Influence of Sustained Learning on Knowledge Transferability in Distance Learning

https://doi.org/10.3991/ijet.v17i10.30917

Baohua Wang[1], Yunchao Du[2(✉)], Qingyuan Shen[3]
[1] Zhejiang Business Technology Institute, Ningbo, China
[2] Ningbo University of Technology, Ningbo, China
[3] Nam Seoul University, Chungcheongnam-do, Republic of Korea
du_yunchao@nbut.edu.cn

Abstract—Through the network teaching platform, distance teaching provides relevant distance technical support services for adult education, and evaluates teaching results of the teaching method, relying on modern network technology and integrating educational resources. It has become a consistent pursuit in the field of education to change the learning mode of distance learners, to cultivate higher-order sustained thinking ability, and to promote sustained learning so that learners' knowledge transferability becomes more obvious. The results show that Cronbach's á coefficient and KMO values of the questionnaire are 0.879 and 0.850, indicating that the reliability and validity of the questionnaire are good. Sustained learning, which consists of learning engagement, learning motivation and learning strategy, can significantly improve knowledge transferability. Distance learning duration and age of learners have significant differences in knowledge transferability. Gender and specialty have no significant difference in knowledge transferability. Conclusions have very important reference value for improving sustained learning effect of learners in distance teaching, promoting the occurrence of learners' multiple interaction behaviors in distance teaching, and realizing cooperative knowledge construction of learners in distance teaching.

Keywords—distance learning, sustained learning, knowledge transferability, impact

1 Introduction

With the gradual application of educational information technology in distance education, it has become the mainstream of modern adult education. At the same time, distance education is widely used even in primary and secondary schools and universities for the elderly. Distance education and online education are both specific application forms of educational informatization, which are mainly educational ways of effective teacher-student interaction through network and information technology, multimedia resources and mobile Internet platform. Distance education has the characteristics of long-distance, fast transmission speed and obvious teaching effect. It realizes teaching process in the form of video, text, audio and data, and ultimately

improves learning skill level of learners. Compared with traditional classroom teaching, distance education is a new teaching mode that adapts to the background of enlarging the scale of higher education objects and increasing demand for learning anytime and anywhere. It is an effective supplementary form and a new exploration of traditional teaching. Distance education effectively overcomes physical separation between teachers and students in space and effectively realizes brand-new transformation of education form. Through distance education, modern information technology can be used to share teaching resources efficiently. Then, teachers are required to follow rules of distance teaching, to consider individual attributes of adult learners, and to carry out effective integration of educational resources. In this process, the structure and role orientation of the teacher-student relationship have undergone qualitative changes. Distance teaching has liberated teachers from traditional face-to-face teaching mode, but it does not mean that function of teachers has been weakened by technology.

In fact, distance teaching needs to pay more attention to teachers' teaching ability and learners' sustained learning, which forces distance education teachers to put more emphasis on cultivating students' higher-order thinking and innovative thinking. It means they should provide students with more intelligent and dynamic teaching. Sustained learning mainly refers to ability of learners to comprehensively solve complex practical problems in life and to work by transforming information into effective critical knowledge and higher-order thinking, which has become the core demand for high-quality and skilled talents in today's society. Under the background of education science evaluation gradually perfect, fundamental change of learners' learning style, by learning more high-quality distance learning courses, trains learners' high-order thinking ability and innovation spirit. Behavior occurrence frequency of learning quality are becoming new focus of education evaluation. However, in distance education, there are few opportunities for interaction between teachers and students. Due to characteristics of adult education learners' combination of work and study, irregular learning time, and use of fragmented learning time, distance education platform is difficult to ensure interaction time, and interaction opportunities are few. Adult learners have a great need for teachers to answer questions and to discuss in class, while teachers on the platform fail to give timely feedback to students' questions, which makes it impossible for students to fully appreciate advantages of distance education. Therefore, only by comprehensively improving sustained learning of learners in distance learning, can their knowledge transferability be effectively enhanced and effective knowledge accumulation is realized.

