

Analysis of Students' Deep Learning Abilities in the Course of Financial Econometrics

Li Liu^{1*}, Yuanchu Li¹

¹ Hunan University of Technology, School of Economics and Trade, Zhuzhou, Hunan, China

Email Address

zwjll706@163.com (Li Liu)

*Correspondence: zwjll706@163.com

Received: 8 March 2024; Accepted: 2 April 2024; Published: 14 May 2024

Abstract:

This study focuses on students majoring in Financial Engineering at the School of Economics and Trade at H University. By combining the teaching practice of “Financial Econometrics”, a scale was constructed to measure course challenge, learning engagement, and deep learning abilities. Through a questionnaire survey, the following research findings were obtained: There are significant differences in gender and year of enrollment regarding the different factors of course challenge, learning engagement, and deep learning abilities. It was found that students exhibit lower levels of cognitive engagement in the course. In terms of deep learning abilities, students demonstrate good performance in autonomous learning but perform poorly in analytical learning and research-oriented learning. Furthermore, deep learning abilities are less influenced by course challenge and more influenced by students' learning engagement. Therefore, it is crucial to emphasize the impact of students' behavioral and cognitive engagement on deep learning abilities. Finally, based on the research findings, corresponding research recommendations are proposed.

Keywords:

Financial Econometrics, Course Challenge, Learning Engagement, Deep Learning Abilities

1. Introduction

The Ministry of Education has successively issued policy documents such as the “Opinions on Strengthening the Construction, Application, and Management of Online Open Courses in Higher Education” and the “Education Informatization 2.0 Action Plan”, which has triggered teaching practices among university teachers. However, the current situation of deep learning among college students in blended learning is not optimistic. The course “Financial Econometrics” is characterized by rigorous theory, strong logical reasoning, and requires students to comprehensively apply mathematical and statistical analysis methods. Since 2020, the teaching team has conducted explorations of blended teaching in course of “Financial Econometrics”. However, the teachers have also found that students' deep learning abilities need to be

improved. Therefore, promoting classroom reforms plays an important role in cultivating students' deep learning abilities.

Therefore, this paper takes the teaching of "Financial Econometrics" in blended learning as an example to investigate the current situation of students' deep learning, aiming to help teachers gain a deeper understanding of the actual situation of students' deep learning in teaching. A questionnaire survey was conducted among students who have studied "Financial Econometrics" in the School of Economics and Trade at H University. The goal is to encourage teachers to optimize course design and teaching practices through online teaching platforms and propose corresponding strategies to enhance students' deep learning abilities in blended learning.

2. Current Research Status

In 1976, Swedish scholars Marton, F and Saljo, R. introduced the concepts of deep learning and surface learning [1]. Since then, more scholars have elaborated on the meaning of deep learning from various perspectives [2,3,4,5]. Domestic scholars have continued the relevant researches and explored the connotation of deep learning [6,7,8,9].

Regarding the evaluation of deep learning abilities, foreign scholars generally assess them based on learning outcomes, learning processes, and learning objectives [10]. Some scholars propose the measurement of deep learning abilities. Domestic scholars have also evaluated deep learning abilities from different perspectives [11,12,13]. In terms of the influencing factors of deep learning abilities, foreign scholars mainly examine their impact from the perspectives of students and teachers [14,15,16,17]. Domestic scholars also explore deep learning abilities from factors such as student characteristics, teacher factors, learning resources, and interactive environments [12,18,19,20].

This study believes that deep learning involves students independently learning, applying learned knowledge in different real-life contexts with the assistance and guidance of teachers, and critically reconstructing and integrating the acquired knowledge during the process of knowledge learning and application. Based on the teaching practices of the "Financial Econometrics", this paper suggests that deep learning abilities manifest aspects such as independent learning, analytical learning, and research-oriented learning.

3. Research Design

3.1. Sample

The research team developed a self-designed questionnaire titled "Survey on the Current Status of Deep Learning in the Teaching of Financial Econometrics." The questionnaire was distributed through the "SurveyStar" platform. The survey participants included students majoring in Financial Engineering at the School of Economics and Trade at H University, who had taken the "Financial Econometrics" course. A total of 222 valid responses were collected. Among them, there were 93 male students (41.9%) and 129 female students (58.1%). The students were also divided into four groups based on their year of enrollment: 38 students from the 2018 (17.1%), 70 students from the 2019 (31.5%), 76 students from the 2020 (34.3%), and 38 students from the 2021 (17.1%).

