

Promote Teacher's Professional Development of China Greater Bay Area based on the Communities of Practice (CoPs)

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The Guangdong-Hong Kong-Macao Greater Bay Area is a new step to boost the area's development, educational coordination and development is an important part of it. Communities of Practice (CoPs) is an effective way to foster professional development of teachers and develop schools of all types. To investigate the educational role of CoP, 335 teachers from 80 schools in the Greater Bay Area participated in the questionnaire. Exploratory Factor Analysis (EFA) and Structural Equation Model (SEM) validated the theoretical model of CoPs evaluation and its factor relationship. The evaluation model of CoPs is formed after the data analysis. Proposed "two-dimensional tension" mechanism and "differential interaction" mechanism. This study verifies influencing-factors CoPs development, proposes the interaction mechanism between individuals and groups in CoPs, which is not only conducive to the advancement of CoPs projects, but also provides cross-regional organization coordination, theoretical research reference and teacher professional development based on network environment.

Keywords: Communities of Practice, Confirmatory Factor Analysis, Exploratory Factor Analysis, Structural Equation Modeling.

Introduction

Communities of Practice (CoPs), a practice-based, pluralistic, democratic, open and equal-development community, can not only enhance the holistic development of the participating groups, but also enhance the level of individual participation in practice (Zheng, 2007). Jean Lave and Etienne Wenger first proposed the conception of a "CoPs" in 1991 (Omidvar, 2014), with the aim of using the community's framework for the professional development of individual and group teachers. The CoPs includes two roles: Old-timers and New-comers. The CoPs includes two roles: Old-timers and New-comers. New-comers who join the Community can carry out social practice and contextualized learning with familiar hands with mature practical ability, and make the professional capacity development of teachers or campus administrators achieve a leap from "quantity" to "quality" under the similar practice mode of "teacher workshop". Moreover, with the support of the network environment, the member units of the Community in different regions can achieve the cross-regional collaborative development of the groups through participation methods such as community incentives, community interaction, community collaboration and community knowledge and skills learning. In recent years, the CoPs has been regarded as an effective way for teachers' professional development, innovation ability development and "Internet Plus Education" reform. Based on the above descriptions of the three categories of factors, the structure and title setting of the CoPs Evaluation Questionnaire (as shown in Table 1) was designed, and the theoretical model of practical community development evaluation (as shown in Figure 1) is proposed according to the theoretical description and factor structure.

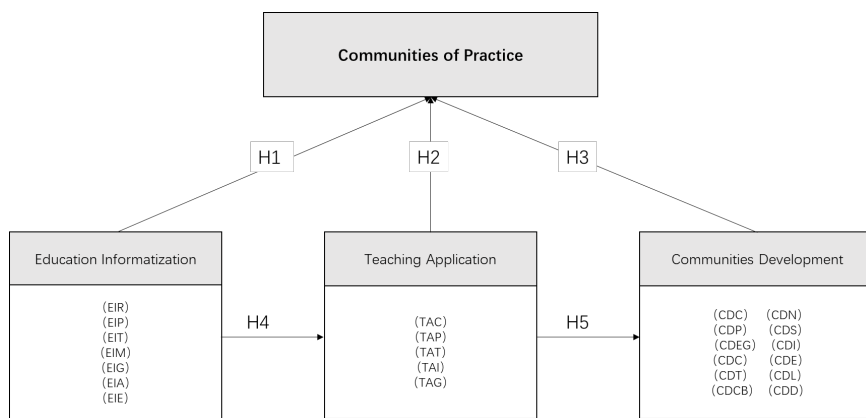
TABLE 1
Community development evaluation questionnaire

Type of investigation	Items setting
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Educational Informationization Supporting factors (EI)	Resource application (EIR), Platform Application (EIP), Tools application (EIT), Synergistic mechanism (EIM), Group Development (EIG), Activity Development (EIA), Information System (EIS).
Teaching Application factors (TA)	Professional Content knowledge (TAC), Teaching Application Pedagogy (TAP), Teaching Application Technology (TAT), Individual Participation (TAI), Group Synergistic Approach (TAG).
Practical Community Development factors (CD)	Four-level Cross Integration (CDC), Eight New Explorations (CDNs), CoPs Participation (CDP), CoPs Support (CDS), CoPs Engagement (CDEG), CoPs Interactivity (CDI), CoPs Emotion (CDE), CoPs Time Assurance (CDT), CoPs Location Awareness (CDL), CoPs Cyberspace awareness (CDCB), CoPs Two-dimensional Tension (CDD).