2 Theoretical background and research hypothesis

2.1 Theoretical background

Brandon et al. [1] believed that construction of knowledge concept of attention should pay attention to dynamic change of knowledge, rather than certainty and objective invariability. Individual knowledge is constructed by human beings. Under-

standing of things cannot be limited to sensory stimuli. Perception of things must be constructed by individual learners according to their own knowledge system. Through active construction of knowledge system, learners need to purposefully and consciously process and transform new problems, new views and new ideas. Situational demands that students should not blindly pursue generalized knowledge divorced from the situation, but should be good at applying acquired knowledge to different situations. Teaching view based on constructivism thinks that teaching is not simply transmission of objective knowledge, but also requires learners to acquire new knowledge experience according to existing knowledge system, and to strive to complete reorganization of knowledge structure. It is necessary to summarize distance teaching, to break through simple mode of pure video playback, and to create situational teaching, scaffolding teaching, group learning and cooperative learning and other modes to realize knowledge construction of learners.

Sustained learning has been widely accepted in the field of education worldwide, but there are many different interpretations of the precise definition of sustained learning. However, most people tend to believe that sustained learning focuses on learners' learning ability of complex problems, replication ability of higher-order thinking and nonlinear thinking ability. It requires learners to further comprehensive application process of sustained understanding, reflective criticism and other abilities on the basis of surface learning. Sustained learning requires learners to use higher-order thinking such as analysis, reorganization and integration to process new information and reconstruct knowledge systems acquired by new learning with original knowledge systems, to accelerate efficient construction of learners' knowledge systems. Finally, integrated knowledge transfer can be applied to different situations. This point is very consistent with constructivism theory of learning and knowledge. In the process of promoting students' sustained learning, higher requirements are put forward for teachers' teaching, which requires teachers to optimize design of more high-quality course teaching links.

2.2 Research hypothesis

As for how sustained learning affects learning performance and promotes knowledge transfer, Gordon et al. [2] mainly showed that modification of teaching methods, task requirements and evaluation processes encouraged students to change their learning methods and increased the use of methods, which could effectively improve learners' learning performance. Lynch et al. [3] surveyed the influence of the study method on pre-service teachers' critical thinking and metacognitive skills., Results showed that learning way of self-evaluation and peer evaluation was helpful to realize the depth of learners' learning effect, and that sustained learning behavior could lead to higher quality learning outcomes and higher critical thinking skills. Borredon et al. [4] believed that teaching mode of learning team could be adopted in sustained learning, the proposed theoretical basis of a specific learning mode suitable for France, described conditions for implementing this mode in a French institution of higher learning, and reported beneficial results of learning experience from a cross-cultural perspective. Filius et al. [5] thought small private online course (SPOC) was a

