Effects of Anxiety on Active Class Attitude in E-Learning

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Abstract

In this study, we clarified how anxiety during learning in e-learning affects active class attitude. Furthermore, we clarified mechanisms by which the causal relationship between anxiety and active class attitude. At that time, based on results of our previous studies and reviews of previous studies, we analyzed anxiety during learning and active class attitude in consideration of learning strategy and willingness to learn. As a result, we found that the higher anxiety of learner at the start of semester, the lower active class attitude and deep information processing at the end of semester. On the other hand, when willingness to learn is high, willingness to learn suppresses effects of anxiety, on the contrary, enhances active class attitude. Our study suggests that the causal relationship between anxiety and active class attitude is adjusted by willingness to learn. These findings obtained in this study can be evaluated as useful for maximizing learning effects in e-learning.

Palabras clave: E-learning; Anxiety during learning; Active class attitude; learning strategy; Willingness to learn.

Introduction

In Japan, The Ministry of Education, Culture, Sports, Science and Technology (MEXT) has called for development of e-learning as initiative to encourage independent learning and guarantee quality in higher education. In addition, because of Covid-19, the attention to e-learning has increased and the introduction has

been urgent. In this study, we examined e-learning in which a learner views a video on their own of course and then takes a test.

It is difficult to say that quality of education in e-learning has been sufficiently examined. In the past, research has discussed quality of education by analyzing degree of participation and concentration in lectures through screen migration and viewing times found in transaction logs of various learning systems used in e- learning. Although learning logs have advantages of being obtained over a period of time, learning behavior is interpreted from logs under assumptions, and quality of education must be estimated. An analysis by learning behavior logs alone is limited to a partial understanding of the psychological factors of learners. To clarify quality of education in e-learning, it is necessary to have a multifaceted understanding of psychological factors and learning strategies of learners that support their learning behavior.

Then, there are many psychological factors that support their learning behavior, but e-learning, which is a novel learning environment for learners. So, anxiety during learning is particularly impactful. Previous studies addressed by classes in face-to-face (hereinafter, face-to-face lectures), and some pointed out that anxiety during learning has a suppressive effect on learning [1]. Therefore, we will make clear the anxiety of learners in e-learning and effects on learner and learning strategies, mechanisms that bring about such effects.

Active class attitude is psychological factor which support learning in e-learning. E-learning requires student to independently carry out learning tasks presented by teacher. On the other hand, anxiety in e- learning has a certain effect on learner's active class attitude. Therefore, it is necessary to pay attention to active class attitude. It is explained that active class attitude is not only related to credits and graduation but also involves striving to overcome challenges of class for a purpose of self-growth and is positively correlated with time spent in class learning and out-of-class learning and time spent learning independently, which is not related to class [2].

We have surveyed e-learning classes at Shizuoka University (see 3.1) and found trends in each department of anxiety during learning and active class attitude [3]. And, we confirmed that anxiety during learning tended to decrease at the end of semester. While it was verified that anxiety during learning changes in line with progression in a learning process, it is not clear how it changes for individual learner. In addition, since anxiety during learning and active class attitude are treated as independent, they do not reveal mechanisms that lead to interactions and relationships between each psychological factor in learning process. Our purposes of in this paper are as follows: (1) We clarify effects of anxiety during e-learning on active class attitude and deep information processing, focusing on the causal relationships within individual learners start and end of semester. Deep information processing is a

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learning strategy that is profoundly related to e- learning. Deep information processing is a strategy to memorize learning content by linking it to known information as well as to other learning content [4]. In e-learning, descriptions offered by a lecturer of a class become fixed, and there is a possibility that guidances given by a lecturer of class each time is insufficient. Therefore, it is necessary for learners to optimize their learning strategies themselves, and deep information processing is considered to be used at that time. (2) We focus on anxiety during learning and active class attitude, clarifying mechanisms under which cause-and-effect relationship between anxiety during learning and active class attitude is generated. Then, it has been suggested that willingness to learn depends on whether or not a person continues to engage in learning in a face of difficult conditions [5]. In view of the fact that e-learning occurred in a novel learning environment and at a time when efforts were being made to

control COVID-19, it is presumed to have been a difficult situation for learners. Therefore, this study considered adjustments based on willingness to learn.

