Influences of Learning Emotion on Learning Outcome in Online Teaching Mode

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Abstract—Online learning becomes one of the major learning modes and ways of learners due to the comprehensive integration of Internet and artificial intelligence (AI) technology into the education field. Users who adopt online and mobile learning mode present explosive growth. Due to free of time and space limits like traditional classroom teaching and possessing of rich education video resources, online learning is attracting many learners to engage in studies independently. In the future, intelligent and individualized online education development shall pay more attention to influence factors of learners' learning outcomes, especially learning emotion of learners, except for knowledge teaching and acceptance. In this study, a questionnaire concerning influences of learning emotion of learners on learning outcome was designed based on existing studies. Learning emotion of learners influences learning outcome through four aspects, including learning interest, learning attitude, learning belief and learning motivation. Results demonstrate that learning interest, learning attitude and learning motivations can improve learning outcomes significantly. There are significant differences of learning outcomes among different grades and the latest comprehensive assessment levels. Conclusions can provide important references for universities to make scientific reforms in online teaching mode to increase learning experiences of learners.

Keywords—online teaching, learning emotion, learning outcome, influences

1 Introduction

Compared with traditional classroom teaching, online learning is free of limits by time, place and space due to the integration of 5G and artificial intelligence (AI) technology into the education field. However, there's a phenomenon that the emotional communication between teachers and students is hindered. Teachers cannot gain a real-time perception of the learning emotional state and provide feedback to students timely. Moreover, it is very difficult to adjust and optimize learning activities in man-machine interaction. Currently, there's a very large scale of online education platforms which are used commonly in China, accompanied by a very large use scale. All of platforms are highly appreciated by learners. Since mobile learning terminals like cell phone and

computer allows study at any time, they meet using demands of users greatly and learners can transfer from traditional classroom teaching model to the richer, diversified and more attractive online learning, thus enabling to choose the learning content that they are interested in at any time and any places. As a new learning mode, online learning makes students able to study on online teaching platform at any time and any place. Such open learning mode based on Internet technology and information technology is a hotspot trend of education development in the future.

In nowadays when the digital information teaching mode is perfecting gradually, openness and sharing become major characteristics of online learning, which become strong supplementations to the traditional classroom teaching mode. Network perfection as well as popularization and use of mobile terminals lay good hardware foundations for online learning. Contemporary university students have strong learning acceptance and the sharp increase of online learning platforms further perfects online learning software conditions. However, online teaching also faces more challenges. In particular, teachers and teaching management departments have to further strengthen adaptation to the complicated online teaching environment. In the process of online teaching, it is easy to focus on teaching technologies, but ignore state recording throughout the online teaching as well as influences of content and form on learning emotion of learners. Based on previous studies, learning emotion is an important regulating factor for students to adapt to online learning. Online learning injects new vitality to the education field. Online learning platform evaluates teaching through the input-process-output framework. Teaching quality is one of important input indexes of this framework and learning emotion of learners is an important index of process evaluation. At present, many associated studies have fully proved the relationship between learning outcome and network learning emotions. The stronger enthusiasm of learning emotional engagement leads to the more obvious and better learning outcome. During online learning and teaching, there are few teacher-student interactions due to spatial separation. Teachers cannot perceive learning emotions of students fully and lack effective teaching behaviors that consider the learning emotions of students. Using deep learning technology not only can analyze and feedback learning emotional information of students in the learning process but also can analyze their overall data of learning schedule, attentions, and learning quality. As a result, it can improve teaching quality effectively and provide learners with better classroom experiences.

