Analysis Model of Teacher-Support and Learning Engagement in E-Learning

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Abstract. Recently, millions of persons research e-learning which has important social significance and extensive application background. E-learning influences the global higher education significantly. Based on the applied superiority of MOOC (the chief kind of e-learning), the main research aim of this paper is to provide effective learning strategy and to increase the engagement and the learning effect in e-learning. This paper utilizes the acquired big data during e-learning to analyze three dimensions of teacher-support and five dimensions of learners' learning engagement in detail. An effective model is proposed to analyze the relation between teacher-support and learning engagement. Based on the acquired big data, the mean, variance, correlation coefficient and other datum are analyzed to compare teacher-support and learning engagement in the effective model, all path coefficients of the result achieve significant level: $p > 0.05$. This paper proposes improved recommendations and supplies effective learning strategies.

Keywords: E-learning · Big data · Comparative model · Teacher-support Learning engagement

1 Introduction

E-learning is the use of electronic educational technology in learning and teaching. Conceptually, e-learning is a word of broadly generalization with instructional technology, information and communication technology in education, multimedia learning, technology-enhanced learning, computer managed instruction, computer-based training, web-based training (WBT), online education, virtual education. In e-learning, the learner utilizes online platform to execute autonomic learning: online learning courseware, online video course, online test, online exercise, online interaction and so forth. E-learning is still a learner-centric educational activity like the traditional education; teacher-support makes great difference to the learners who execute the learning process in e-learning [1–3]. So the relation between teacher-support and learning engagement should be deeply analyzed to research the learning needs, the learning motivation and the learning habit. The analysis model can contribute the teachers to maximize the teaching effect during the previous course construction and the later

S. Liu et al. (Eds.): eLEOT 2018, LNICST 243, pp. 53–61, 2018.
https://doi.org/10.1007/978-3-319-93719-9_8

teaching process, the research can also contribute the teachers to update teaching concept and lead to a sharp improvement in the quality of teaching.

Data acquisition and dimension measurement in learning engagement. Learning engagement is a key factor in e-learning, this paper utilizes five dimensions to measure the learning engagement in e-learning [4]. Online engagement dimension mainly measures the level which the learner utilizes online system to increase the learning effect; Online active learning dimension mainly measures how to execute the learning process with the suggestive learning methods of e-learning; Online social interaction dimension mainly measures the level which the learner utilizes online system to attend the social interactions in e-learning; Online teacher-student interaction dimension mainly measures the level which teacher and learner carry out the interactive issue; Online cooperation dimension mainly measures the level which the learner participate in the online cooperation.

Data acquisition and dimension measurement in teacher-support. Teacher-support is another key factor in e-learning. In the traditional education, Fredricks discusses the relation between teacher-support and learning engagement, the result shows that the learners increase the learning engagement while the learners get the better teacher-support [7]. What the relation between teacher-support and learning engagement are shown in e-learning? The research result from Shea shows that if the teachers supply the behavioral support and the strategy support, the learner will obtain social presence and increase the learning engagement [8]. The conclusion from high-level documents and researches shows that all the teachers' behavior, the teachers' attitude, the teaching method selection, the learning task design and feedback on learning all can affect the learning engagement in e-learning [5, 6]. Further research shows that the needed content from teacher-support has three aspects, those aspects are autonomous learning design, emotion encouragement and learning strategy support. Autonomous learning can also be called autonomic support is that teacher support the learner to autonomously choose the learning task, the learning content and the problem solving method; emotion encouragement called emotional support is that the teacher timely and actively concern the emotion which the learner evokes facing the challenge in e-learning; learning strategy support called cognitive support is that the teacher supply the challenge, the higher learning strategy and the further exercise to the learner.

Based on the research and analysis above, in e-learning, teacher-support makes important effects on the learning engagement. At present, related researches mainly focus on the model between teacher-support and learning engagement in the traditional teaching, and some other researches focus on elucidating the instructional theory of teacher-support in e-learning [9–12]. It needs further authentication that what is the relation between teacher-support and learning engagement and which aspect can deeply affect the learning engagement in e-learning [12–15]. So this paper models the relation between teacher-support and learning engagement to research and to analyze the above issues and appropriates the analytical model to propose the improvement measures for e-learning.

2 Research Technique

2.1 Data Acquisition

Experimental measurement is the main research method based on the data acquisition. The main research object is 1351 Harbin Institute of Technology undergraduates participating in e-learning, and the random sampling and cluster sampling methods are used in this experimental measurement. Field survey and online survey are used in the data acquisition, 1225 valid questionnaires are collected, and the efficient is 90.6%. Every research object completes at least one e-learning course which includes "Communication Principles course", "Microwave Technique course", "Higher Mathematics course" and other related courses, these undergraduates are all between the ages of 18 and 24. The specialty ranges from communication engineering, materiality, machine building, boiler, welding, management, electronics, automation, biochemistry, to physics and chemistry.

