross-checking of information. These dimensions are consistent with the critically reflective work behavior model validated by de Groot et al. (2012).

Following expert review, a pilot study was conducted in March 2026 using convenience sampling from one HVE institution in Shanghai. A total of 44 questionnaires were collected. The pilot test was used to assess the internal consistency of the adapted instruments and to identify potential wording or measurement problems before formal data collection. The overall pilot reliability was excellent ($\alpha = .940$). At the construct level, Cronbach's alpha values were .940 for supervisor support, .952 for peer support, and .905 for reflective practice.

3.4 Data Analysis

Data analysis proceeded from scale checks to parcel-level model testing. Descriptive statistics and internal consistency coefficients were first computed for the main scales and subscales. Item-level confirmatory factor analyses (CFAs) were then estimated separately for supervisor support, peer support, and reflective practice. After these checks, 15 subscale means were used as parcels to test one-factor, three-factor, and higher-order workplace learning models. Covariance-based structural equation modeling (SEM) was used because the study focused on theory-driven model fit testing and model comparison rather than prediction (Boateng et al., 2018; Brown, 2015; Hair et al., 2019; Kline, 2016).

Model evaluation used chi-square/df, comparative fit index (CFI), Tucker-Lewis index (TLI), root mean square error of approximation (RMSEA), and standardized root mean square residual (SRMR) rather than relying on chi-square alone. Convergent validity was examined through standardized item loadings, composite reliability (CR), and average variance extracted (AVE) (Fornell & Larcker, 1981). Discriminant validity at the parcel level was examined using heterotrait-monotrait ratio (HTMT) values (Henseler et al., 2015) and comparison with the one-factor model.

4. Results

4.1 Descriptive Statistics and Preliminary Measurement Checks

Item-level CFAs were conducted for the three adapted multidimensional scales before parcel-level modeling. As shown in Table 1, all three models showed acceptable fit.

Table 1. Item-level CFA fit for component scales

Model	Chi-square	df	Chi-square/df	CFI	TLI	RMSEA	SRMR
Supervisor support item-level CFA	175.469	174	1.008	1.000	.999	.005	.030
Peer support item-level CFA	214.569	199	1.078	.996	.995	.014	.030
Reflective practice item-level CFA	97.921	71	1.379	.989	.987	.031	.042

Internal consistency was also adequate for model testing. Cronbach's alpha was .912 for supervisor support, .912 for peer support, and .897 for reflective practice. Table 2 reports the subscale means, standard deviations, and reliability coefficients. Subscale alphas ranged from

.760 to .880, with the two-item cross-checking dimension showing a Spearman-Brown coefficient of .781.

Table 2. Subscale descriptive statistics and reliability

Subscale	Items	<i>M</i>	<i>SD</i>	Alpha
Autonomy support	4	3.836	.863	.845
Emotional support	3	3.845	.875	.780
Networking support	5	3.784	.794	.839
Trust and availability	3	3.915	.815	.784
Similarity	3	3.808	.862	.760
Empathy	3	3.847	.880	.794
Informational support	5	3.524	.911	.877
Peer emotional support	4	3.721	.835	.832
Instructional support	3	3.559	.934	.787
Validation/feedback	4	3.537	.994	.880
Companionship support	6	3.629	.838	.876
Individual reflection	4	4.066	.761	.833
Reflection in social interaction	4	3.954	.839	.868
Openness to new findings	4	3.753	.851	.852
Cross-checking of information	2	3.794	.959	.781

Before SEM estimation, the parcel distributions were inspected. Univariate normality tests were significant, as expected with a sample of 385, but skewness and kurtosis values for the 15 modeled parcels were within commonly accepted ranges. Skewness ranged from -.965 to -.195, and kurtosis ranged from -.933 to .409. Mardia's test indicated multivariate non-normality, so model evaluation used approximate fit indices alongside chi-square.

4.2 Parcel-level Confirmatory Factor Analysis

The parcel-level analysis first compared a one-factor workplace learning model with the theoretically specified three-factor model. As shown in Table 3, the one-factor model fitted the data poorly, chi-square/df = 5.490, CFI = .767, TLI = .728, RMSEA = .108, and SRMR = .090. The three-factor model showed good fit, chi-square/df = 1.583, CFI = .971, TLI = .965, RMSEA = .039, and SRMR = .039. The higher-order model produced comparable fit. These results indicate that the parcels were better represented by three related dimensions than by one undifferentiated factor, and that the three dimensions can be interpreted within a higher-order workplace learning representation.