2 Literature review and hypothesis development

With the comprehensive breakthroughs of emerging information technologies (ITs) like “Internet + education” and AI, studies on learning emotion are attracting more and more attention. From the perspective of psychology, Weiss [1] believed that emotion is a general psychological state of human and it is a body performance of human brain. Emotion is the different inherent psychological changes and external manifestations which are formed due to different individual attitudes toward objective objects. Recently, McCombs and Whisler [2] pointed out that learning emotion has complicated

components, mainly including interest and attitude. These components influence overall learning plan and learning progresses of learners. Stauffer [3] emphasized the necessity of mindset which includes developing self-awareness, revealing options students may not realize they have, and motivating students to make choices that drive innovation. Gable and Haidt [4] found that with the application of positive psychology in various fields, learning emotion influences learning outcome gradually. In particular, positive learning emotional engagement is an important component of learning engagement. Positive emotional learning experiences include learning interest, learning happiness, learning motivations, etc. negative emotions include boring, sadness, depression, anger and anxiety. With respect to the question that how learning emotion influence learning outcome and learning performance level, Chen and Wang [5] concluded that the academic performances and positive emotions which are produced based on multimedia materials of video are the best and there's partial correlation between negative learning emotion and academic performances. Learners who learn based on multimedia materials of video could acquire better academic performances. Wachtler and Ebner [6] also indicated that managing students' selective attention could be achieved by providing different forms of interaction and communication in the video. Allcoat and Mühlenen [7] pointed out that under virtual and real conditions, the positive emotion of learners is strengthened and the negative emotion decreases. Learners under virtual and real conditions have a higher degree of engagement than learners under other conditions, thus enabling to get better learning outcomes. Rusk and Rothbaum [8] demonstrated that individuals with the higher learning objective have higher utilization of cognitive reassessment. The emotional adjustment goal might be conducive to explain individual differences in uses between defensive and constructive emotional regulation strategies. D'Mello and Graesser [9] tracked about 110 points in courses to measure learning emotion of learners. Scott and Myers [10] proved that firemen with rich experiences can control emotions better and promote them to use emotional labor technology. Hascher [11] introduced the theories of influences of emotion on learning, and discussed importance of these theories on study at schools. School-based studies on the role of study in learning have gained empirical evidence. Vince [12] believed that individual emotion has relatively obvious influences on organizational learning and individual learning emotion is conducive to getting a more extensive understanding on systematic learning and promoting realization of organizational performance goal. Höpfl and Linstead [13] analyzed the important value of learning emotion in organizations in detail and results demonstrate that a good learning emotion can effectively promote employees to complete the organizational performance goal. Shepherd [14] pointed out that teachers educate students on how to manage their emotions to avoid the possibility of failure and improve their emotional intelligence, and help students to train individual emotional regulation. Vuorela and Nummenmaa [15] analyzed emotions that students have experienced when using web-based learning environments (WBLE) as well as emotion regulation strategies and computer self-efficacy. Results showed that students have experienced extensive learning emotions when using WBLE and particularly, interaction in activities is an important premise of emotional reaction. Marchand and Gutierrez [16] believed that the mid-term emotions (hope, frustration, and anxiety) in the online course and hybrid course are significantly correlated with

learning outcome. Zembylas [17] analyzed learning emotional performances of adult learners in online course and results showed that adult learners could adjust their learning emotion according to specific demands and dimension of online learning, and they have relatively good mastering ability. Artino [18] believed that different from traditional classroom teaching, emotion has important influences on learning, engagement and achievement in online learning environment. He also analyzed emotional problems in online learning environments (OLE) in the online environment and different perspectives of two participants (students and teachers). Zembylas et al. [19] collected emotional data of adult learners related with online learning, such as emotion diary, semi-structured interviews, and e-mails. Results demonstrated that in the online learning environment, social and emotional communication and contact problems are vital in emotional exploration of adult learners Wosnitza and Volet [20] discussed the origin, direction and influences of emotion in social network services, and discussed usefulness of these methods in investigating emotion sources and directions in social communication and online learning. Results showed that learning emotion of students plays a very important role in learning process. Feidakis et al. [21] indicated that emotion awareness in a certain group was a useful functionality because if the bad feelings of peers were noticed, members had the chance and the initiative to intervene in their groups.

According to existing studies, this study believes learning emotion can be measured from learning interest, learning attitude, learning motivation and learning belief. Hence, four hypotheses were proposed.