Figure 1

Influencing Factors and Research Hypothesis of Practice Community Evaluation Model.



According to the connotation of the influencing factors of the practical community evaluation model, the research hypotheses are as follows:

- 1) Hypothesis 1: Informatization supporting factors can effectively evaluate the development level of practical community;
- 2) Hypothesis 2: Teaching application factors can effectively evaluate the development level of practical community;
- 3) Hypothesis 3: Practical community development factors can effectively evaluate the level of practical community development;
- 4) Hypothesis 4: There is a high correlation between informatization supporting factors and teaching application factors;
- 5) Hypothesis 5: There is high correlation between factors of teaching application and factors of practice community development.

Research Design & Methods

Methodology

Research Objects. This study is based on the 2019 Guangdong Provincial Practical Community Project for Education Informatization Teaching and Learning, which issued a recommendation and selection notice in July 2019, published the list of candidates in October, and officially started training in November. This survey was completed in the implementation phase of the Practical Community Project in December. A total of 335 questionnaires were collected, with 327 valid questionnaires and an effective recovery rate of 97.61%. Male teachers accounted for 27.68%, while female teachers accounted for 72.32%.

Research Tools and Methods. Based on the above factors and theoretical basis, the questionnaire consists of 107 questions (specific questions are set as shown in Table 1). The attitude survey is conducted by using the seven-level Richter Scale, which stands for "very dissenting", "common" 4 "ordinary" and "very agreeable" 7 ". This study applies exploratory factor analysis (EFA) to study the topic factor fitness of questionnaires (Yong, 2013), applies confirmatory factor analysis (CFA) to study the theoretical model of practical community evaluation (Schreiber, 2006), and on the

basis of guaranteeing the reliability and validity of data, studies the load and index fitness of model factors to verify the theoretical model of practical community evaluation.

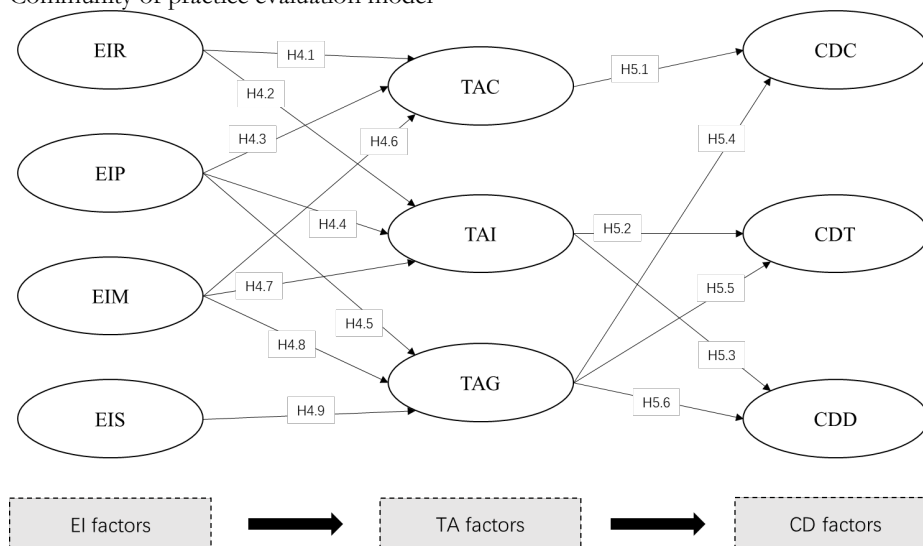
Research Process

Model Factor Exploration based on EFA. SPSS was used to test the factor reliability and applicability of the sample data. The reliability test was conducted after the sample (N = 154) was processed by the validity half division method, and the α reliability coefficient was 0.984, with higher reliability. In order to verify the applicability of factor analysis, the KMO measure test and the Bartlett spherical test (Gallagher, 2003) were conducted, and the KMO value was 0.939 > 0.8, which indicated that the questionnaire data was very suitable for factor analysis. The Bartlett spherical test value was 0.000 less than 0.05, indicating that there was a meaningful correlation between the variables.