special form of online education. Research showed that there were obvious challenges in realizing sustained learning in SPOC, requiring teachers to pay more attention to social and teaching activities and other sustained learning content. Nielsen [6] believed that concept-based learning activity (CBLA) had been used in clinical education, and research results showed that including concept-based learning could promote sustained learning, connection between theory and practice, and clinical judgment. Shearer et al. [7] believed that sustained learning of learners must be promoted through a series of design changes of graduate education courses in online courses. Research results showed that teachers could effectively improve sustained learning by changing teaching strategies and could realize improvement of learning efficiency of learners. Manikandan et al. [8] believed that the use of online resources and self-study was to enable community of learners to access intelligence-based systems, and introduced the introduction of intelligent sustained learning process model in self-learning systems. Dunleavy et al. [9] believed that enhancement of learning performance by learners through sustained learning was a strategy to improve educational achievement and was an independent and valuable educational outcome. Aguiar-Castillo et al. [10] believed that gamification was a tool used to promote students' commitment and motivation. Studies showed that students' satisfaction would be directly affected by application characteristics and pro-sustained learning methods. The higher students' satisfaction was, the greater promotion effect of their sustained learning strategies would be. Fourie [11] argued that students using sustained learning methods were considered to have better quality and preferable learning outcomes than those using surface learning methods, and discussed the extent to which South African Institutes of Higher Education promoted and developed sustained learning methods for their undergraduates. Filius et al. [12] showed that students could use online audio peer feedback as a method to select sustained learning methods, and effect of sustained learning would become more obvious. Golightly et al. [13] evaluated the extent to which first-year geography education students used surface learning in embedded problem-based learning (PBL) model, and evidence showed that implementing PBL helped to promote sustained learning effect. Results of Sáiz-Manzanares et al. [14] showed that the use of personalized e-learning system could predict students' learning results and the use of effective learning behavior patterns, which could improve students' satisfaction with teaching practice. Fiorini [15] believed that interdisciplinary education for learners could achieve effective sustained learning effect and improve learners' innovation ability. As it can be seen from the existing research literature, sustained learning, as a core concept to achieve educational goals, has been widely recognized worldwide. However, there is no consensus on definition, connotation and measurement, and many researchers have conducted a large number of studies and experiments according to their understanding. However, compared with surface learning such as learning browsing videos and posting discussions, sustained learning is more diversified in form and content, and requires more information technology support, interaction between teachers and students, and good learning strategies. Distance sustained learning, as defined in this study, means that in distance learning, learners fully participate in the complex knowledge points and core skills training of distance courses and acquire profound and meaningful learning processes. Therefore, based on

the scale of sustained learning for college students in a mixed learning environment compiled by Li et al. [16], this study clearly shows that sustained learning includes three aspects, namely, learning engagement, learning motivation and learning strategy, which are the core elements of sustained learning. Therefore, this study proposes the following three hypotheses.

- H1: In distance teaching, learning engagement can significantly improve knowledge transferability.
- H2: In distance learning, learning motivation can significantly improve knowledge transferability.
- H3: In distance teaching, learning strategy can significantly improve knowledge transferability.

3 Research design

3.1 Questionnaire design

In this study, qualitative data of semi-structured interviews are written and annotated word by word, and contents with the same attributes are classified and summarized by the category analysis method. Research tool is a structured questionnaire, which is divided into three parts. The first part is control variable question, including gender, grade, major, distance learning duration and other four questions of the respondents. The second part is sustained learning scale. For sustained learning, this study adopts the questionnaire of Li et al. [16], which includes three aspects of sustained learning. They are learning engagement, learning motivation and learning strategy. There should be 4, 6 and 15 topics, which are widely used in China's education field at present. This part is measured in the form of 7-level Likert scale. The third part is measurement of knowledge transferability. This study uses final score of all subjects in distance teaching divided by the mid-term score as basic data, and ranks them by top 5%, top 15%, top 30%, top 50%, top 70, top 90% and top 100% respectively, and gives 7, 6, 5, 4, 3, 2 and 1 points respectively. At the same time, SPSS 25.0 software is used for quantitative analysis, including reliability and effectiveness analysis, descriptive statistical analysis, independent sample T-test, multiple regression analysis and variance test.

3.2 Research objects

This study conducts a questionnaire survey on an ordinary municipal undergraduate university in Ningbo, China. School of continuing education of it undertakes tasks of distance teaching and teaching management. It has built a good online teaching information platform with a key investment of more than 3 million CNY, which effectively realizes distance teaching during the epidemic prevention and control period, and achieves good teaching results. A total of 297 questionnaires are sent out to adult learners, and 267 are recovered. After excluding invalid questionnaires, 216 valid

questionnaires are obtained with effective recovery of 80.89%. Descriptive statistical results of specific research objects are shown in Table 1.

