A Meta-analysis based Study of the Factors Influencing Students' Engagement in Classroom Learning

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Abstract

To address the differences in current research on factors influencing student engagement in classroom learning, a combination of qualitative and quantitative meta-analysis was used to integrate a total of 43 high-quality empirical and relevant international literature that met the research criteria, and a total of 13 factors were found to influence student engagement in learning activities, such as teacher-student relationships, emotional factors, and student learning and thinking skills, all of which were significantly related. The analysis of the moderating variables also revealed significant differences between basic education and higher education in terms of personality traits, thinking skills and learning background on student engagement.

Keywords: *classroom learning; student engagement; basic education; higher education; meta-analysis*

1 INTRODUCTION

Learning engagement includes cognitive, behavioural, and affective engagement in classroom participation and is the quantity and quality of students' behavioural responses in the learning process as well as in extra-curricular and social activities to achieve successful learning outcomes [5]. According to Astin's theory of involvement [1], learning engagement affects a wide range of individuals, particularly in the process of participating in education, and can be influenced by a variety of factors, both individual student factors that directly affect students' classroom engagement and external factors that indirectly affect learning outcomes.

Student classroom participation behaviour and facilitation is an important issue in educational research and practice, and different scholars have presented different research findings. Based on the existing research literature and with the help of meta-analysis methods, we explore what factors have been identified in existing international research as influencing students' classroom learning engagement and to what extent these factors affect students' willingness and behaviour to engage in classroom learning. In addition, it will be explored if there are any differences between these factors on students' classroom participation at different educational levels.

By answering the relevant questions, we present the specific content and stage differences of the factors influencing students' classroom learning participation in a clear and intuitive way, which, theoretically, helps to explain the scattered and heterogeneous nature of existing research discussions, find the sources of differences and analyse the causes of differences, and to a certain extent, enrich the research related to the coherence of teaching and learning at different stages of education; in practice, it helps to formulate effective strategies to promote students' participation and enhance classroom participation and teaching effectiveness. In practice, it helps to provide some reference and support for the development of effective student participation facilitation strategies and the enhancement of classroom participation and teaching effectiveness.

2 RESEARCH DESIGN

2.1 Research Methodology

Meta-analysis (Meta-analysis), proposed by the American educational psychologist G V Glass, is a method of synthesising the results of a large number of existing empirical studies on the same topic for statistical analysis [4]. Encompassing both quantitative and qualitative analysis, it is a method of applying specific design and statistical analysis methods to the quantitative analysis of existing research findings. Initially applied mainly in the fields of medicine and psychology, as the meta-analytic approach has developed, the method has

also received attention from scholars in other fields and is increasingly accepted and recognised. The application of meta-analytic methods by different scholars gives us a reference and to a certain extent affirms the feasibility of this paper to use meta-analytic methods to conduct a secondary analysis and review of the factors influencing students' learning engagement.

2.2 Research design

In accordance with the meta-analysis literature collection and screening criteria, the international relevant literature was collated, and the literature that met the criteria was coded and pre-processed to produce a coding list of basic literature information. The pooled results were then entered into the meta-analysis software CMA for data processing, and after the meta-analysis results were obtained, the results were tested for heterogeneity, published bias analysis, moderating variables were obtained and the meta-analysis results were interpreted.

In order to obtain comprehensive literature related to student learning engagement studies, ensure data sources, and overcome publication bias, a search was conducted in Web of Science, Emerald, ProQuest and other databases using keywords such as "engagement", "student engagement", "In order to obtain comprehensive literature on student engagement studies, we searched Web of Science, Emerald, ProQuest and other databases using keywords such as "engagement", "student engagement", "attendance", "absence", etc. We obtained more than 400 relevant articles. and different studies took different analysis methods, due to the limitations of the current meta-analysis methods, the following screening criteria were set when selecting the meta-analysis sample [2]: (i) the literature must be international empirical studies, excluding theoretical studies and review papers; (ii) the object of study in the literature must be student engagement, deleting literature where the dependent variable is not student classroom engagement; in addition, the literature must report the correlation coefficient r between the independent variable and student classroom engagement with standard error SE or t-values, p-values, and other data that enable the calculation of the correlation coefficient; (iii) ensure the independence of the sample, i.e. it must be an independent study that does not contain the same sample.

The literature coding includes the basic information and content analysis of the literature and the summary of effect size statistics required for the meta-analysis. The content description of the literature mainly includes basic information such as the author of the literature (showing the first author), the research object, the content of the study and the extraction of conclusions, while the effect size statistics mainly include the sample size and the correlation coefficient r or can be transformed according to the Fischer Z formula t-values, p-values, etc.

The CMA (Comprehensive Meta Analysis) 2.0 meta-analysis software was used to conduct a meta-analysis of the factors influencing students' participation in learning, and most of the literature could use the correlation coefficient r as the effect value input.