- H1: under the online teaching mode, learning interest has significantly positive promotion on learning outcome.
- H2: under the online teaching mode, learning attitude has significantly positive promotion on learning outcome.
- H3: under the online teaching mode, learning belief has significantly positive promotion on learning outcome.
- H4: under the online teaching mode, learning motivation has significantly positive promotion on learning outcome.

3 Methodology

3.1 Questionnaire compilation

Based on associated literature review, the author found that there's relatively standard format and contents in existing measurement scales and only few have been highly accepted. The author invited associated experts in education and psychology to guide the whole compilation process of questionnaire. Meanwhile, the author compiled a Questionnaire for Learning emotion Status of University Students as the measurement tool based on review of abundant scales in Chinese and foreign languages and careful review of associated literatures. Besides, the scientificity of this measurement scale was verified. The questionnaire is composed of two parts and has 26 questions. Part I has 4 questions and it is mainly used to understand background information of respondents.

Specific information includes gender, grade, major and rank of the latest comprehensive assessment. Part II has 22 questions and it is the major measurement part. It includes learning interest, learning attitude, learning belief and learning motivations, which involve 5, 6, 4, and 4, questions, respectively. The learning outcome has 3 questions. All questions were measured by the Likert-7 scale.

3.2 Respondents

Recently, the Ministry of Education of Liaoning Province have been guiding local universities to innovate online education integration and explore innovative development of online education and course education integration, online-offline integration, management-service integration and theory-practice integration. It also guides universities to implement practices of online education reform and promote reforms in teaching, training, evaluation and support. In this study, students form a School of Architecture of an ordinary engineering college in Shenyang City, Liaoning Province was chosen as the respondent. This college is one of the pilot units of constructing digital campus in Liaoning Province and it has input considerable capitals in construction of online education platforms in the recent five years. The digital campus construction of this university is going to use the new generation of Its to improve digitalization, networking and intelligence level of university management, support the education governance system and modernized governance with informationization, promote transformation of education decision-making from experience-driven type to data-driven type, transformation from one-way education management to collaborative education management, and transformation from passive responses of education services to positive services. In this study, the questionnaire survey was carried out anonymously. A total of 262 questionnaires were sent through the courseware, among which 238 were collected. After invalid questionnaires were deleted, 219 valid questionnaires were collected, showing an effective recovery rate of 83.59%. Descriptive statistical results are shown in Table 1.

Table 1. Descriptive statistical results of respondents

Name	Options	Frequency Number	Percentage (%)	Cumulative Percentage (%)
Gender	Females	59	26.94	26.94
	Males	160	73.06	100
Majors	Civil Engineering	26	11.87	11.87
	Water supply and Drainage Science and Engineering	39	17.81	29.68
	Engineering Management	83	37.9	67.58
	Architectures	34	15.53	83.11
	Environmental Science	27	12.33	95.43
	Geomatics Engineering	10	4.57	100
Grade	Freshman	35	15.98	15.98
	Sophomore	51	23.29	39.27

	Junior	76	34.7	73.97
	Senior	57	26.03	100
The latest comprehensive assessment level	Excellent	17	7.76	7.76
	Good	84	38.36	46.12
	Moderate	57	26.03	72.15
	Pass	49	22.37	94.52
	Failed	12	5.48	100
Total		219	100	100

4 Results analysis

4.1 Reliability and validity analysis

It can be seen from Table 2 that reliability coefficient is 0.876 (>0.8), indicating that the research data has high-reliability quality in this study.

Table 2. Reliability results

Observed variables	Question No.	Corrected Item Total Correlation (CITC)	α coefficient with items deleted	Cronbach α	Cronbach α
Learning interest	factor1-1	0.672	0.783	0.829	0.876
	factor1-2	0.640	0.791		
	factor1-3	0.652	0.787		
	factor1-4	0.577	0.809		
	factor1-5	0.597	0.803		
Learning attitude	factor2-1	0.354	0.746	0.747	
	factor2-2	0.636	0.665		
	factor2-3	0.648	0.668		
	factor2-4	0.625	0.675		
	factor2-5	0.356	0.746		
	factor2-6	0.343	0.753		
Learning belief	factor3-1	0.470	0.681	0.720	
	factor3-2	0.484	0.674		
	factor3-3	0.529	0.646		
	factor3-4	0.553	0.633		
Learning motivations	factor4-1	0.386	0.575	0.629	
	factor4-2	0.376	0.582		
	factor4-3	0.439	0.536		
	factor4-4	0.434	0.54		
Learning outcome	factor5-1	0.849	0.878	0.921	
	factor5-2	0.835	0.889		
	factor5-3	0.834	0.89		

