



Analysis of the Influence Factors of the Teaching Material Compilation Input of University Teachers Based on SPSS

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Abstract. Given teaching material construction as one of the national missions and responsibilities at the institutional level and the compilation input of teaching materials by teachers is considered critical in guaranteeing high-quality teaching material construction, this paper creatively discusses the influence factors of the teaching material compilation input from the perspective of university teachers. The research is unfolded in form of a questionnaire survey involving more than 700 university teachers and applies SPSS to process the data collected. Correlation analysis, factor analysis and multiple regression analysis were used in data processing to explore the key factors that influence their compilation input. Comprehensively, it shows that multiple factors are relevant; and the weight of teaching materials in professional title appraisal, support strength of teaching material programs, performance & salary appraisal, and honor awards are of high correlation to compilation input (i.e., the common factor) and significance.

Keywords: SPSS · multivariate regression analysis · teaching material construction · compilation input · influence factors

1 Introduction

Higher education in China has been on connotative development, which highlights the significance of the construction of high-quality teaching materials to establish a high-level teaching system and decide the essential issue – talent cultivation. In 2016, the General Office of the CPC Central Committee and the General Office of the State Council have clearly defined teaching material construction as one of the national missions and responsibilities at the institutional level. At the end of 2019, the National Committee for Teaching Materials issued The Construction Planning of Teaching Materials in Middle and Primary Schools and Colleges (2019–2022), and the Ministry of Education issued The Management Measures of Teaching Materials for Regular Institutions of Higher Education, to point out that it shall strongly encourage excellent teachers with higher academic level and rich teaching experience to engage in textbook compilation practice and to stress the priority of overall quality improvement [1, 2]. In 2020, the

first national selection of excellent teaching materials was launched, marking a further achievement in terms of the incentive mechanism in teaching material construction, which provided teachers with momentum for their compilation work [3]. The cases have demonstrated that universities have to respond to high-quality teaching material construction by acknowledging the core of “who are the constructors” and following the principle of “content orientation”. Thereupon, teachers, as the main force in the compilation journey, can better play their pivotal role, and the compilation practice can stand out as the prominent part.

It is an unfortunate fact that most studies concerning university teaching materials focus on the construction and the management system perspectives, rather than on compilation practice. In some cases, the compilation is regarded as one of the elements to improve teaching material construction, or pays more attention to the problems in specific compilation practice for specialized courses and the countermeasures. Furthermore, few studies have explored the influence factors of the compilation input from the university teachers’ perspective [4–6].

SPSS is a common piece of data analysis software in statistics, applicable to interdisciplinary empirical data analysis, equipped with nearly all analysis functions, including exploratory factor analysis, and multivariate regression analysis. Generally, exploratory factor analysis uses principal component analysis (PCA) to extract the common factor and determine the reliability and validity of the questionnaire. In this context, the research applies SPSS and statistical analysis methods to explore university teachers’ compilation input and its influence factors. With the outreached, innovative research methods, the research is of great reference significance to propose promotion countermeasures for university teachers’ compilation input, guild the compilation practice, and ensure high-quality construction of teaching materials.

2 Method and Data

2.1 Research Design and Implement

The research is unfolded in form of a questionnaire and applies SPSS to process the data collected. The procedure involves the design, formation, issuance, collection, and acceptance of the questionnaire and the accounting and processing of data. And it recognizes the condition of compilation input and its influence factors, and the relationships between them were analyzed [7, 8].

According to Lv and Wang [9, 10] and the opinions from teachers with rich teaching experience and teaching management experts, the study concludes that the influence factors of the compilation input of university teachers may include teaching material management, funding support, incentives, and workload assessment; and consequently, a specialized questionnaire named “Survey Questionnaire for the Compilation Input and its Influence Factors of University Teachers” was accomplished.

The questionnaire can be divided into three parts: (1) personal information, including age, gender, education, length of service, and professional title; (2) input factors in the compilation process, including time, energy, enthusiasm, and professional level; (3) influence factors of the compilation input, including teaching material management, funding support, incentives, and workload assessment, which can be subdivided into

management institution, policies & systems, knowledge of teachers on relevant policies, support strength of teaching material programs, support scope of teaching material programs, support channels of teaching material programs, the weight of teaching materials in professional title appraisal, assessment of teaching material workload, performance & salary appraisal, thresholds of teaching material awards, kinds of teaching material awards, bonuses of teaching material awards, and honor awards for teaching materials. The questionnaire is endowed with specific questions for different indicators and takes the form of the Likert scale to define five degrees of importance from very unimportant (1 Score) to very important (5 Score). An initial test was launched with a limited range to acquire feedback and expert advice for the wide-ranged official questionnaire.