Related Research

E-learning, unlike face-to-face lectures, is strongly affected by an activeness of learning and learning strategies of learners [6]. Consequently, many studies focusing on learners of e-learning have focused on self-regulated learning strategies. In such a context, psychological factors are treated as one set of factors affecting self-regulated learning strategies, and psychological factors of learners are appraised as having a major impact on self-regulated learning strategies and success or failure of learning attitudes and actual learning [7]. Among psychological factors of learners, several studies have suggested that, in particular, anxiety during learning is important factor in their learning.

Anxiety during learning and active class attitude

Ito (2003) analyzed self-efficacy and anxiety during learning to clarify differences in functions of self-regulated learning strategies between cognitive and motivational aspects of learning [1]. As a result, it was clarified that the higher anxiety during learning, the more cognitive self-regulated learning strategies, intrinsic regulation strategies, and extrinsic regulation strategies were used. In his study, it was shown that anxiety during learning affected all self-adjusted learning strategies. And, consider that extrinsic regulation strategies inhibited continuity of learning, it was evaluated that anxiety during learning had a negative impact on continuity of learning. But, also, there is a room to consider that the intrinsic regulated strategy was facilitating for active learning efforts. In addition, Miura et al. (1997) focused on anxiety surrounding testing and conducted a continuous survey from two weeks before a test to one week after it [5]. Their results showed that the higher anxiety, the greater the drive to confront it. And, Vermunt [8] indicated that learners who are motivated to engage in learning for self-development, self-improvement, and usefulness in society are proactive in taking action to resolve and mitigate their anxiety and gaps in their understanding. Even in light of this, it is not possible to state that anxiety during learning has an inhibitive effect for their learning. Even if there is a high anxiety, if the learner has a positive attitude toward it, anxiety can be regarded as promoting learning.

The reason e-learning has been promoted in higher education in Japan is to guarantee a quality of higher

education by extending out-of-class learning. Therefore, in previous research of active class attitude, discussions focused exclusively on the length of time spent learning. On the other hand, some have pointed out that it is necessary to focus not only on quantitative aspects of time spent learning, but also on qualitative aspects such as active class attitudes and assignments as well as existences of a stance to acquire knowledge and skills. Hatano (2011) described active class attitude as "learning attitudes whereby one attempts to proactively approach assignments given in class for one's own growth, not simply to obtain credits and graduate." He developed a measurement scale and clarified that active class attitude positively correlates with positivity toward learning, intention to continue, self-esteem, and future goal orientation [9]. In addition, it was found that active class attitude was positively correlated with in-class learning hours spent participating in classes at universities, out-of-class learning time (preparatory study, revision, and assignments) spent learning outside of classes, and voluntary study hours, which were not related to classes [2]. In other words,

by focusing on active class attitude, it can be said that, unlike conventional research, the activeness of learners can be captured from both quantitative and qualitative perspectives.

From the above, it is difficult to give a uniform evaluation of anxiety during learning when focusing only on results of learning. However, there seem to be factors that distinguish whether anxiety during learning act as a facilitator of learning or restrict it. By considering these factors and their effects in analysis, it seems possible to show impacts of anxiety on learning. And, we thought one of the factors is willingness to learn [5, 10] from the review of previous studies mentioned above. It should be noted that willingness has been confirmed that it is different from positivity and active class attitude [2].

Research Methods

Investigated class and respondents

Survey was carried out for 2,032 participants enrolled in university-wide course "Introduction to Mathematics and Data Science" at Shizuoka University. This subject is a mandatory course for first-year students in all departments (Faculty of Humanities and Social Sciences, Faculty of Science, Faculty of Agriculture, Faculty of Education, Faculty of Agriculture, School of Regional Development, Faculty of Engineering, and Faculty of Informatics). In this course, face-to-face lectures were not implemented, and students viewed on-demand lecture video from learning management system (hereinafter, LMS); subsequently, tests were completed. Communication and Q&As were all conducted through LMS.