Validity study is used to analyze whether items are reasonable and significant. Validity analysis adopts factor analysis and makes comprehensive analysis by using KMO value, communality, variance interpretation rate value and factor loading coefficient. It is used to verify the validity level of data. KMO value is used to determine the appropriate degree of information extraction. Communality is used to exclude unreasonable research items. The variance interpretation rate is used to interpret the information extraction level. The factor loading coefficient is used to measure the correspondence between measurement factors (dimensions) and questions.

It can be seen from Table 3 that the communality corresponding to all research items values higher than 0.4, indicating that information of research items could be extracted effectively. Moreover, the KMO value is 0.814 (>0.6) and data information could be extracted effectively. Besides, the variance interpretation rates of 5 factors are 19.235%, 18.310%, 12.386%, 12.216% and 8.320%, and the cumulative variance interpretation rate after rotation is 70.466%>50%. This indicates that the information size of research items could be extracted effectively. Validity was verified by KMO and Bartlett test. Table 3 shows that KMO value is 0.814 (>0.8) and the corresponding *P*-value is 0.000 (<0.001). Research data is very applicable to extract information.

Table 3. Validity test results

Name	Factor loading coefficients					Communality (common factor variance)
	Factor 1	*Factor 2*	*Factor 3*	*Factor 4*	*Factor 5*	
factor1-1	0.161	0.697	0.269	0.016	-0.033	0.586
factor1-2	0.170	0.658	0.261	-0.043	-0.075	0.537
factor1-3	0.174	0.693	0.240	-0.033	-0.035	0.571
factor1-4	0.101	0.290	0.822	0.046	-0.009	0.771
factor1-5	0.188	0.313	0.805	0.068	0.015	0.785
factor2-1	0.114	0.294	0.797	0.045	0.060	0.740
factor2-2	0.176	0.813	0.118	0.098	0.058	0.719
factor2-3	0.219	0.852	0.020	0.088	0.070	0.787
factor2-4	0.192	0.815	0.003	0.139	0.001	0.720
factor2-5	-0.119	0.104	0.185	0.652	0.113	0.497
factor2-6	-0.039	0.077	0.186	0.659	0.144	0.497
factor3-1	0.152	-0.127	0.405	0.536	0.107	0.502
factor3-2	0.089	-0.172	0.432	0.514	0.149	0.510
factor3-3	0.091	-0.001	0.066	0.150	0.929	0.898
factor3-4	0.011	-0.007	0.021	0.195	0.928	0.899
factor4-1	0.081	0.139	-0.201	0.744	0.080	0.626
factor4-2	0.084	0.050	-0.179	0.777	-0.039	0.646
factor4-3	0.894	0.171	0.145	0.001	0.034	0.851
factor4-4	0.869	0.261	0.114	0.001	-0.030	0.837
factor5-1	0.882	0.224	0.124	-0.005	0.064	0.848
factor5-2	0.888	0.214	0.068	0.053	-0.001	0.841
factor5-3	0.885	0.182	0.060	0.093	0.075	0.834

Characteristic root (before rotation)	6.816	3.019	2.449	1.790	1.428	-
Variance interpretation rate % (before rotation)	30.984%	13.721%	11.130%	8.138%	6.493%	-
Cumulative variance interpretation rate % (before rotation)	30.984%	44.705%	55.835%	63.974%	70.466%	-
Characteristic root (after rotation)	4.232	4.028	2.725	2.688	1.83	-
Variance interpretation rate %(after rotation)	19.235%	18.310%	12.386%	12.216%	8.320%	-
Cumulative variance interpretation rate % (after rotation)	19.235%	37.545%	49.930%	62.147%	70.466%	-
KMO value	0.814					-
Bartlett test value	3585.212					-
Df	231					-
p-value	0					-