Table 1. Descriptive statistical results

Name	Options	Frequency	Percentage (%)	Cumulative percentage (%)
Gender	Male	111	51.39	51.39
	Female	105	48.61	100
Specialty	Computer Science and Technology	12	5.56	5.56
	Administrative management	27	12.5	18.06
	Marketing major	63	29.17	47.22
	Human Resource Management	81	37.5	84.72
	Electrical engineering and automation	33	15.28	100
Age group	18-25years old	31	14.35	14.35
	26-30years old	77	35.65	50
	30-45years old	84	38.89	88.89
	More than 45 years old	24	11.11	100
Distance learning duration	More than one year	94	43.52	43.52
	One to three years	87	40.28	83.8
	More than three years	35	16.2	100
Summation		216	100	100

As it can be seen from Table 1, respondents are average in gender and are reasonably distributed in majors. The number of respondents over 45 years old is relatively small. As a whole, respondents have good representatives.

4 Results

4.1 Reliability and validity test

Reliability analysis is an effective method to test the stability and reliability of scales, among which Cronbach's á is the most commonly used reliability test method. SPSS 25.0 tool is used to analyze scale retest data. As it can be seen from Table 2, the overall reliability coefficient (Cronbach's á coefficient) of the questionnaire in this study is 0.879, greater than 0.8, and coefficient values of every dimension are all above 0.8, indicating that the reliability of the data is high and that the scale has good internal consistency.

Table 2. Reliability test results

Variable	Question number	Total correlation of correction items(CITC)	Item deleted α coefficient	Cronbach's α coefficient	Cronbach's α coefficient
Sustained learning engagement	A1	0.853	0.929	0.943	0.879
	A2	0.890	0.918		
	A3	0.882	0.920		
	A4	0.832	0.936		
Sustained learning motivation	B1	0.710	0.898	0.909	
	B2	0.724	0.896		
	B3	0.831	0.881		
	B4	0.762	0.891		
	B5	0.731	0.895		
	B6	0.738	0.895		
Sustained learning strategy	C1	0.420	0.853	0.858	
	C2	0.499	0.849		
	C3	0.641	0.841		
	C4	0.638	0.841		
	C5	0.590	0.844		
	C6	0.532	0.847		
	C7	0.550	0.846		
	C8	0.573	0.845		
	C9	0.312	0.858		
	C10	0.137	0.868		
	C11	0.466	0.851		
	C12	0.553	0.846		
	C13	0.551	0.846		
	C14	0.550	0.847		
	C15	0.424	0.853		

As it can be seen from Table 3, KMO and Bartlett test are used for validity verification. KMO value is 0.850 and is greater than 0.8, indicating that research data is suitable for extracting information.

Table 3. KMO and Bartlett test

KMO value		0.85
Bartlett sphericity test	approximate chi-square	3170.342
	df.	300
	P value	0

4.2 Regression results

As it can be seen from Table 4, hypothesis 1 is true. In other words, learning engagement can significantly improve knowledge transferability in distance teaching. The main possible reason is that based on network communication platform, learners can use distance education classes built by mobile electronic devices (mobile phones, computers) to carry out self-learning. Distance teaching creates a learning platform centered on college students, and teachers give learners high-quality learning resources and efficient learning tools through careful design of teaching process, to create simulated teaching scenes similar to real ones. It can fully realize efficient integration of teaching resources and stimulate learners' attention time and degree. By gathering the greatest contribution of teachers' collective wisdom, distance teaching platform promotes college students to explore the truth and essence behind knowledge and phenomena, and to ask for their inherent logic and laws. Effective network technology to build cognitive, contextualized, inquiry learning and collaborative learning platform, promotes learners to question the depth of multi-faceted and multiple perspectives analysis, refactoring framework, as well as knowledge to make understanding of knowledge and curing. It causes a high level of experience of thinking, critique consciousness, independent thinking, and trainability of coordination, internalizes into the core literacy, and acquires a higher level of knowledge transferability.