In lectures, relevant teaching units were grouped into sections. Sections ran from section 1 to section 8, with each section consisting of five to eight lesson videos and one to three tests. For example, section 1 consisted of a teaching unit (video) on "Big Data and AI," "Medical Diagnostics 1," "Medical Diagnostics 2," "Image Recognition," and "Voice Recognition," with one test assigned. Each student was required to complete viewing of videos and tests in each section within a time period linked to course schedule.

Survey procedures and survey items

Survey was conducted online and at two points, at the end of section 1 (hereinafter, "T1") and section 8 (hereinafter, "T2"). T1 ran from May 25 to June 18, 2020, and T2 ran from July 6 to July 22, 2020.

In questionnaire, we asked respondents' major, operating system of their PCs and smartphones, gender, and age, number of online classes. In addition, we asked respondents to choose from nine topics related to data science in terms of what they have acquired so far and what they want to acquire in the future. We also asked their psychological states in e-learning (Tables 1 and 2), by "Anxiety during learning scale" [1] and "Active class attitudes scale" [8] and their learning strategy in e-learning (Table 3) by "Deep information processing scale" [4].

Results

243 persons answered in common with T1 and T2. Of these, responses of 11 persons, containing ambiguities or inconsistencies were excluded. We analyzed responses of 232 persons (Valid response rate 11.42%; male 137, female 93, other 1, unknown 1; average age 18.35 years old (SD=0.62)).

Psychological factors and learning strategy

We conducted exploratory factor analysis for active class attitude, anxiety during learning, and deep information processing (Tables 1 to 3). We confirmed that the first eigenvalue was large enough compared to the second eigenvalue and that the one-factor solution was appropriate. The explanation rate was 53.97% for active class attitude, 70.72% for anxiety during learning, and 57.05% for deep information processing. As each scale showed same factor structure as in previous studies. Coefficient omega was .88 for active class attitude, .91 for anxiety during learning, and .85 for deep information processing, confirming a certain reliability.

Table 1

Active class attitude (maximum likelihood method, Promax rotation)

Item No., Item Content (* Inverse Scale)	F1	Commonality
5. I complete assignments from this class with the sense that I should just submit them and be done with it.*	.76	.57
1. I just listen mindlessly to this lecture.*	.75	.57
3. I watch with the sense that all I have to do is watch. *	.73	.53
2. I'm enthusiastic about participating in this class.	.72	.51
7. I work on assignments for this class until I am satisfied.	.67	.44
4. I work on assignments for this class so that they may be viewed as satisfactory.	.65	.42
8. I try to complete the assignments for this class as well as possible.	.62	.38
6. I put the minimum effort necessary into the assignments for this class.*	.61	.37

Table 2

Anxiety during learning (maximum likelihood method, Promax rotation)

Item No., Item Content (* Inverse Scale)	F1	Commonality
5. I feel perfectly normal while studying.*	.86	.74
4. I feel confident while studying.*	.84	.70
6. I feel comfortable while studying.*	.83	.68
2. I feel worried, for some reason, while studying.	.81	.66
1. I become anxious while studying.	.80	.65
3. When I study, I get worried.	.69	.47

Table 3

Deep information processing (maximum likelihood method, Promax rotation)

Item No., Item Content	F1	Commonality
5. While studying, I remember content through association.	.81	.66
3. I proceed with learning while recalling content.	.80	.64
6. While studying, I connect new content with what I have learned so far in my head.	.73	.53
4. When I am learning terms, I learn similar things together.	.65	.43
2. While studying, I remember the same content together.	.63	.40
1. I proceed with my studies while recalling what I have previously learned.	.53	.38

Causal relationships between anxiety, active class attitude, and deep information processing

We used covariance structure analysis by cross-lagged effect model to confirm causal relationship between active class attitude, anxiety during learning, and deep information processing in T1 and T2. As a result of analysis, model shown in Figure 1. Fit indices were GFI=.99, AGFI=.96, CFI=. 99, RMSEA=.04. Therefore, we have determined that this model is well explained and valid.