3 FINDINGS

3.1 Sample coding results

The final sample data was selected from 43 pieces of domestic and international empirical literature that met the criteria, including 16 pieces in Chinese and 37 pieces in English. Some of the literature coding results are shown in Table 1.

Table 1: Selected examples of literature coded information

No.	sample size	Factors
1-21	256	Teaching and learning factors (r=0.272)
1-22	558	Individual student characteristics (t=3.538) Learning context (t=2.340)
1-23	443	Teaching and learning factors (r=0.530)
1-24	1714	Teacher behaviour (r=0.188) Learning resources support (r=0.117)

According to the requirements of the meta-analysis method, this paper needs to translate and collate the factors affecting students' classroom participation, and merge the same and similar factors in order to analyse the combined effect amount of each influencing factor. The independent variables with a frequency of occurrence greater than 2 and the corresponding literature were selected for the meta-analysis, and a total of 13 influencing factors were derived for inclusion in the meta-analysis after translation and aggregation of similar concepts for 43 papers and their discussion results.

3.2 Test of heterogeneity

The results of the heterogeneity test for this study are shown in Table 2. The results of the Q test were all significant (p < 0.05), indicating the existence of heterogeneity among the studies; meanwhile, the value of I² was greater than 80% and most of them were above 95%, indicating that each influencing factor partly accounted for a higher value in its effect [7]. Therefore, all tests of influences in this study were analysed using a random effects model

Table 2: Heterogeneity test results

Factors	K	N	Heterogeneity (Q test)			Tau-squared			
			Q-value	P-value	I^2	τ^2	SE	Variance	τ
Environmental support	9	44771	739.739	0.000	98.919	0.041	0.036	0.001	0.204
Partnerships	7	22507	451.417	0.000	98.671	0.050	0.043	0.002	0.223
Teacher behaviour	20	160253	7707.823	0.000	99.753	0.087	0.069	0.005	0.294
Teaching Factors	10	21309	272.628	0.000	96.699	0.030	0.023	0.001	0.173
Emotional factors	12	21752	1320.599	0.000	99.167	0.082	0.055	0.003	0.286
Teacher-Student Relations	8	70187	1396.584	0.000	99.499	0.076	0.074	0.005	0.275
Individual student characteristics	9	22503	124.131	0.000	93.555	0.012	0.009	0.000	0.110
Student personality traits	5	16797	129.457	0.000	97.683	0.018	0.019	0.000	0.133
Student thinking skills	4	84197	754.048	0.000	99.470	0.182	0.153	0.023	0.427
Student Learning Behaviour	14	144695	1993.275	0.000	99.348	0.045	0.038	0.001	0.211
Student Learning Ability	5	93663	66.853	0.000	94.017	0.009	0.009	0.000	0.092
Learning Context	6	4214	105.380	0.000	95.255	0.031	0.022	0.001	0.175
Learning Resources Support	5	20521	81.931	0.000	95.118	0.011	0.010	0.000	0.104
Total	114	727369	19821.565	0.000	99.430	0.024	0.014	0.000	0.155

3.3 Publication bias analysis

The test for publication bias in this paper uses the Egger test. The total fail-safe coefficient for each influencing factor (N=2789) is much greater than the total value of K (K=114), meaning that for each observed study 2789 negative experimental results are required to reverse the findings; the Egger regression intercept is 4.560, a small intercept value that does not deviate significantly from 0, indicating that the intercept term is not significantly different from 0. All factors are relatively robust and the results of the meta-analysis are not easily affected by significant of publication bias.

3.4 Effect value analysis

For the different types of effect value indicators, the reference values corresponding to different degrees of correlation are different. Cohen [3] proposed an empirical guideline for determining the strength of the correlation coefficient r, an r value of 0.00 to 0.09 indicates essentially no correlation, 0.10 to 0.29 a weak correlation, 0.30 to 0.49 a moderate correlation, and 0.5 to 1.0 a strong correlation. Based on this criterion, the correlations between all influential factors and students' participation in classroom learning were analysed and summarised. Based on the results of the effect value analysis, we can see that all factors occur more than twice, and in addition the range of no confidence intervals includes 0.000, which all pass the test and can be adopted in their entirety.