4.2 Regression results

Correlation analysis could be carried out before regression analysis (Figure1). Factor5 shows significant correlations with factor1, factor2, factor3 and factor4, with correlation coefficients of 0.402, 0.360, 0.155 and 0.732, respectively (>0). This means that factor5 has positive correlations with factor1, factor2, factor3, and factor4.

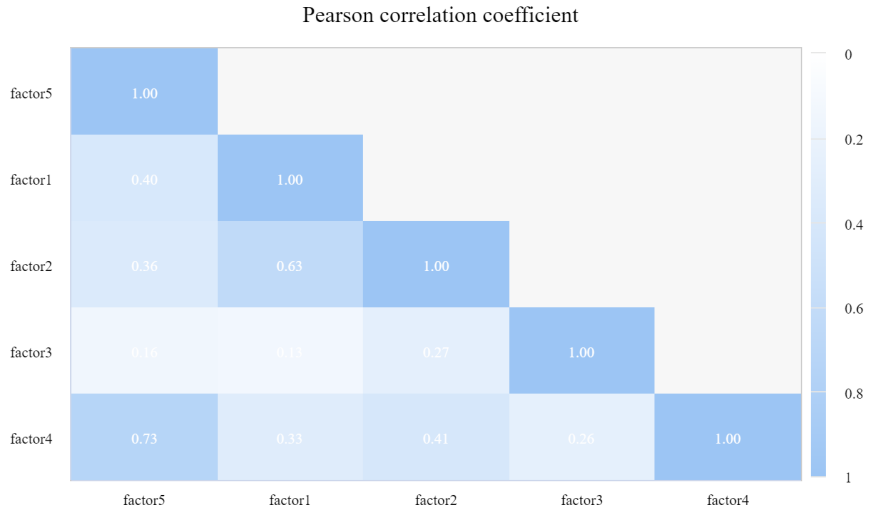

Fig. 1. Correlation diagram

It can be seen from Table 4 that R^2 of the model is 0.879, indicating that four independent variables of learning emotion can interpret 87.9% variations of learning outcome. According to the F-test of the model, it found that the model also proves significance of equation regression through an F-test (F=387.628, p=0.000<0.05). Besides, multicollinearity of the model was also tested and it found that VIF values in the model

were smaller than 5, indicating the absence of collinearity problem. Moreover, the D-W value was near the number 2. Hence, the model has no autocorrelation and there's no correlation between sample data. The model is relatively good.

Table 4. Regression results

	Regression coefficients	**95% CI**	**VIF**
Constants	-0.325 (-1.864)	-0.668 ~ 0.017	-
factor1	0.228** (5.033)	0.139 ~ 0.317	1.955
factor2	0.093* (2.389)	0.017 ~ 0.170	1.478
factor3	0.022 (0.689)	-0.040 ~ 0.084	1.522
factor4	0.742** (23.275)	0.680 ~ 0.805	1.974
Sample size	219		
R^2	0.879		
Adjusted R^2	0.876		
F value	F (4,214)=387.628,p=0.000		
D-W value: 1.944			

* $p<0.05$ ** $p<0.01$, numbers in the brackets are t-values.

Hypothesis H1 is verified. Learning interest has significantly positive promotion on learning outcome. Once university students form stronger learning interest in a course, they will concentrate more on analysis of the internal logic relationship of knowledge, review the knowledge system and thereby get higher-level level outcomes. The production and development process of interest to online learning are usually regular and they develops from superficial layer to deep layer. In particular, university students are very curious in the process of online teaching to facilitate them to explore studies. The good use of online teaching platform allows teachers to improve university students' interest in online learning through group discussion, interaction Q&A, random test, roll call and sign in. In other words, some meaningful questions and interaction links are embedded into the teaching video to increase learners' attentions on learning content and learning resources. During online teaching, teachers can improve attention level of learners effectively, stimulate learning motivations and maintain learning engagement by extensively using videos, cartoons and answers. Teachers implement online teaching activities by effective using video resources. This means that teachers improves interest of learners by setting question scenarios before playing the relevant video resources, accompanied with small gift and extra scores. Learners can study with questions, thus improving their learning outcomes.