Table 3. Parcel-level workplace learning model fit indices

Model	Chi-square	df	Chi-square/df	CFI	TLI	RMSEA	SRMR
One-factor model	494.060	90	5.490	.767	.728	.108	.090
Three-factor model	137.686	87	1.583	.971	.965	.039	.039
Higher-order model	137.687	87	1.583	.971	.965	.039	.039

The standardized parcel loadings in the three-factor model are shown in Table 4. All freely estimated loadings were significant at $p < .001$. Loadings for supervisor support ranged from .630 to .730, loadings for peer support ranged from .559 to .720, and loadings for reflective practice ranged from .566 to .747.

Table 4. Standardized parcel loadings in the three-factor model

Latent factor	Indicator	Std. loading	<i>p</i>
Supervisor support	Autonomy support	.730	-
	Emotional support	.673	< .001
	Networking support	.661	< .001
	Trust and availability	.655	< .001
	Similarity	.637	< .001
	Empathy	.630	< .001
Peer support	Informational support	.720	-
	Peer emotional support	.559	< .001
	Instructional support	.625	< .001
	Validation/feedback	.624	< .001
	Companionship support	.623	< .001
Reflective practice	Individual reflection	.634	-
	Reflection in social interaction	.740	< .001
	Openness to new findings	.747	< .001
	Cross-checking of information	.566	< .001

Note. The first indicator of each latent factor was fixed for model identification.

The higher-order model was then examined to determine whether supervisor support, peer support, and reflective practice could be represented by a broader workplace learning factor. The standardized second-order loading was .858 for supervisor support, .813 for peer support, and .578 for reflective practice. All three dimensions contributed positively to the higher-order factor, although reflective practice was less strongly aligned with the broader factor than the two social support dimensions.

4.3 Reliability, Convergent Validity, and Discriminant Validity

Evidence for composite reliability and convergent validity at the item-to-first-order-dimension level is reported in Table 5. All composite reliability values met conventional expectations, and all AVE values exceeded .50. The standardized item loading ranges also support the interpretation that the adapted items formed coherent lower-order dimensions before those dimensions were used as parcels.

Table 5. Reliability and convergent validity of first-order dimensions

Variable	Dimension	Standardized item loading range	CR	AVE
Supervisor support	Autonomy support	0.690-0.787	.845	.578
	Emotional support	0.705-0.769	.781	.543
	Networking support	0.696-0.751	.839	.511
	Trust and availability	0.730-0.747	.784	.548
	Similarity	0.681-0.767	.762	.517
	Empathy	0.727-0.765	.794	.563
Peer support	Informational support	0.743-0.807	.878	.589
	Emotional support	0.723-0.766	.832	.553
	Instructional support	0.730-0.759	.788	.553
	Validation/feedback	0.778-0.828	.881	.649
	Companionship support	0.713-0.759	.877	.542
Reflective practice	Individual reflection	0.697-0.778	.834	.556
	Reflection in social interaction	0.770-0.818	.869	.623
	Openness to new findings	0.676-0.816	.855	.597
	Cross-checking of information	0.748-0.856	.784	.646

Discriminant validity at the parcel level was examined using HTMT values. As shown in Table 6, the HTMT values were .697 for supervisor support and peer support, .517 for supervisor

support and reflective practice, and .467 for peer support and reflective practice. All values were below .85, indicating acceptable discriminant validity among the three dimensions.

Table 6. HTMT values for discriminant validity

Construct 1	Construct 2	HTMT
Supervisor support	Peer support	.697
Supervisor support	Reflective practice	.517
Peer support	Reflective practice	.467

4.4 Common Method Considerations

Two statistical checks were used to assess common method concerns. For the 15 subscale parcels, the first unrotated factor explained 34.97% of the variance, below the commonly used 50% warning level. The one-factor CFA model also fitted substantially worse than the three-factor model. These findings suggest that common method bias was unlikely to account for the main measurement pattern, although common method variance cannot be ruled out in a cross-sectional self-report survey (Podsakoff et al., 2003).