Table 3: Specific results of meta-analysis of factors influencing student learning engagement

Influencing factors	K	N	Effect value	95% confidence interval		Two-tailed test	
				Lower limit	Upper limit	Z-value	P-value
Environmental support	9	44771	0.252	0.093	0.399	40.481	0.000
Partnerships	7	22507	0.313	0.136	0.471	17.338	0.000
Teacher behaviour	20	160253	0.346	0.244	0.440	63.321	0.000
Teaching Factors	10	21309	0.270	0.119	0.409	17.556	0.000
Emotional factors	12	21752	0.367	0.237	0.484	25.826	0.000
Teacher-Student Relations	8	70187	0.460	0.311	0.587	147.451	0.000
Individual student characteristics	9	22503	0.175	0.012	0.330	9.887	0.000
Student personality traits	5	16797	0.292	0.054	0.498	60.016	0.000
Student thinking skills	4	84197	0.445	0.252	0.640	19.443	0.000
Student Learning Behaviour	14	144695	0.350	0.229	0.460	57.461	0.000
Student Learning Ability	5	93663	0.168	-0.050	0.372	66.245	0.000
Learning Context	6	4214	0.291	0.097	0.464	15.076	0.000
Learning Resources Support	5	20521	0.183	-0.036	0.386	9.968	0.000
Total	113	727369	0.308	0.243	0.370	189.953	0.000

Table 4: Correlations of factors influencing student learning

Correlation coefficient	Influencing factors
Medium correlation ($0.3 \leq r < 0.5$)	teacher-student relationships, students' thinking skills, emotional factors, teacher behaviour, students' learning behaviour, partnerships
Weak correlation ($0.10 \leq r < 029$)	student personality traits, learning context, teaching and learning factors, environmental support, learning resource support, individual student characteristics, student learning ability

Based on the summary results presented, it was concluded that the relationship between the 13 influencing factors and all independent variables and students' classroom learning engagement was statistically significant at the $p < 0.05$ level. The results show that there are six factors such as teacher-student relationship (0.46), students' thinking skills (0.445) and affective factors (0.367) that are moderately strongly correlated, seven factors such as students' personality traits (0.292), learning background (0.291) and teaching factors (0.27) that are weakly correlated with learning engagement, and zero factors that are largely uncorrelated with students' classroom learning engagement. This indicates that the research related to the factors influencing students' classroom learning engagement in the domestic and international empirical literature is relatively scattered, and there is no highly unified paradigm of expression and generally accepted research findings, which is one of the implications of this study.

3.5 Analysis of moderating variables

As the same variables varied across studies, studies were grouped according to variable characteristics to identify moderating variables where heterogeneity existed.

Table 5: Results of the analysis of stage of education as a moderating variable

Influencing factors	Adjustment variables	k	Effect value	95% confidence interval		Two-tailed test		Heterogeneity between groups		
				Lower limit	Upper limit	Z-value	P-value	Qb	df (Q)	P-value
Student personality traits								9.721	1	0.002
	Basic Education	2	0.840	0.604	0.941	26.949	0.000			
	Higher Education	3	0.287	0.036	0.504	12.898	0.000			
Student thinking skills								3.928	1	0.047
	Basic Education	2	0.428	0.232	0.591	18.049	0.000			
	Higher Education	2	0.142	-0.075	0.346	57.728	0.000			
Learning Context								13.155	1	0.000
	Basic Education	2	0.491	0.361	0.603	13.696	0.000			
	Higher Education	4	0.182	0.079	0.281	10.593	0.000			

In this paper, the Qb corresponding to students' personality traits, students' thinking ability and learning background are significant when the different learning stages, i.e. basic education stage and higher education stage, are used as moderating variables, indicating that the difference in the study targets between basic education and higher education has a moderating effect on students' learning background before classroom participation and students' thinking skills have a moderating effect on the relationship between students' thinking skills and students' classroom learning engagement. The remaining seven eligible factors were not significant, suggesting that the differences in the study population between the different levels of education did not have a significant moderating effect on the relationship between teacher behaviour, pedagogical factors and individual student characteristics and student engagement in class.

4   FINDINGS

The factors that had a greater impact on students' engagement in learning activities were teacher-student relationship (0.460), teacher behaviour (0.346), students' thinking skills (0.445) and learning ability (0.168), which is in line with several researchers such as Berti et al.

(2010), Conner and Pope (2013) and Cooper (2014) who argued that "teacher-student relationships and positive teacher behaviour are key factors influencing student engagement in the classroom", with students who are highly receptive to knowledge, responsive, willing to think and have high levels of thinking skills tending to be more actively engaged in classroom learning. The low correlates include students' personality traits (0.292), students' learning backgrounds (0.291) and teaching factors (0.270), which are inconsistent with the findings of several scholars that positive teacher-student relationships and partner support are key influences on students' engagement in learning activities. However, it supports the findings of Tong Yangshuai and other scholars that students with open and extroverted personality traits are more willing to actively participate in the classroom [6].

5   CONCLUSION

The study found that for one thing, depending on the degree of correlation between the independent and dependent variables, the most critical factors influencing students' participation in classroom learning were teacher-student relationships and students' thinking skills; and for another, the different stages of students' education

explained to some extent the heterogeneity between studies on factors affecting participation in classroom learning. This finding is enlightening for school management and teaching reform, as good communication and rapport between teachers and students can directly promote students' interaction and participation in the classroom. School administrators and teachers should break away from the stereotypical hierarchy of teachers and students, truly understand students, care deeply for them and be friends with them, so as to encourage students to actively participate in the classroom and teach each other.

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