2.2 Data Processing and Statistics

Overview

The research takes the front-line full-time teachers from J University as the samples to have a sampling questionnaire survey, with 756 questionnaires issued, and 723 valid questionnaires collected; the effective rate is 95.63%. The survey covers 339 males (46.89%) and 384 females (53.11%). Statistical results indicates a concentrated distribution in age (mostly 36 and above), an even distribution in the professional title (75.52% associate professors and professors), a concentrated distribution in education (86.03% master and above), and a concentrated distribution in service length (mostly 6 years and above, 44.26% exceeds 10 years). As the backbone force, these teachers, as the respondents, are representative enough to demonstrate reasonability and credibility.

After quantifying the survey results of the input factors and influence factors, it suggests that, from the teachers' perspective, the average scores of time, energy, enthusiasm, and professional level are 4.74, 4.67, 3.97, and 3.64, respectively, and the average scores of teaching material management, funding support, incentives, and workload assessment are 4.12, 4.52, 4.48, and 4.63, respectively. In light of that, it shows that the time and energy inputs of teachers are of great significance. At the same time, there is a consensus among the teachers that teaching material management, funding support, incentives, and workload assessment are highly important and shall be regarded as the principal influence factors.

Reliability and Validity Analyses

a. Reliability Test

The reliability test for data reports the stability and consistency of the questionnaire. The higher the test coefficient, the higher the stability, consistency, and reliability. The test applies Cronbach's Alpha and SPSS, and the results display the Cronbach's Alpha coefficients of compilation input, teaching material management, funding support, incentives, and workload assessment are 0.887, 0.886, 0.855, 0.894 and 0.881 respectively, and the overall coefficient is 0.912, suggesting that the questionnaire design is reasonable and the results are reliable.

b. Validity Test

The validity test is used to verify whether the questionnaire results accord with the exceptions and whether the indicators and questionnaire are compatible with the true requirements and purposes of the measurement procedure. The test applies KMO and Bartlett's test of sphericity, and the results refer to Table 1.

The closer KMO ($0 < \text{KMO} < 1$) approaches to 1, the higher the correlation between the variables measures, thus the more suitable the original variables for factor analysis. Bartlett's test is based on the original correlation coefficient matrix, which is the null hypothesis (H0). When the test results reject the null hypothesis, factor analysis between indicators is available. As shown in Table 1, the KMO is 0.894, close to 1, suggesting that each indicator in the scale is of high correlation and that the validity is favorable. In this case, the degree of freedom is 136, p is 0.000 (< 0.05), and the significant test of sphericity rejects the null hypothesis and admits to factor analysis.

Extraction of the Common Factor

The exploratory factor analysis for compilation input is based on SPSS. As shown in Table 2, there is one factor whose eigenvalue is greater than 1 and the degree of explanation for the compilation input dimension is 76.499%, which means that this factor interprets 76.499% of the total variation. The common factor extracted is acceptable provided the factors after the extraction jointly interpret more than 50% of all the variables.

Table 1. Validity Analysis

Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy		0.894
Bartlett's Test of Sphericity	Approx. Chi-Square	18592.94
	df	136
	Sig.	0.000

Table 2. Results of Factor Analysis for Compilation Input

Total Variance Explained						
Components	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	Variance (%)	Cumulativen (%)	Total	Variance (%)	Cumulative (%)
1	3.06	76.499	76.499	1.365	34.128	34.128
2	0.621	15.515	92.014			
3	0.194	4.854	96.868			
4	0.125	3.132	100			

Extraction Method: Principal Component Analysis (PCA).

3 Empirical Analysis

3.1 Correlation Analysis

The research has concluded 18 indicators for the influence factors of compilation input, including age, gender, professional title, length of service, management institution, policies & systems, knowledge of teachers on relevant policies, support strength of teaching material programs, support scope of teaching material programs, support channels of teaching material programs, the weight of teaching materials in professional title appraisal, assessment of teaching material workload, performance & salary appraisal, thresholds of teaching material awards, kinds of teaching material awards, bonuses of teaching material awards, and honor awards for teaching materials.

The research makes the correlation analysis the priority to determine whether these factors have any correlations with the common factor (i.e., compilation input) and their significance, so as to capture the principal influence factors of compilation input. As shown in Table 3, age is presented in a Spearman correlation coefficient for it serves as a categorical variable, and the other continuous variables are expressed in Pearson correlation coefficients.