3.2. Measurement

The questionnaire consisted of three aspects: course challenge, learning engagement, and deep learning abilities. The course challenge section included dimensions such as cognitive goals of the course, classroom learning behaviors, laboratory practices, requirements for course papers' quality, and assessment criteria. The learning engagement section covered behavioral engagement, cognitive engagement, and emotional engagement. The deep learning abilities section included proactive learning, analytical learning, comprehensive learning, and research-oriented learning. All items were scored using a 5-point Likert scale.

4. Results

4.1. Reliability and Validity Testing

Firstly, the dimensions covered in this questionnaire were developed based on relevant literature and the teaching practices of the "Financial Econometrics" course, which could reflect the actual situation of education and teaching under the blended learning mode, ensuring good content validity [21-22]. Secondly, the corrected item-total correlations (CITC) of all retained items were greater than 0.4, and removing any item which did not increase the Cronbach's coefficient of the overall scale. Thirdly, The KMO values for the scales of course challenges, learning engagement, and deep learning abilities were all above 0.8, and the p-value of the Bartlett's test of sphericity was less than 0.01, indicating the suitability for factor analysis. Additionally, using principal component analysis and Kaiser normalization with maximum variance rotation, factor loadings were obtained. Items with loadings above 0.5 were retained, and all eigenvalues were greater than 1. The results show that the course challenge scale consisted of five dimensions: cognitive goals of the course, requirements for course papers' quality, assessment criteria, laboratory practices, and classroom learning behaviors. The learning engagement scale included three dimensions: behavioral engagement, emotional engagement, and cognitive engagement. The deep learning abilities scale comprised three dimensions: proactive learning, analytical learning, and research-oriented learning. Based on the test results, the Cronbach's coefficients for the three scales mentioned above were all above 0.85, and the cumulative variance contribution rates exceeded 60%, indicating good reliability.

4.2 Analysis of Survey Results

4.2.1. Descriptive statistics

The descriptive statistical results show that in the course challenges scale, the mean values of the majority of items were above 4.20. Students had a relatively consistent perception of the course challenge, with high agreement on cognitive goals of the course, requirements for course papers' quality, and assessment criteria.

In the learning engagement scale, the mean values of behavioral engagement and emotional engagement were relatively high, ranging from 4.16 to 4.59. However, the mean value of cognitive engagement was relatively low, with all items related to knowledge integration having mean values below 4. Overall, there was not a significant difference in students' agreement on course learning engagement.

In the deep learning abilities scale, the mean values of proactive learning items ranged from 3.55 to 4.26, with only three items having mean values above 4. The

mean values of analytical learning items ranged from 3.27 to 3.84, and for research-oriented learning, the mean values ranged from 3.15 to 3.62. These results indicate that students have significant room for improvement in terms of deep learning abilities.

4.2.2. Group Analysis

Using the factor loading as weights derived from the factor analysis results, we calculated the weighted average of each factor to assess the differences among different genders and enrollment years.

(1) Group analysis between Genders

As shown in Table 1, in terms of course challenges, there were gender differences in the mean values for requirements of course papers' quality, laboratory practices, and classroom learning behaviors, with mean differences of -0.1809 ($p < 0.1$), -0.1234 ($p < 0.1$), and -0.3209 ($p < 0.05$), respectively. However, there were no significant mean differences in cognitive goals of the course and assessment criteria ($p > 0.1$).

Regarding learning engagement, there were gender differences in behavioral engagement and cognitive engagement, with mean differences of -0.1613 ($p < 0.1$) and -0.2806 ($p < 0.01$), respectively. The differences were relatively significant. However, there was no significant mean difference in emotional engagement ($p > 0.1$).

In terms of deep learning abilities, there was a significant gender difference in analytical learning, with a mean difference of -0.2471 ($p < 0.01$). However, there were no significant differences in proactive learning and research-oriented learning ($p > 0.1$).

These results indicate that, overall, female students outperformed male students in terms of course challenges, learning engagement, and deep learning abilities.

Table 1. Group analysis between Genders.