Hypothesis H2 is verified. Learning attitude has significantly positive promotion on learning outcome. Many learners are forced to online learning due to influences by COVID-19 epidemics. These learners have not so many interests in learning resources and they won't make active study. Therefore, they are easy to produce relatively negative learning attitude. When organizing online learning, universities have to pay attentions to learning attitude of these students. It can facilitate learning and improve students' ability in solving problems positively during learning as long as having a good and positive learning attitude. This makes the attitude of learning objective more cor-

rect. Conclusions of this study also prove that a good learning attitude is the basic cognition of learners to online learning. The students who have more obvious learning attitude have stronger endogenous motivations of learning and achieve better learning outcomes. Therefore, when university students adapt to the technological use continuously, this also gives university teachers some inspirations, helps them recognize advantages and disadvantages of online teaching through changes in their working contents and deepens understanding on online teaching, such openness of teaching, technological improvement teaching efficiency and accidental activity of sub-groups.

Hypothesis H3 is not verified. Learning belief has no significantly positive promotion on learning outcome. This might be because although various online learning platforms are relatively perfect and equipped with massive teaching resources as well as friendly interfaces at present, learners need more understanding of teachers and parents as well as interactive supports from classmates. Due to the relatively single interaction mode of online learning platforms, university students can develop negative psychological emotion after learning for an excessive period, thus further decreasing their learning belief. This doesn't promote their learning outcome effectively. Online learning is strong supplementations of traditional classroom teaching model and it has good characteristics of repeated learning. It can test university students at any time and any place, thus increasing convenience of education. However, university students often have bad experiences in network learning, especially, online learning, and even gain shadows in inner hearts. They lack of curiosity and enthusiasm to knowledge. Online learning further decreases the lifelong learning ability and continuous initiative learning of learners, which fails to further strengthen learning belief. Some students even give up online learning and only start learning again after returning to traditional classroom teaching at schools, thus decreasing learning outcome comprehensively.

Hypothesis H4 is verified. Learning motivation has significantly positive promotion on learning outcome. Online learning motivation refers to the learning power of learners that is triggered by external stimuli in the online learning environment (including learning platform, teachers and classmates). It facilitates the original power of learners to finish learning tasks comprehensively. During online learning, appropriate praising, bonus and high-quality interactions of teachers can help students to acquire excellent academic performances. Particularly, students can choose courses more conveniently and freely in the online teaching environment. Based on university's respect to individual characteristics of students, students can complete professional knowledge learning and skill mastering better through thinking, understanding and trials. Moreover, teachers have to spend more time to concern emotional changes of learners, encourage students to concentrate on online learning contents positively, explore internal logics of professional knowledge, and help learners complete online learning tasks easily and effectively. At present, most online learning platforms have very good operation and allow learners to feel richer learning experiences. When learners improving learning effect continuously, online learning platforms can analyze preferences of learners and discover deep stimuli of learners' motivations through their browsing history, test data and other big data, thus enabling to recommend them richer individualized knowledge learning resources. Through the recommended more accurate individual

learning resources by online learning platforms, learners can feel richness and convenience of online learning, thus improving their perception of easy use and usability, and stimulating more learning motivations.