According to the results, it is known that the significance value of gender is greater than 0.01, indicating a significant difference; and all the other 17 factors are less than 0.01, indicating a highly significant difference. Specifically, the correlation coefficients of gender, age, professional title, education, and length of service are negative and less than 0.2 in absolute terms, indicating a highly weak negative correlation and thus, insignificant influence on compilation input. Moreover, the significance values of gender and age are greater than that of the other items, suggesting that their influence on compilation input is even more insignificant. On the other hand, the correlation coefficients of management institutions, policies & systems, knowledge of policies, support scope, support channels, workload assessment, and kinds of awards are between 0.2 and 0.4, indicating weak positive correlations and weak influence of them on compilation input. The correlation coefficients of thresholds of awards and bonuses of awards are between 0.4 and 0.6, indicating moderate-intensity positive correlations and that these two factors can impact the compilation input of university teachers to some extent. At last, the correlation coefficients of professional title appraisal, performance & salary appraisal, and honor awards all exceed 0.6 to prove that they have strong positive correlations and can largely influence compilation input. Of which, professional title appraisal, as the overriding influence factor, has the highest correlation coefficient (up to 0.709).

3.2 Multivariate Regression Analysis

After the correlation analysis, it is founded that the indicators' differences in correlation coefficients are insignificant other than support strength, professional title appraisal, performance & salary appraisal, and honor awards. Therefore, a multivariate regression analysis for the data collected is needed to further explore the implication of the 18

Table 3. Correlation Coefficients of the Influence Factors of Compilation Input

Influence Factors	Spearman Correlation Coefficient	Sig. (one-tailed)
Gender	-0.137	0.013
Influence Factors	Pearson Correlation Coefficient	Sig. (one-tailed)
Age	-0.116	0.009
Professional Title	-0.158	0.000
Education	-0.139	0.000
Length of Service	-0.164	0.000
management institution	0.362	0.000
Policies & Systems	0.378	0.000
Knowledge of Policies	0.261	0.000
Support Strength	0.641	0.000
Support Scope	0.374	0.000
Support Channels	0.358	0.000
Professional Title Appraisal	0.709	0.000
Workload Assessment	0.376	0.000
Performance & salary appraisal	0.632	0.000
Threshold of Award	0.468	0.000
Kinds of Award	0.389	0.000
Bonuses	0.464	0.000
Honor Awards	0.613	0.000

indicators on compilation input. By locating the core influence factors, it may manage to encourage teachers to engage in the compilation work.

Establishment of a Multiple Linear Regression Model

$$Y = \beta_0 + \beta_1x_1 + \beta_2x_2 + \beta_3x_3 + \beta_4x_4 + \beta_5x_5 + \beta_6x_6 + \beta_7x_7 + \beta_8x_8 + \beta_9x_9 + \beta_{10}x_{10} \\ + \beta_{11}x_{11} + \beta_{12}x_{12} + \beta_{13}x_{13} + \beta_{14}x_{14} + \beta_{15}x_{15} + \beta_{16}x_{16} + \beta_{17}x_{17} + \beta_{18}x_{18} + u$$

where, respectively, y donates the compilation input of teachers; x_1 to x_{18} are 18 indicators for the influence factors of compilation input; β_0 to β_{18} are the model parameters; and u is the error term. The results refer to Tables 4 and 5.

F-Test for the Overall Regression Effect

The F-test serves as a test of significance for the overall regression effect. Through F-distribution Table, it can be known that at a level of $\alpha = 0.05$, $F_{\alpha}(10,700) \approx 2 < F = 63.479$. Thus, it suggests that the regressive effect is favorable and the variance

Table 4. Analysis of Variance in Regression (ANOVA^b)

Model		Sum of squares	df	Mean Square	F	Sig.
1	Regression	198.649	11	18.275	63.479	0.000
	Residual	196.967	710	0.279		
	Total	397.135	721			

explained is significantly greater than the variance unexplained, and the model has an overall significant linear effect.

T-Test for the Regressive Coefficients

Table 5 presents the results of the coefficients in the multiple linear regression model after the T-test. When the significant value of a variable is less than 0.05, the variable has a significant influence on overall satisfaction. In this case, the significant values of age, gender, education, knowledge of policies, support scope, support channels, and incentives are too great to be included in the equation as explanatory variables (Sig. > 0.05). In other words, these factors are negligible to overall satisfaction. On the contrary, 11 factors, including professional title, length of service, management institution, policies & systems, support strength, professional title appraisal, workload assessment, performance & salary appraisal, thresholds of awards, bonuses of awards, and honor awards are significant enough to be input into the equation (Sig. < 0.05), indicating their great influence on the compilation input of university teachers.