Anxiety during learning, active class attitude, and deep information processing between T1 and T2 all showed significant positive effects (β=.70, p<.01; β=.68, p<.01, β=.63, p<.01). Anxiety during learning in T1 showed a negative effect on active class attitude and deep information processing in T2 (β=.08, p<.05, β=.08, p<.05). We confirmed that the higher anxiety during learning at the start of the course, the lower active class attitude and deep information processing at the completion of the course.

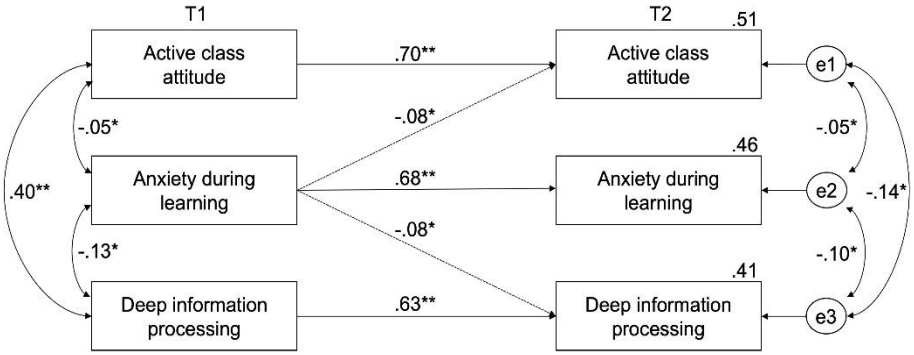

Figure 1. A cross-lagged effect model (standardized path coefficient) examining the causal relationships (** p<. 01, * p<. 05)

Mechanisms through which anxiety affects active class attitude

To verify the mechanisms through which anxiety during learning affects active class attitude, we conducted a hierarchical multiple regression analysis using active class attitude as dependent variable. Active class attitude in T1 (covariate), anxiety during learning and willingness to learn (main effect), and anxiety and willingness to learn (interactive effect) were sequentially entered into the regression equation in Step 1, Step 2, and Step 3, respectively (Table 4).

Table 4

*Hierarchical multiple regression analysis based on anxiety during learning and willingness to learn (** p<. 01, * p<. 05)*

Input Sequence	Variables	R^2 growth	Test for increase in explanatory rate (*F*-Value)	*B*	*SE*	*β*
1 Covariate	T1 active class attitude			.70	.05	.72**
2 Main effect	Anxiety during learning	.04	9.01**	.18	.05	.02
	Willingness to learn			.13	.02	.13**
3 Interactive Effect	Willingness to learn x Anxiety during learning	.01	7.17*	.06	.02	.06*

Main effects of willingness to learn and interactive effect were significant (β=.13, t=2.68, p<.01; β=.06, t=2.28, p<.05). In order to examine interactive effects [11], we substituted the mean +/- 1SD for learning motivation and anxiety in regression equation obtained (Figure 2). Simultaneously, we carried out sub-effect test following Aiken and West [12]. As a result of sub-effect test, we confirmed that the effect of anxiety during learning was significant when willingness to learn was high (β=.15, t=2.58, p<.01). On the other hand, when willingness to learn was low, the effect of anxiety during learning was not significant (β=-.03, t=-0.9, n.s.). To sum up, the higher willingness to learn, the greater effect of anxiety during learning on active class attitude. It may, therefore, effect of anxiety during learning on active class attitude were adjusted by willingness to learn.