2.2 Research Method

Learning engagement model depends on e-learning. The model utilizes learning engagement data table as the quantitative index. The learning engagement data table consists of five dimensions: online engagement dimension, online active learning dimension, online social interaction dimension, online teacher-student interaction dimension, online cooperation dimension. The learning engagement data table utilizes five points scoring method, the points from "1" to "5" respectively represents "all mismatch" to "exact match", and higher points represent more learning engagement. In the learning engagement data table, the measured reliability coefficient (*Cronbach's alpha*) of five dimensions and internal consistency respectively are 0.81, 0.82, 0.79, 0.85 and 0.87, the confirmatory factor analysis is $\chi^2 = 217.5$, $df = 95.6$, $\chi^2/df = 2.28$, $GFI = 0.86$, $CFI = 0.95$, $TLI = 0.97$, $RMSEA = 0.08$, $RMR = 0.07$. The datum shows that the table involves better construct validity.

Teacher-support model depends on e-learning. The model utilizes teacher-support data table as the quantitative index. The teacher-support data table consists of three dimensions: autonomic support, cognitive support, emotional support. Autonomic support involves four problems, cognitive support involves four problems, and emotional support involves three problems. The teacher-support data table utilizes five points scoring method, the points from "1" to "5" respectively represents "all mismatch" to "exact match", and higher points represent more perceptive teacher-support. In the learning engagement data table, the measured reliability coefficient (*Cronbach's alpha*) of three dimensions and internal consistency respectively are 0.80, 0.81 and 0.87, the confirmatory factor analysis is $\chi^2 = 55.93$, $df = 40$, $\chi^2/df = 1.33$, $GFI = 0.89$, $CFI = 0.97$, $TLI = 0.98$, $RMSEA = 0.06$, $RMR = 0.07$. The datum shows that the table involves better construct validity.

2.3 Data Processing and Analysis Method

The model mainly utilizes SPSS and AMOS to process data. Descriptive statistics is utilized to analyze the collected data by SPSS22.0. Based on the theoretical basis and the research hypothesis, this paper sets up a structural equation model. In the data processing procedure, correlation analysis, confirmatory factor analysis and path analysis are used to verify parameters by AMOS21.0.

3 Research Results

3.1 The Overall Level of Learning Engagement in E-Learning

The descriptive statistical analysis of learning engagement for e-learning is shown in Table 1. The holistic mean value of learning engagement is 3.57 which is just higher than the theoretical mean value 3.0. In the five dimensions, the engagement level is sorted in order from high to low: online engagement, online active learning, online social interaction, online cooperation and online teacher-student interaction. Specifically, in online engagement, "learning-platform investigates the needs of learners before the formal curriculum" (*Mean* = 4.03), "learning-platform recommends the learning content for the learners referred to personal characteristic" (*Mean* = 3.96), "learning-platform provides many useful details of cases for learners to analyze the problem and make the decision" (*Mean* = 3.72); in online active learning, "have good learning habits, such as real-time notes, preview, periodic summary for learning" (*Mean* = 3.74), this item gets the highest score, followed by "have a set of personalized learning methods for e-learning" (*Mean* = 3.59), the lowest score item is that "keep e-learning on time" (*Mean* = 3.30); in online social interaction, the score of each item is generally low, such as "feel like face-to-face chat when using the chat function in learning-platform" (*Mean* = 3.48), "get the good advice based on the comments of other learners" (*Mean* = 3.41), "share their learning experiences and feelings with other learners" (*Mean* = 3.25), and "share learning resources with other learners" (*Mean* = 3.28), in above aspects, learners do not put enough enthusiasm; in online cooperation, "classmates supervise and promote each other in the learning process" (*Mean* = 3.29), "regularly discuss the problem in online cooperation situation" (*Mean* = 3.21), "hold a group discussion activity, positively think and answer other learner's problems" (*Mean* = 3.37); in online teacher-student interaction, "firstly tend to ask teachers for

Table 1. Descriptive statistics of learning engagement for online learners

Variable	Mean (M)	Standard deviation (S.D.)
E-learning engagement	3.57	0.57
Online engagement	3.90	0.77
Online active learning	3.55	0.59
Online social interaction	3.31	0.65
Online teacher-student interaction	3.16	0.61
Online cooperation	3.28	0.58

help when having learning problems" (*Mean* = 3.08), "teachers participate in the discussion to solve learner's questions in time" (*Mean* = 3.21), "according to the learner's online examination and homework, teachers supply the pertinent advice" (*Mean* = 3.14).