The coefficient (absolute value) of an influencing factor reflects its degree of explanation of the result (i.e., its influence on satisfaction). Based on the comparison of the 11 influence factors' standardized coefficients in absolute terms, the order of priority is: professional title appraisal > support strength > performance & salary appraisal > honor awards > bonuses of awards > thresholds of awards > workload assessment > policies & systems > management institution > professional title > length of service. Eventually, given the results from the analyses above, it demonstrates that professional title appraisal, support strength, performance & salary appraisal, and honor awards have great significance on the compilation input of university teachers, while the other 7 indicators are significant yet weaker compared with the 4 items mentioned. In addition, the coefficients of professional title and length of service are negative, indicating their negative impact on compilation input. In other words, the greater the profession title or the teaching age, the smaller the magnitude of compilation input from the individual.

Table 5. Regressive Coefficients for Each Indicator

Model		Unstandardized Coefficients		Standardized Coefficients		
1		B	SE	Beta	t	sig.
	Constants	1.978	0.231		9.381	0.000
	Gender	0.006	0.038	0.003	0.131	0.913
	Age	-0.004	0.004	-0.025	-0.723	0.451
	Professional Title	-0.090	0.032	-0.110	-2.713	0.006
	Education	-0.012	0.035	-0.014	-0.486	0.614
	Length of Service	-0.096	0.030	-0.100	-2.162	0.009
	Management Institution	0.143	0.022	0.164	2.602	0.000
	Policies & Systems	0.162	0.041	0.198	2.903	0.000
	Knowledge of Policies	0.052	0.061	0.065	1.038	0.312
	Support Strength	0.303	0.025	0.430	11.431	0.000
	Support Scope	0.054	0.024	0.067	1.126	0.221
	Support Channels	0.049	0.062	0.057	0.995	0.189
	Professional Title Appraisal	0.361	0.032	0.489	13.812	0.000
	Workload Assessment	0.181	0.056	0.215	5.216	0.000
	Performance & Salary Appraisal	0.274	0.043	0.389	10.975	0.000
	Thresholds of Awards	0.205	0.032	0.251	6.546	0.000
	Kinds of Awards	0.049	0.054	0.064	1.021	0.213
	Bonuses of Awards	0.213	0.023	0.284	7.346	0.000
	Honor Awards	0.256	0.020	0.342	9.763	0.000

4 Conclusions

In general, professional title appraisal, support strength, performance & salary appraisal, and honor awards have strong positive correlations to compilation input. And the multivariate regression analysis further demonstrates that, in absolute terms, the standardized coefficient of professional title appraisal is greater than that of support strength, performance & salary appraisal, and honor awards in sequence. Particularly, professional title appraisal has the highest correlation coefficient and standardized coefficient in absolute terms and therefore the greatest influence on compilation input.

In this context, future research that involves promotion countermeasures of compilation input may focus on the following three dimensions:

- (1) Optimization of the assessment system. The compilation practice inherently requires a massive investment of time and energy, and an improved workload assessment mechanism from the university and school levels that considers compilation, revision, and approval of teaching materials as important indicators may be favorable. From the professional title appraisal dimension, especially, it may contribute to teachers' enthusiasm in the compilation practice by increasing the weight of teaching material construction and teaching material achievements or setting up pluses;
- (2) Improvement of funding in teaching material construction. It may have a comprehensive investigation of the situations of the teaching material publishing market, to increase the budget for teaching material construction flexibly and guarantee the publication of teaching materials, cleaning off the obstacles on the road of teaching material compilation. The construction may highlight the educational purpose of teaching materials and closely combine with the institution's characteristics and development orientation to prioritize the compilation work on its key disciplines, characteristic subjects, emerging industries, and interdisciplinarity;
- (3) Establishment of a scientific and reasonable incentive mechanism for teaching material practice. Honor awards, as the ultimate incentive method, can trigger teachers' activity in teaching materials in form of praise, bonus, etc. to allow of prolonged enthusiasm. A two-level incentive system may be established by the university and its schools to lower the thresholds of awards and optimize the weight of teaching materials, thereby increasing the sense of achievement of teachers and their recognition of the system, maintaining a long-lasting power for them to engage in the compilation work.

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