Factors	Gender	Mean	Difference	t	p
Requirements for course papers' quality	Male	4.1741	-0.1809*	-1.915	0.057
	Female	4.3550			
Laboratory practices	Male	4.6323	-0.1234*	-1.911	0.057
	Female	4.7557			
Classroom learning	Male	4.0397	-0.3209***	-3.389	0.001
	Female	4.3606			
Behavioral engagement	Male	4.2104	-0.1613*	-1.714	.088
	Female	4.3717			
Cognitive engagement	Male	3.8792	-0.2806**	-2.488	.014
	Female	4.1598			
Analytical learning	Male	3.3324	-0.2471***	-2.629	.009
	Female	3.5795			

*: $p < 0.1$; **: $p < 0.05$; ***: $p < 0.01$

(2) Group analysis among enrollment years

Using one-way analysis of variance (ANOVA), the results indicated that there were significant differences in the evaluations of students from different enrollment year only in the three factors related to deep learning abilities. As shown in Table 2, in terms of proactive learning, the 2020 cohort of students performed significantly better than the 2021 cohort, with a mean difference of 0.2474 ($p < 0.1$). In terms of analytical learning, the 2018 cohort scored significantly lower than both the 2019 and 2020

cohorts, with mean differences of -0.2915 ($p < 0.05$) and -0.3145 ($p < 0.05$), respectively. For research-oriented learning, the 2020 cohort outperformed the 2021 cohort, with a mean difference of 0.3246 ($p < 0.05$). Overall, the 2020 cohort exhibited better performance in terms of deep learning abilities, while the 2018 cohort showed slightly lower performance in analytical learning. The 2021 cohort displayed slightly lower performance in both proactive learning and research-oriented learning.

Please note that the translation provided is an approximation, and the interpretation of statistical results may require a deeper understanding of the context and specific statistical techniques used in the study.

Table 2. Group analysis among enrollment years.

Factors	Enrollment year (I)	Enrollment year (J)	(I-J)	p
Proactive learning	2020	2021	0.2474*	0.062
Analytical learning	2018	2019	-0.2915**	0.038
	2018	2020	-0.3145**	0.023
	2020	2021	0.2474*	0.074
Research-oriented learning	2020	2021	0.3246**	0.036

*, $p < 0.1$; **, $p < 0.05$

5. Research Findings

This study constructed scales for course challenge, learning engagement, and deep learning capability based on relevant literature and the teaching practice of “Financial Econometrics”. The course challenge scale consists of five dimensions: course cognitive objectives, requirements for course papers, assessment criteria, laboratory operation behavior, and classroom learning behavior. The learning engagement scale includes three dimensions: behavioral engagement, emotional engagement, and cognitive engagement. The deep learning capability scale comprises three dimensions: proactive learning, analytical learning, and research-oriented learning.

Descriptive statistics results indicate that students have a high level of recognition for the course challenge in Financial Econometrics. Regarding learning engagement, students show high scores in behavioral and emotional engagement but lower scores in cognitive engagement. In terms of deep learning capability, students demonstrate good performance in proactive learning but perform poorly in analytical learning and research-oriented learning, especially with a low mean in research-oriented learning.

In group analysis, (1) the survey indicates that male students have a lower level of recognition for the course challenge in 'Financial Econometrics' compared to female students. However, in terms of learning engagement, male students do not score higher than female students in behavioral and cognitive engagement. Male students also exhibit inferior performance in proactive and analytical learning. The mean of male students in research-oriented learning is slightly higher than that of female students, but the difference is not significant. It also reflects that female students indeed outperform male students in course cognition, learning engagement, and deep learning capability. (2) The survey results that in terms of deep learning capability, the overall performance of the students enrolling in 2020 surpasses that of other academic years. The students enrolling in 2018 exhibits slightly lower performance in analytical learning, while those in 2021 shows slightly lower performance in proactive and research-oriented learning.

6. Conclusions

Currently, students' level of engagement is not fully satisfactory, especially among male students who exhibit a lack of motivation, unsatisfactory classroom performance, and a passive attitude towards assignments, exercises, and exams. The following measures can be implemented in teaching: (1) Emphasize the course learning objectives and their significance, helping students compensate for deficiencies in foundational theories and methods. (2) Encourage students to enhance self-discipline and develop reasonable study plans, enabling them to manage their course study, extracurricular activities, and leisure time effectively. (3) Teachers can incorporate more diverse case analyses and specialized discussions in classroom teaching to make the learning environment more active and challenging. (4) In subsequent teaching processes, teachers can enhance corresponding course cases, experimental analysis, and guidance for course papers, allowing students to connect theoretical knowledge with practical problems, expand and deepen their understanding of the subject matter, and cultivate their innovation and practical abilities.

Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this article.

Funding

This study was supported by the Research Project on Teaching Reform of Higher Education in Hunan Province, entitled "Research on Strategies to Improve Deep Learning Abilities of College Students in Blended Learning: A Case Study of Financial Econometrics", project number HNJC-2022-0190.