3.2 The Overall Level of Teacher-Support Perceived by Online Learner

By describing the statistical analysis, the mean value and the standard deviation value of teacher-support perceived by online learner in all dimensions are shown in Table 2. The overall level of teacher-support perceived by online learner is in normal state (*Mean* = 3.67). In three dimensions, the support level perceived by the learner is sorted in order from high to low: autonomic support, cognitive support and emotional support. The specific content of each dimension: in autonomic support dimension, "make pluralistic online learning evaluation modes" (*Mean* = 3.81) gets the highest score, followed by "give the learner enough free time to arrange own study plan" (*Mean* = 3.69), "make learning tasks or learning plans flexibly" (*Mean* = 3.65) and "realize the importance of the course in the learning process" (*Mean* = 3.52) both get low scores; in cognitive support dimension, teachers get the highest score in "provide plentiful resources for the learners to extend their learning" (*Mean* = 3.95), followed by "encourage and guide the learners to carry out inquiring learning/rethinking learning" (*Mean* = 3.72), "provide relevant learning tools" (*Mean* = 3.63) and "provide online learning guide" (*Mean* = 3.60) get the lowest score; in emotional support dimension, the details in each item are "put high attention on the suggestions and ideas from the learners and give feedback timely" (*Mean* = 3.69), "focus on the learner's performance and learning motivation" (*Mean* = 3.47), and "understand the learner's learning difficulties" (*Mean* = 3.44).

Table 2. Descriptive statistics of teacher-support perceived by online learners

Variable	Mean (M)	Standard deviation (S.D.)
The overall level of teacher-support	3.67	0.59
Autonomic support	3.75	0.65
Cognitive support	3.72	0.68
Emotional support	3.51	0.77

3.3 The Influence of Teacher-Support on E-Learning Engagement

The letter makes the detailed correlation analysis between teacher-support and e-learning engagement to explore the correlation between the two variables. The result can be statistically represented by the product-moment correlation coefficient. *Spearman Correlation Coefficient* of teacher-support and e-learning engagement are shown in Table 3. Three dimensions of teacher-support involve significant correlation with all factors of e-learning engagement, and the result indicates that teacher-support makes a great impact on learner's e-learning engagement. Further regression analysis and path analysis can be made according to above conclusion.

Table 3. Analysis of the relation between teachers support and e-learning engagement

	Autonomic support	Cognitive support	Emotional support
Online engagement	0.61**	0.65**	0.55**
Online active learning	0.60**	0.58**	0.56**
Online social interaction	0.56**	0.60**	0.56**
Online teacher-student interaction	0.59**	0.62**	0.57**
Online cooperation	0.61**	0.58**	0.66**

Remarks: ** is significantly correlated at the level of 0.01(bilateral)

3.4 Structural Equation Model Analysis on the Proposed Relation

For an in-depth analysis the effect and path coefficient of teacher-support on e-learning engagement, based on research theory and related analysis, this paper establishes a hypothesis model which uses teachers' autonomic support, cognitive support and emotion support as external variables, and uses e-learning engagement as an internal variable. Then confirmatory factor analysis and path analysis are carried out in the model. Finally, after the evaluation of fitness and model correction, a structural equation model for the impact of teacher-support on e-learning engagement is formed, as shown in Fig. 1.

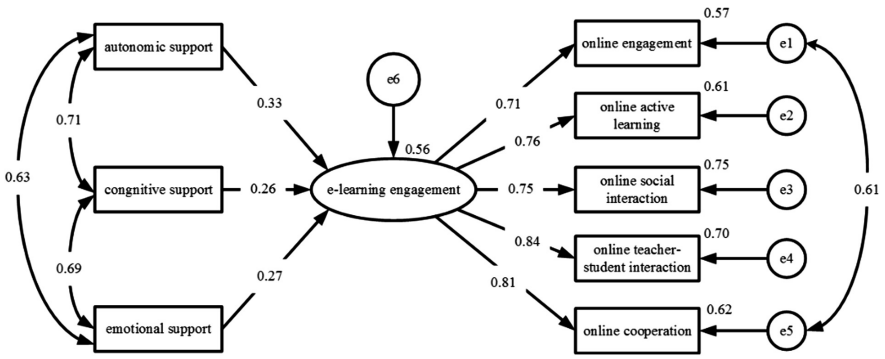

Fig. 1. Structural equation model on the relation between teacher-support and e-learning engagement

The fitting index of this model is: $\chi^2 = 10.51$, $df = 6.87$, $\chi^2/df = 1.52$, $GFI = 0.99$, $CFI = 0.96$, $TLI = 0.98$, $RMSEA = 0.03$, $RMR = 0.07$. All indicators match the model fit standard, and the model-fitting degree meets the requirements. Referring to the value of path coefficient estimated by the maximum likelihood method, the standard regression coefficient and the significant level are shown in Table 4.