Table 4. Regression results

	Normalization coefficient	**t**	***P***	**VIF**	**R^2**	**Adjust R^2**	**F**
Constant	-	4.493	0.000**	-	0.159	0.147	F(3,212)=13.392, p=0.000
Learning investment	0.178	2.683	0.008**	1.112			
Learning motivation	0.256	3.754	0.000**	1.175			
Learning strategy	0.137	2.102	0.037*	1.066			
D-W value: 2.203							

* p<0.05 ** p<0.01

Hypothesis 2 is true. In other words, learning motivation can significantly improve knowledge transferability in distance education. Main reason is that teachers master students' present situation with help of online platforms, combine with characteristics of current online teaching technology, and teaching law, set challenging problems, and that they build open real or virtual simulation situations. In addition, they gather cross-regional professionals to carry out the interaction between teachers and students, along with the interaction between students and students, They can stimulate students' inquiry of desire, improve students' sense of efficacy, achievement and belonging. It also focuses on inspiring distance teaching teachers at all levels and schools, that teachers should pay attention to richness and diversity of teaching methods of learning content, and that guide students in the process of spontaneous learn considering essential attributes and internal logic between topic knowledge points., so that students in osmosis depth build, internalize their knowledge structure. This can not only coruscate vitality of classroom teaching, but also make students' learning rise to height of rational thinking, and can realize skill transfer of learners.

Hypothesis 3 is true. In other words, learning strategy can significantly improve knowledge transferability in distance teaching. Main reason is that to realize knowledge transfer, learners need not only simply stay on surface understanding of knowledge, but also need to adopt more scientific learning strategies to explore internal logic and system framework of knowledge points. In distance teaching, apart from surface learning methods, learners also need to use sustained learning strategies such as induction, generalization, questioning, contrast and association to analyze problems. In distance teaching, learners are adults, and their learning methods for knowledge are fixed. Therefore, they need to break through the existing knowledge learning strategy system and more sustained learning strategies such as summarizing questions and asking questions are used to recall basic knowledge points. In distance education, it should constantly break through learners' learning strategies, innovate more high-quality learning methods, break traditional teaching mode, deepen learners' different views on analysis of the same question, adopt different learning strategies to gradually accumulate new knowledge learning systems, and enhance knowledge transferability in solving complex problems.

4.3 Difference analysis

As it can be seen from Table 5, analysis of variance (ANOVA) is used to study the difference of distance learning duration on one item of knowledge transferability. All samples with different distance learning duration have significant effect on knowledge transferability (p<0.05), which means that samples with different distance learning duration have different effects on knowledge transferability. Specific analysis shows that distance learning duration has a significant effect on knowledge transferability at the level of 0.05 (F=3.495, p=0.032), and specific comparison shows that there are more significant differences in groups. It can be seen from the score that distance learning duration of one to three years is significantly higher than other groups, mainly because they are better than beginners in mastering skills of distance learning and can realize efficient learning process. At the same time, they have more self-efficacy of autonomous learning than those who study for more than three years. They can effectively tap inherent logical potential of various knowledge in distance teaching draw their unique knowledge system, and realize effective transfer of knowledge.

Table 5. Results of variance analysis

	Distance learning duration (Mean ± standard deviation)			**F**	***p***
	1.0(n=94)	***2.0(n=87)***	***3.0(n=35)***		
Knowledge transferability	3.11±1.16	3.54±1.13	3.46±1.12	3.495	0.032*
	Age group (Mean ± standard deviation)			**F**	***p***
	1.0(n=31)	***2.0(n=77)***	***3.0(n=84)***	***4.0(n=24)***		
	3.06±1.24	3.10±1.06	3.13±1.14	3.83±0.92	3.092	0.028*

* p<0.05 ** p<0.01

ANOVA is used to study differences of age groups in knowledge transferability. It can be seen from the above table that all samples of different age groups have significant differences in knowledge transferability (p<0.05), which means that samples of different age groups have differences in knowledge transferability. Specific analysis shows that age groups have significant effect on knowledge transferability at the level of 0.05 (F=3.092, p=0.028), and specific comparison shows the average scores of groups with significant differences. knowledge transferability of learners over age of 45 in distance education is significantly higher than other age groups, mainly because learners' basic work is love type over age of 45, When they are old, they can also accept distance education, which means that they particularly have strong subjective willingness to learn, to comply with requirements of distance teaching time and finish learning tasks. Their knowledge transferability is higher than other groups. At the same time, there is another important potential reason that cannot be ignored is that learners over 45 years have rich life and work experience, and knowledge of distance teaching can be more convenient and efficient to transform into their knowledge points and build their unique knowledge system.