Load Analysis of Various Indicators. Practice community informationization support class index screening out 4 categories altogether 12 questions. The practical community teaching applies the class target to sift out 3 kinds altogether 9 questions. Practical Community Development Index selected three categories of 16 questions. Based on the results of the correlation analysis of the factors of the Community of Practice evaluation model, the research hypothesis 4 and the research hypothesis 5 may be further clarified, and the following hypotheses shall be put forward to adapt the factors of the model by taking the factors influencing the indicators as observation variables and the three factors as potential variables, include hypothesis from 4.1 to 4.9, and hypothesis from 5.1 to 5.6.

Figure 2

Community of practice evaluation model



Results

Model Factor Exploration based on EFA

According to the results of factor correlation, a practical community evaluation model consisting of 37 topics in three categories was formed, 9 topics in the informatization support category, 12 topics in the teaching application category and 26 topics in the community development category. According to the reliability analysis results, α reliability coefficients of all factors were higher than 0.9, and had higher factor analysis applicability (KMO > 0.8) and factor correlation ($r > 0.6$). The model was constructed with all samples with data volume of 327 (N = 327). The model factor relationship and path coefficients were analyzed with the structural equation model (SEM), and the model adaptation key index was obtained after modification based on the model adaptation results. For example, the card-party freedom (c2/df) was 2.73 (less than 3), the RMSEA value was 0.073 (less than 0.08), and the CFI value was 0.94 (more than 0.9). Other adaptation indexes were shown in the table 3. Although some of the indexes were not suitable, the overall indexes were suitable and the compatibility was good. It was shown that the model had a higher fitness degree, the model and the questionnaire had a better level of community evaluation, and the structure (Validity) was good.

TABLE 2

Results and criteria of structural equation model adaptation

Model adaptation	Results	Adaptation value (x)	Adaptation results
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χ^2/df	2.731	$x < 3$	Yes
NFI	0.907	$x > 0.90$	Yes
RFI	0.90	$x > 0.90$	Yes
IFI	0.939	$x > 0.90$	Yes
TLI	0.932	$x > 0.90$	Yes
CFI	0.939	$x > 0.90$	Yes
GFI	0.789	$x > 0.90$	No
AGFI	0.752	$x > 0.90$	No
RMSEA	0.073	$x < 0.08$	Yes