According to the significant test standard value of parameter estimation ($p < 0.05$, *C.R.* is higher than the absolute value of 1.96), all three path coefficient reached 0.05

which are in a significant level as shown in the Table 4. In Fig. 1, the path regression coefficient (β) is all positive, which indicates that the autonomic support, cognition support and emotional support from teachers can positively influence e-learning engagement. The values of specific effects on the three factors to the internal variable ("the direct effect of e-learning engagement") are 0.33, 0.26, 0.27. Teachers' autonomic support has the greatest impact on the e-learning engagement in all dimensions, followed by emotional support, and finally cognitive support. The total effect of the three factors values 0.56.

Table 4. Standard regression coefficient and the significance

Path	Standard error (S.E.)	Critical Ratio (C.R.)	Significance (*p*)
Autonomic support → E-learning engagement	0.05	3.73	***
Cognitive support → E-learning engagement	0.08	2.82	.002
Emotional support → E-learning engagement	0.07	3.51	***

4 Conclusion and Suggestion

E-learning is the inevitable trend with the internet information technology development. Through analyzing the relation of teacher-support and e-learning engagement, it is clear that teacher-support plays a key role in improving the effect of the learners. Teachers, platform developers, maintainers, and curriculum producers who undertake the task of curriculum construction can rationally design curriculum system, scientifically allocate teaching resources, set up humanized function in learning-platform and improve the learner's sense of achievement and acquisition. This paper holds that there are three points as follows:

(1) Construct the curriculum system rationally. The scientific allocation and the quality of teaching resource are important factors which affect the learning interest and attitude of the learners. The arrangement should be based on specific objects and should contain professional rules in online courses. The learning-platform should optimize the curriculum system, set scientific and flexible plans and facilitate the learners to learn courses. Conversely, the poor quality and dull content of learning resources easily make learners to evoke a negative learning attitude. In the process of curriculum system development, designers should pay attention to setting online course combining with offline practice and learner's psychological audio-visual, strengthen the research and construction of teaching

resources, design teaching plans scientifically, make full use of modern teaching media, design plentiful and interesting teaching situation. Furthermore teaching resources should be scientifically allocated. While constructing the curriculum video resources library, developers should upload course plans, reference texts, assisted videos and any others related contents to the learning-platform, so as to facilitate the further learning for the learners. Under the right circumstances, the individualized course can be pushed in accordance with the specific requirements of the learners to meet the diverse and individualized needs from the learners.

(2) Develop the humanized function in learning-platform, optimize the discussion community. Because e-learning is a kind of autonomic learning, in this way, learners and teachers are in physical isolation, so the virtual discussion community on learning-platform should be friendly, perfect and fully interactive to help learners to solve the puzzles and problems in the first time. The above methods can be used to reduce the loneliness of the learners in e-learning. Learning-platform interface should be designed simply and clearly. Its function should be easy enough to allow the learners to grasp the usage method. Opening web page quickly and accessing to learning materials timely can avoid losing control in the learning application and learning media. What's more, WeChat-Moment develops the chat function which allows the teacher to upload voice or video files. Above methods are used to enhance learner's interaction, communication and share behavior and promote the sense of individual achievement. By discussion community, learners can set up a communication among peers, encourage and help each other, share successful experiences, and help the learners to be interested and confidence in e-learning. Because the online communication between users (include learners and teachers) is the result of independent thinking. It can organize effective language in a limited time and fully express personal opinions. Learners are also enable to feel the concern of the teachers and learning partners, which will satisfy learner's emotional needs, promote and mobilize the motivation and initiative of learners.

(3) Combine e-learning with offline activity. Online learners need more positive self-efficacy as support for providing internal motivation and for the further learning. Learner's achievement sense is required to improve. The "Ranking List" column can be set up on learning-platform to motivate learners. "Ranking List" aperiodically gives honorary titles (such as the best learner, the best debater, the best fans and the most active person) to specific person who is up to standard as rewards. In addition, some offline activities can be hold, such as creating opportunities for some learners who get the title to have an offline meet with teachers, convening a symposium on exchange of learning experience, recording special video about learning experience pushed on platform, organizing incentive activities. In a word, holding offline activities for learners can effectively improve their belongingness and initiative, and their learning motivation is roused.

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