4.3 Difference analysis

It can be seen from Table 5 that there are significant differences in learning outcomes among different grades. Obviously, online learning outcome of freshmen is higher than those of other grades. This is because online learning is extensively applied in high schools in China; freshman basically can adopt various online learning modes. Since they are just admitted to universities, they have stronger learning efficacy to facilitate them to finish academic tasks and achieve better learning outcomes. Specifically, the online learning outcome of junior students is the lowest, because junior students undertake pressures of employment and postgraduate entrance exams. Students who choose employment pay more attentions to social practices and lack of learning time, thus resulting in low academic performances. Students who choose to take postgraduate entrance exams spend more time in learning politics, English, and math with consideration to the postgraduate entrance exam system in China, and they have low enthusiasm on online learning of professional courses. They have no enough time and efforts to finish online learning, finally resulting in low learning efficiency. This also inspires universities not to adopt "one-size-fits-all" teaching mode when formulate online learning tasks to freshman, sophomore, junior and senior students. Instead, learning emphasis points of students at different grades shall be considered. Universities shall reform the online teaching mode and develop higher-quality teaching resources to attract students to finish online learning tasks and improve learning outcome.

Table 5. Differences of learning outcome among different grades

learning outcome	Grade (mean±SD)				F	*p*
	Freshman (n=35)	***Sophomore (n=51)***	***Junior (n=76)***	***Senior (n=57)***		
	4.62±1.44	4.48±1.34	3.90±1.47	4.44±1.40	3.037	0.030*

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

It can be seen from Table 6 that there's significant difference of leaning outcome among the latest comprehensive assessment levels. This is because the latest comprehensive assessment represents the learning comprehensive ability and quality of a student. Students with higher comprehensive assessment levels are willing to spend more times to finish online learning tasks. Online learning tests independent learning, independent thinking and self-management ability of students. In particular, many universities usually increase proportion of online learning in total academic performances to encourage students in online learning. Therefore, students with good learning basis are stimulated to finish online learning better and they present significantly better learning outcome than other students. Meanwhile, students with a high comprehensive assessment grade may master better learning skills, formulate scientific learning progress, and set specific goals. They make positive interactions and careful notes during online

learning finish all homework assigned by teachers, and review class notes every day in their spare time. In this study, they will combine their practical learning conditions and finally achieve a better learning outcome.

Table 6. Differences in learning outcome among the latest comprehensive assessment levels

learning outcome	Latest comprehensive assessment level (mean±SD)					F	p
	Excellent (n=17)	***Good (n=84)***	***Moderate (n=57)***	***Pass (n=49)***	***Failed (n=12)***		
	4.65±1.54	4.63±1.48	4.53±1.52	3.80±1.50	4.00±1.54	3.639	0.007**

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

5 Conclusions

With the coming of digital technology, online learning is highly appreciated by more learners for its good openness and sharing. Online learning breaks time limit and space isolation comprehensively, so that learners can adopt more flexible and diversified learning modes, and carry out individualized learning at a more convenient learning time. Online learning has injected new vitality to the education field. Learning emotion of learners is an important consideration in learning and teaching evaluation. So far, many associated studies have fully proved the correlation between learning outcome and online engagement. In other words, the higher learning emotion, the better learning effect is. In this study, questionnaire to investigate influences of learning emotion of learners on learning outcome is designed and it influences learning outcome from perspectives of learning interest, learning attitude, learning belief and learning motivations. The following conclusions can be drawn: the designed questionnaire has very good reliability and validity. Learning interest, learning attitude and learning motivations can improve learning outcomes significantly. There are significant differences of learning outcomes among different grades and the latest comprehensive assessment levels. It is suggested to make deeper studies on following aspects, such as online learning emotional engagement recognition based on deep learning, perfect learning emotional classification system and determine complicated composition of learning emotion, explore association learning emotional status of learners and teaching activities, etc.