ANOVA is used to study difference between majors in knowledge transferability. It can be seen from Table 6 that all samples from different majors show no significant difference in knowledge transferability (p>0.05), which means that all samples from different majors showed consistency in knowledge transferability without any difference. A possible reason lies in the fact that adults do not have a strong goal in distance learning. They are more likely to obtain relevant diplomas through continuing education. Therefore, there is no significant difference in knowledge transferability of distance learning among adult learners of different majors.

Table 6. Differences in knowledge transferability of majors

	Majors (Mean ± standard deviation)					**F**	***p***
knowledge transferability	***1.0 (n=12)***	***2.0 n=27)***	***3.0 (n=63)***	***4.0 (n=81)***	***5.0 (n=33)***		
	3.83 ±1.19	2.96 ±1.13	3.21 ±1.06	3.37 ±1.02	3.27 ±1.04	1.65	0.163

* p<0.05 ** p<0.01

T-test of independent sample is used to study gender differences in knowledge transferability. As it can be seen from Table 7, samples of different genders do not show significant differences in knowledge transferability (p>0.05), which means that samples of different genders show consistency in knowledge transferability without difference. There is no significant difference in knowledge transferability between different gender samples. Main reason is that distance education is a type of continuing education in China, and the proportion of male and female applicants is relatively close. Men and women spend almost the same amount of time and energy in distance learning, so there is no obvious difference in knowledge transferability.

Table 7. Gender differences in knowledge transferability

Knowledge transferability	**Gender (Mean ± standard deviation)**		**t**	***p***
	0.0(n=111)	***1.0(n=105)***		
	3.23±1.06	3.33±1.07	-0.683	0.495

* $p<0.05$ ** $p<0.01$

5 Conclusion

The wide application of artificial intelligence and big data has made distance learning model more widely developed. In distance teaching, sustained learning is conducive to triggering higher-order thinking experience and improving learning performance. In distance teaching, teachers need to focus more on cultivating students' higher-order thinking and innovative thinking, to accelerate improvement of learners' knowledge transferability. This study designs the questionnaire on the influence of sustained learning on knowledge transferability in distance learning, analyzes the influence of three aspects of sustained learning on knowledge transferability, and considers differences of individual characteristics of different learners in knowledge transferability. Results show that Cronbach á and KMO values of the questionnaire are 0.879 and 0.850, indicating that the reliability and validity of the questionnaire are good. Learning investment, learning motivation and learning strategy can significantly improve knowledge transferability. Distance learning duration and age of learners have significant differences in knowledge transferability. Gender and specialty have no significant difference in knowledge transferability. It is suggested that further research should be carried out on effective supervision of teachers and efficient interaction between teachers and students in distance learning, difference of sustained learning degree of distance learners, and effective evaluation of knowledge transferability of distance learning.

6 Acknowledgment

This study was supported by Educational Science Planning Project of Zhejiang Province (2022SCG115), Educational Science Planning Project of Ningbo City (2021YGH022).