5. Discussion

5.1 Discussion of Findings

The findings provide empirical support for the proposed three-dimensional model of workplace learning at the subscale level. The poor fit of the one-factor parcel model indicates that students' responses to supervisor support, peer support, and reflective practice should not be treated as a single undifferentiated score. The good fit of the three-factor and higher-order parcel models, together with positive second-order loadings, suggests that the dimensions are distinguishable yet coordinated. This is consistent with workplace learning theory, which treats learning through work as a negotiated relationship between workplace affordances and learner engagement (Billett, 2001, 2004).

Supervisor support emerged as the strongest component of the higher-order model. This pattern is plausible in HVE contexts, where students often depend on supervisors to gain access to meaningful tasks, feedback, norms of professional conduct, and work-related networks. The result aligns with internship research showing that supportive supervisors shape students' learning and satisfaction (Ali et al., 2022; To & Lung, 2020). In this study, supervisor support carried a large share of the common variance captured by the broader workplace learning factor.

Peer support is often treated as secondary to formal supervision, but students frequently rely on peers for immediate clarification, emotional reassurance, and shared problem solving. The moderate correlation between supervisor support and peer support indicates that the two mechanisms are related, while the acceptable HTMT values and the better fit of the three-factor model suggest that they should not be collapsed into one generic support factor.

Treating supervisor support and peer support as related but distinct also strengthens the practical usefulness of the model. If the two are collapsed into a single social support score, institutions may miss different intervention targets. Supervisor support may require training workplace mentors to provide autonomy-supportive guidance, regular feedback, respectful communication, and access to professional networks. Peer support may require different ar-

rangements, such as cohort-based placement grouping, peer debriefing sessions, online placement communities, or structured opportunities for students to exchange workplace problems.

Reflective practice also contributed to the higher-order structure, although its second-order loading was lower than those for supervisor support and peer support. This lower loading suggests that reflective practice overlaps less strongly with the two social dimensions and captures a more distinct aspect of workplace learning: the learner's own interpretive work. Reflection may still depend partly on the quality of workplace guidance and peer dialogue available to students, but it should remain conceptually distinct within the model.

The item-level results support the convergent validity of the first-order dimensions. All first-order dimensions showed acceptable composite reliability, and their AVE values exceeded .50. These results indicate that the adapted items formed coherent lower-order dimensions before those dimensions were used as parcels in the higher-order workplace learning model. The parcel-level model should be interpreted as evidence for the organization of adapted subscale dimensions rather than as a replacement for item-level scale validation.

5.2 Theoretical Implications

The study contributes to workplace learning research by testing a measurable structure for workplace learning at the subscale level. Rather than treating workplace learning as a broad placement experience, the model distinguishes three dimensions that are relevant to learning in workplace placements. The higher-order model allows researchers to examine workplace learning as an overall construct while retaining the distinctive contribution of its dimensions. This contribution should be understood at the dimension level, because full item-level validation remains a task for future research.

5.3 Practical Implications

For HVE institutions, the findings suggest that improving workplace learning requires more than placing students in work settings. Placement design should intentionally include supervisor preparation, peer learning structures, and guided reflection activities. Supervisors should be encouraged to provide autonomy-supportive guidance, emotional and networking support, and respectful availability. Institutions can also create structured peer exchange sessions before, during, and after placement, allowing students to share problems and interpret experiences together. Reflective journals, debriefing conversations, and evidence-based reflection prompts may help students transform experience into career-relevant learning.

6. Conclusion

This study provides initial subscale-level empirical support for a higher-order model of workplace learning among HVE students in Shanghai, China. Supervisor support, peer support, and reflective practice formed a reliable and well-fitting dimension-level structure. These findings suggest that workplace learning in HVE placements can be examined as an integrated process of guided participation, peer-supported learning, and reflective meaning making. For HVE research and practice, the model offers a practical structure for evaluating and improving the learning quality of workplace placements.

The findings should be interpreted within several boundaries. The study used a cross-sectional self-report design, which limits causal inference and may introduce common method variance. The analysis also relied on subscale parcels, so the full item-level hierarchical structure should

be tested in larger and independent samples. Future research could use longitudinal designs, supervisor ratings, placement performance data, or institutional records where feasible, refine translated items where needed, and examine measurement invariance across gender, school, major, and placement duration. Because the sample was drawn from higher vocational colleges in Shanghai, cross-regional, cross-major, and cross-sectoral testing is needed before the model is generalized more broadly.

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Conflicts of Interest

The author(s) declare no conflicts of interest regarding the publication of this paper.

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