6 References

[1] Weiss, R. P. (2000). Emotion and learning. Training & Development, 54(11), 44-48. https://doi.org/10.3991/ijac.v14i2.25845

[2] Stauffer, D. (2021). Mindset Trek: eLearning for developing personal innovativeness. International Journal of Advanced Corporate Learning, 14(2), 64-68. https://doi.org/10.1207/s15326985ep2403_4

[3] McCombs, B. L., & Whisler, J. S. (1989). The role of affective variables in autonomous learning. Educational Psychologist, 24(3), 277-306. https://doi.org/10.1207/s15326985ep2403_4

[4] Gable, S. L., & Haidt, J. (2005). What (and why) is positive psychology?. Review of general psychology, 9(2), 103-110. https://doi.org/10.1037/1089-2680.9.2.103
[5] Chen, C. M., & Wang, H. P. (2011). Using emotion recognition technology to assess the effects of different multimedia materials on learning emotion and performance. Library & Information Science Research, 33(3), 244-255. https://doi.org/10.1016/j.lisr.2010.09.010
[6] Wachtler, J., & Ebner, M. (2019). Scheduling interactions in learning videos. International Journal of Learning Analytics and Artificial Intelligence for Education, 1(1), 58-76. https://doi.org/10.3991/ijai.v1i1.10995
[7] Allcoat, D., & von Mühlenen, A. (2018). Learning in virtual reality: Effects on performance, emotion and engagement. Research in Learning Technology, 26, 2140. https://doi.org/10.25304/rlt.v26.2140
[8] Rusk, N., Tamir, M., & Rothbaum, F. (2011). Performance and learning goals for emotion regulation. Motivation and Emotion, 35(4), 444-460. https://doi.org/10.1007/s11031-011-9229-6
[9] D'Mello, S., & Graesser, A. (2012). Dynamics of affective states during complex learning. Learning and Instruction, 22(2), 145-157. https://doi.org/10.1016/j.learninstruc.2011.10.001
[10] Scott, C., & Myers, K. K. (2005). The socialization of emotion: Learning emotion management at the fire station. Journal of Applied Communication Research, 33(1), 67-92. https://doi.org/10.1080/0090988042000318521
[11] Hascher, T. (2010). Learning and emotion: Perspectives for theory and research. European Educational Research Journal, 9(1), 13-28. https://doi.org/10.2304/eerj.2010.9.1.13
[12] Vince, R. (2002). The impact of emotion on organizational learning. Human Resource Development International, 5(1), 73-85. https://doi.org/10.1080/13678860110016904
[13] Höpfl, H., & Linstead, S. (1997). Introduction: Learning to feel and feeling to learn: Emotion and learning in organizations. Management learning, 28(1), 5-12. https://doi.org/10.1177/1350507697281001
[14] Shepherd, D. A. (2004). Educating entrepreneurship students about emotion and learning from failure. Academy of Management Learning & Education, 3(3), 274-287. https://doi.org/10.5465/amle.2004.14242217
[15] Vuorela, M., & Nummenmaa, L. (2004). Experienced emotions, emotion regulation and student activity in a web-based learning environment. European Journal of Psychology of Education, 19(4), 423-436. https://doi.org/10.1007/BF03173219
[16] Marchand, G. C., & Gutierrez, A. P. (2012). The role of emotion in the learning process: Comparisons between online and face-to-face learning settings. The Internet and Higher Education, 15(3), 150-160. https://doi.org/10.1016/j.iheduc.2011.10.001
[17] Zembylas, M. (2008). Adult learners' emotions in online learning. Distance education, 29(1), 71-87. https://doi.org/10.1080/01587910802004852
[18] Artino Jr, A. R. (2012). Emotions in online learning environments: Introduction to the special issue. The Internet and Higher Education, 15(3), 137-140. https://doi.org/10.1016/j.iheduc.2012.04.001
[19] Zembylas, M., Theodorou, M., & Pavlakis, A. (2008). The role of emotions in the experience of online learning: challenges and opportunities. Educational Media International, 45(2), 107-117. https://doi.org/10.1080/09523980802107237
[20] Wosnitza, M., & Volet, S. (2005). Origin, direction and impact of emotions in social online learning. Learning and Instruction, 15(5), 449-464. https://doi.org/10.1016/j.learninstruc.2005.07.009
[21] M. Feidakis1, M., Daradoumis, T., Caballé, S. & Conesa, J. (2014). Embedding emotion awareness into e-learning environments. International Journal of Emerging Technologies in Learning, 9(7), 39-46. https://doi.org/10.3991/ijet.v9i7.3727

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