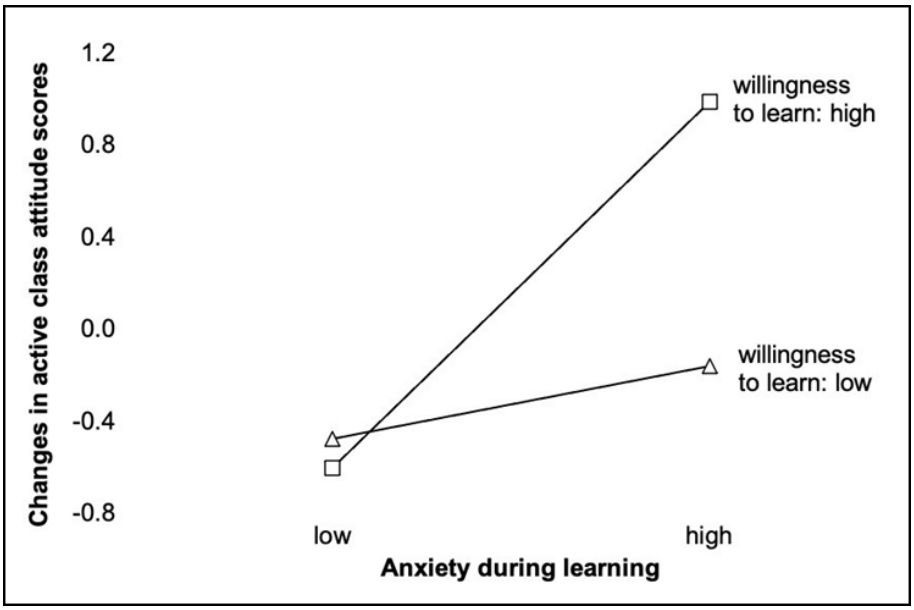

Figure 2. Changes in active class attitude scores due to willingness to learn and anxiety

Conclusion

In this study, we aimed to clarify the causal relationships between anxiety during learning, active class attitude, deep information processing among individual learners before and after taking e-learning. Furthermore, we aimed to establish, by focusing on anxiety during learning and active class attitude, under what mechanism the causal relationship between anxiety during learning and active class attitude was generated.

We can conclude that the higher anxiety during learning at the start of semester, the lower the subsequent active class attitudes and deep information processing. E-learning requires learners to learn actively by presented materials on their own, complete tests within allotted time period, and submit reports or test. In e- learning, students can repeatedly listen to explanations at their own pace and according to their own level of understanding, and they also can engage in advanced learning by their own effort such as seeking learning sources of the Internet. However, it has been suggested that these actions may be hindered by anxiety during learning. Our previous studies have shown that anxiety change as learning progresses [3]. This study hasclarified how anxiety changes within an individual as well as how other psychological factors and learning strategies are affected by changes in anxiety.

Main effect of willingness to learn and interactive effects of willingness to learn and anxiety during learning was significant for active class attitude. As main effect was significant, we can conclude that willingness to learn itself promoted active class attitude. Similar trends have been confirmed in previous studies [13], we can conclude that the results obtained in this study are consistent with the trends in previous studies. Results of sub-effect test suggested that when willingness to learn is high, willingness to learn suppresses effects of anxiety on active class attitude, on the contrary, enhances active class attitude. However, when willingness to learn was low, effect of anxiety during learning on active class attitude was not confirmed. Therefore, we concluded that when willingness to learn is higher than a certain level, the causal relationship between anxiety during learning and active class attitude is adjusted by willingness to learn. Previous studies assessing effects of anxiety during learning on learners and learning suggested that it is not uniform but influenced by other factors. Our study has demonstrated that willingness to learn is one factor that affects.

"Anxiety during learning scale" used in this study is scaled cantering on state anxiety in learning. So, it is

thought that anxiety about not being able to perform daily learning or learning that is desirable for the person is expressed. Therefore, it is presumed that when willingness to learn was high, active class attitude was brought about to somehow dispel anxiety and attempt to overcome it. In studies of anxiety during learning, particularly in research of state anxiety and learning, there have been numerous reports that learning performance may improve despite high state anxiety [14]. Resilience is considered to be related to this. Resilience refers to the processes and ability to adapt well despite difficulties and threats [15, 16] and is said to be largely dependent on individual characteristics. This study did not take resilience into account; therefore, we cannot consider effect of resilience. however, our study suggests that even if an individual has low levels of resilience, if they are highly willingness to learn, learning actively may be conducted, and, ultimately, learning performance may improve.

Finally, in this study, we adopted a hierarchical multiple regression analysis that avoided a mechanical dichotomy, dividing groups into those with either high or low learning motivation, and explored interactions while preserving the continuity of variables. Therefore, when considering the interpretation of the results and future measures, it is important to note that, currently, there are not a lot of learners who are highly motivated to learn. E-learning is now in a transitional phase. As a result, it will be necessary to continually conduct assessments of e-learning and learners.

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