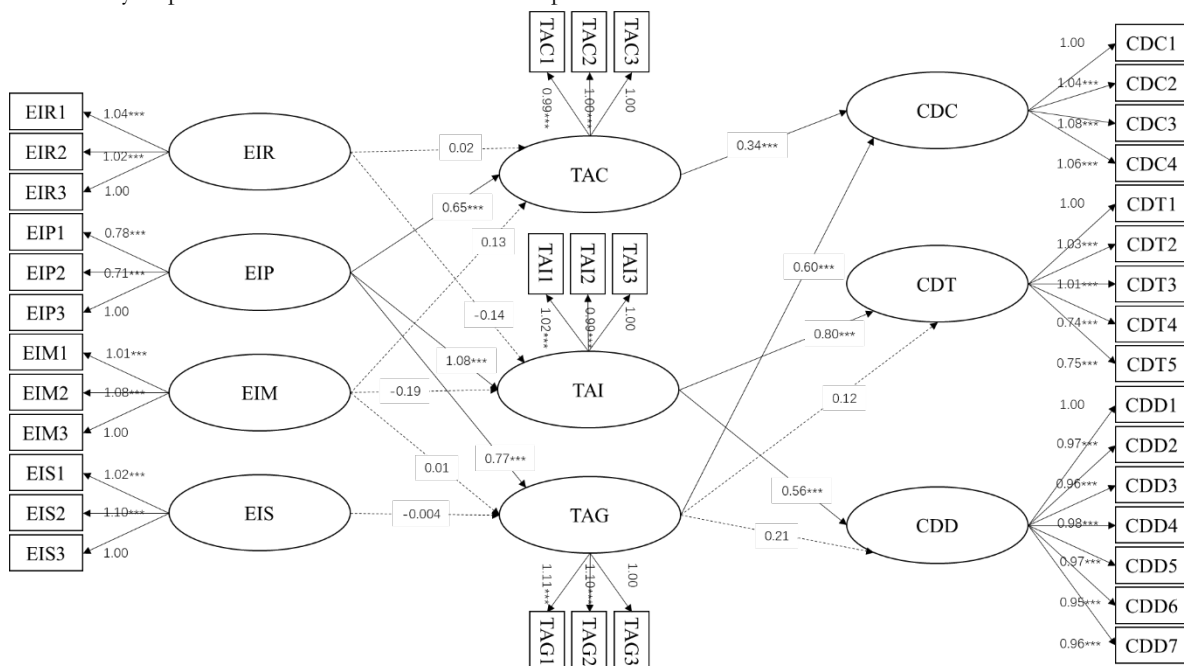
Path Coefficient and Hypothesis Testing

It is found that the model has good adaptability, factor correlation and significance are analyzed by path coefficient and hypothesis test. The final practical community evaluation model is obtained by path coefficient and hypothesis test. Based on the analysis of path-coefficient and P value after model adaptation, hypotheses 4, 5 and 6 are verified, and a community of practice evaluation model and its factor path-coefficient (as shown in Figure 3) are constructed.

TABLE 3
PATH COEFFICIENT AND HYPOTHESIS TEST RESULTS

Model path	Path index	P value	Hypothesis verification
EIR→TAC	0.18	0.833	Negative hypothesis 4.1
EIR→TAI	-0.138	0.097	Negative hypothesis 4.2
EIP→TAC	0.648	***	Positive hypothesis 4.3
EIP→TAI	1.081	***	Positive hypothesis 4.4
EIP→TAG	0.766	***	Positive hypothesis 4.5
EIM→TAC	0.133	0.139	Negative hypothesis 4.6
EIM→TAI	0.006	0.932	Negative hypothesis 4.7
EIM→TAG	0.133	0.139	Negative hypothesis 4.8
EIS→TAG	-0.004	0.914	Negative hypothesis 4.9
TAC→CDC	0.335	***	Positive hypothesis 5.1
TAI→CDT	0.799	***	Positive hypothesis 5.2
TAG→CDC	0.601	***	Positive hypothesis 5.3
TAG→CDT	0.123	0.199	Negative hypothesis 5.4
TAI→CDD	0.561	***	Positive hypothesis 5.5
TAG→CDD	0.214	0.003	Negative hypothesis 5.6

Figure 3
Community of practice evaluation model and factor path coefficient.



Discussion

In this study, exploratory factor analysis and confirmatory factor analysis were used to verify the theoretical model of community evaluation, and to verify the research hypothesis. Firstly, through the KMO measure test (0.939), the Bartlett spherical test ($p < 0.001$) and the alpha reliability coefficient (0.984), the evaluation of the development level of the Community of Practice by three factors, namely, "supporting factors" (hypothesis 1), "teaching application factors" (hypothesis 2) and "development factors of the Community of Practice" (hypothesis 3), is verified; secondly, through exploratory factor analysis, the effective influencing factors (factor load > 0.6 , $p < 0.001$) contained in the three categories are further screened, and through the verification factor analysis results (e.g.: $c2/df = 2.73$, NFI = 0.907, CFI = 0.94, RMSEA = 0.073, etc.), the final evaluation model of the Community of Practice is put forward, and the relevance between informatization supporting factors of Community of Practice and factors of teaching application (hypothesis 4), and the relevance between teaching application factors and factors of the Community of Practice development (hypothesis 5) is verified. Therefore, the hypotheses of this study are verified.

Conclusion

On the basis of theoretical research and project practice, this study proposes three categories and 24 factors, namely, "informatization support", "teaching application" and "practice community development", for the evaluation of practice community to carry out factor exploration, and applies exploratory factor analysis (EFA) to 154 half samples to verify the reliability of theoretical model, KMO measure, Bartlett spherical test, factor load quantity and factor correlation, constructs the structural equation model (SEM) for the evaluation of practice community, tests the path coefficient and model fitness of 10 final factors of the three categories of factors based on 327 samples, and finally designs a practice community evaluation model and validates the research hypothesis. It is found that the facilitation of the Practice Community to individuals is reflected in the factor relationship based on platform application (EIP), mediated by individual professional competence (TAC) and individual participation (TAI), and targeted by two-dimensional tension (CDD). The facilitation of the Practice Community to groups is reflected in the factor relationship based on individual participation (TAI) and professional competence, targeted by space-time cognition (CDT) and four-span integration (CDC), and based on the interaction mechanism between individuals and groups within the Practice Community, the "two-dimensional tension" mechanism of individuals, the "difference interaction" mechanism of groups and the "borderless development" mechanism of the Practice Community.

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