7 References

[1] Brandon, A. F., All, A. C. (2010). Constructivism theory analysis and application to curricula. Nursing Education Perspectives, 31(2), 89-92.
[2] Gordon, C., Debus, R. (2002). Developing deep learning approaches and personal teaching efficacy within a preservice teacher education context. British Journal of Educational Psychology, 72(4), 483-511. https://doi.org/10.1348/00070990260377488
[3] Lynch, R., McNamara, P. M., Seery, N. (2012). Promoting deep learning in a teacher education programme through self-and peer-assessment and feedback. European Journal of Teacher Education, 35(2), 179-197. https://doi.org/10.1080/02619768.2011.643396
[4] Borredon, L., Deffayet, S., Baker, A. C., Kolb, D. (2011). Enhancing deep learning: lessons from the introduction of learning teams in management education in France. Journal of Management Education, 35(3), 324-350. https://doi.org/10.1177/1052562910368652
[5] Filius, R. M., Kleijn, R. A. D., Uijl, S. G., Prins, F. J., Rijen, H. V. V., Grobbee, D. E. (2018). Challenges concerning deep learning in SPOCs. International Journal of Technology Enhanced Learning, 10(1-2), 111-127. https://doi.org/10.1504/IJTEL.2018.088341
[6] Nielsen, A. (2016). Concept-based learning in clinical experiences: Bringing theory to clinical education for deep learning. Journal of Nursing Education, 55(7), 365-371. https://doi.org/10.3928/01484834-20160615-02
[7] Shearer, R. L., Gregg, A., Joo, K. P. (2015). Deep learning in distance education: Are we achieving the goal? American Journal of Distance Education, 29(2), 126-134. https://doi.org/10.1080/08923647.2015.1023637
[8] Manikandan, S., Chinnadurai, M. (2019). Intelligent and deep learning approach OT measure E-learning content in online distance education. The Online Journal of Distance Education and e-Learning, 7(3), 199-204.
[9] Dunleavy, J., Milton, P. (2008). Student engagement for effective teaching and deep learning. Education Canada, 48(5), 4-8.
[10] Aguiar-Castillo, L., Clavijo-Rodriguez, A., Hernández-López, L., De Saa-Pérez, P., Pérez-Jiménez, R. (2021). Gamification and deep learning approaches in higher education. Journal of Hospitality, Leisure, Sport & Tourism Education, 29, 100290. https://doi.org/10.1016/j.jhlste.2020.100290
[11] Fourie, C. M. (2003). Deep learning, what deep learning: research in higher education. South African Journal of Higher Education, 17(1), 123-131. https://doi.org/10.4314/sajhe.v17i1.25201
[12] Filius, R. M., Kleijn, R. A., Uijl, S. G., Prins, F. J., Rijen, H. V., Grobbee, D. E. (2019). Audio peer feedback to promote deep learning in online education. Journal of Computer Assisted Learning, 35(5), 607-619. https://doi.org/10.1111/jcal.12363
[13] Golightly, A., Raath, S. (2015). Problem-based learning to foster deep learning in preservice geography teacher education. Journal of Geography, 114(2), 58-68. https://doi.org/10.1080/00221341.2014.894110
[14] Sáiz-Manzanares, M. C., Osorio, C. I. G., Díez-Pastor, J. F., Antón, L. J. M. (2019). Will personalized e-Learning increase deep learning in higher education? Information Discovery and Delivery, 47 (1), 53-63. https://doi.org/10.1108/IDD-08-2018-0039
[15] Fiorini, R. A. (2018). Transdisciplinary education for deep learning, creativity and innovation. Erudition, 2(4), 123-146.
[16] Li, Y., Rui, D. S., Lu, Q., Ren, Y. (2018). Developing college students' deep learning scale for blended learning environment. E-Education Research, 12, 94-101.

8 Authors

Baohua Wang is scientific research service personnel at Department of Scientific Research and Social Services, Zhejiang Business Technology Institute, No.1988, Jichang Road, Haishu District, Ningbo, China. Her research interests focus on education management (email: wbh@zbti.edu.cn).

Yunchao Du is associate professor at School of Economics and Management, Ningbo University of Technology, No.201 Fenghua Road, Jiangbei District, Ningbo, China. His research interests focus on governance of industrial institute (email: du_yunchao@nbut.edu.cn).

Qingyuan Shen is a Ph.D. candidate at Nam Seoul University in Republic of Korea. His research interests focus on corporate governance and education information technology (email: sqyeconomy@163.com).

Article submitted 2022-03-14. Resubmitted 2022-04-19. Final acceptance 2022-04-21. Final version published as submitted by the authors.