References

- [1] Marton, F.; Saljo, R. On qualitative difference in learning: outcome and process. *British Journal of Educational Psychology*, 1976, 46, 4-11.
- [2] Biggs, J.; Kember, D.; Leung, D.Y.P. The revised two-factor Study Process Questionnaire: R-SPQ-2F. *The British Journal of educational psychology*, 2001, 1, 133-149.
- [3] Egan, K. Learning in depth: A simple innovation that can transform schooling. Chicago: University of Chicago Press, 2011.
- [4] National Research Council. Education for life and work: Developing transferable knowledge and skills in the 21 century. Washington D.C.: National Academic Press, 2013, 5-6.
- [5] John, B.; Biggs, Kevin. F. Collis. Evaluating the quality of learning: The SOLO taxonomy structures of the observed learning outcomes, Translated by Ling-biao Gao and Hong-yan Zhang. Beijing: People's Education Press, 2010, 12.
- [6] Pan, D.G. College students' deep learning: the essential meaning, the conceptual origin and the implementing approaches. *Jangsu Higher Education*, 2020, 04, 30-34, 40.
- [7] Duan, J.J.; Yu, S.Q. Overview of Study on Deep Learning with E-learning Based on Learning Science. *Journal of Distance Education*, 2013, 31(04), 43-51.

- [8] Kang, S.M. On Deep Learning for the Cultivation of Learners' Disciplinary Competencies. *Educational Research*, 2016, 37(07), 111-118.
- [9] Yang, M.; Chen, X.H. An Empirical Study On College Students' Online Deep Learning: the Case of Xihua University. *Journal of Higher Education Research*, 2018, 41(02), 56-62.
- [10] Zhou, W.Y.; Chen, M.Z. Performance Assessment for Deep Learning-Interview with Professor Ray Pecheone, Director of Stanford Center for Assessment. *Learning and Equity, Global Education*, 2017, 46(07), 3-9.
- [11] Wang, J.; Han, L.; Li, Z.K. Research on Influencing Factors and Model Construction of College Students' Deep Learning under the Environment of "Internet +". *Lifelong Education Research*, 2020, 04, 44-54.
- [12] Qu, J.Z.; Xing, L.R. The study on the assessment system for college students deep learning. *J. Changchun Inst. Tech (Soc Sci Edi)*, 2017, 18(01), 106-109.
- [13] Wang, S.L.; Chen, Y.M. On Relationships Between Richness of Educational Experience, Deep Learning and Learning Harvest of College Students. *Heilongjiang Researches on Higher Education*, 2018, 08, 104-108.
- [14] Groves, M. Problem-Based Learning and Learning Approach: Is There a Relationship? *Advances in Health Sciences Education*, 2005, 10(4), 315-326.
- [15] Papinczak, T.; Young, L.; Groves, M, et al. Effects of a Metacognitive Intervention on Students' Approaches to Learning and Self-Efficacy in a First Year Medical Course. *Advances in Health Sciences Education Theory & Practice*, 2008, 13(02), 213-232.
- [16] Offir, B.; Lev, Y.; Bezalel, R. et al. Surface and deep learning processes in distance education: Synchronous versus asynchronous systems. *Computers & Education*, 2008, 51(3), 1172-1183.
- [17] Leung, M.Y.; Chen, D.; Chan, I.Y.S. Attributes of Hong Kong Construction Engineering Student Learning Approaches: Investigation of Chinese and Western Personal Values. *Journal of Professional Issues in Engineering Education and Practice*, 2012, 138(3), 224-233.
- [18] Lin, F. Effect Factors and Mechanism Research about Deep Learning-Based on College Students Study Engagement, Lanzhou: Lan Zhou University, 2017.
- [19] Qian, W.X.; Yi, L.L.; Ma, F. et al. Influencing Factors of Deep Learning in Information Technology Curriculum. *China Educational Technology*, 2018, 11, 87-93.
- [20] Wu, Y.J. Research on Influential Factors and Its Measurement of Learners' Online Deep Learning. *e-Education Research*, 2017, 09, 57-63.
- [21] Zhai, H.J.; Zhang, T. The Local High-Level University's Curriculum Challenge: Evaluation Indicators, Features and Countermeasures. *China Higher Education Research*, 2020, 04, 59-64+70.
- [22] Dixon, M.D. Creating effective student engagement in online courses: What do students find engaging? *Journal of the Scholarship of Teaching and Learning*, 2010, 10(2), 1-13.



© 2024 by the author(s); licensee International Technology and Science Publications (ITS), this work for open access publication is under the Creative Commons Attribution International License (CC BY 4.0). (<http://creativecommons.org/licenses/by/4.0/>)