



Participation style and social anxiety as predictors of active participation in asynchronous discussion forums and academic achievement

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Received: 2 April 2022 / Accepted: 7 December 2022 / Published online: 16 February 2023

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Abstract

Learners in asynchronous discussion forums are inundated with diverse options when it comes to interaction. This enables the embodiment of various styles of participation. On the other hand, the affective domain tends to be overlooked in the online discussion context. The modeling of discussion activities based on both cognitive and affective indicators constitutes this study's unique aspect. In the study, the impact of social anxiety and participation styles on active participation in discussions were investigated using three-factor social anxiety and four-factor participation style models. In addition, the impact of active participation on academic achievement was also examined. Path analysis was used to explain the predictive correlation among these indicators. Students' participation behaviors in discussions during a three-week implementation were analyzed within the scope of a course taught during the COVID-19 pandemic period. The findings showed that social anxiety and participation styles had a significant impact on active participation, which, in turn, significantly affected academic achievement. The study provides crucial inputs in portraying the characteristics of learners in such a way as to tailor online discussions to their needs.

Keywords Social anxiety · Participation style · Active participation · Academic achievement · Online academic discussion · Asynchronous discussion forum

1 Introduction

When studies of online interaction are examined from past to present, it becomes evident that these studies are commonly handled within the framework of socio-cultural and collaborative learning theories (Zhu, 2006). At this point, the theory of social constructivism (Vygotsky, 1978) and the community of inquiry (Garrison

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et al., 2000) framework shed some light on the impact of creating learning communities on student learning. In line with these theoretical standpoints, interpersonal interaction is of paramount importance when it comes to lessening transactional distance in e-learning (Moore, 1997). As described by Moore, this can partially be achieved through learner-learner interaction, which increases achievement (Kurucay & Inan, 2017). In this type of interaction, discussion is a key component of learning, whether it takes place through an asynchronous or synchronous modality. One of the environments in which discussion occurs is in *Asynchronous Discussion Forums* (ADFs) (also called discussion boards). ADFs are a web environment in which participants reflect their views on a topic by putting forward arguments and supporting or objecting to those of others. Consequently, participation in such forums positively contributes to critical thinking, reflection, and other higher-order thinking processes (Parks-Stamm et al., 2017). In fact, ADFs offer learners the opportunity to interact and co-construct knowledge with their peers, regardless of time and place (Mercimek & Çaka, 2022; Sun & Gao, 2017; Şahin et al., 2020).

The physical lockdown caused by COVID-19 has led to an increase in attempts at socialization on the part of students in their e-learning environments (Dascalu et al., 2021; Miltiadous et al., 2020). These attempts manifest themselves through online discussions. However, student engagement remains a challenging issue for educators to overcome in order not to miss the pedagogical benefits of online discussions. Existing research efforts are mainly based on cognitive factors or metrics for assessing the pedagogical effectiveness of online discussions. However, the interaction dynamics are quite open to the influence of socio-affective factors. Therefore, there is a growing demand for current academic endeavors to include not only cognitive but also socio-affective factors when evaluating student engagement and learning outcomes in ADFs. The present study modeled discussion activities based on both cognitive and affective indicators. It handled active participation behaviors as an antecedent of academic achievement and as an outcome of a synthesis of social anxiety as an outstanding affective indicator and participatory styles in ADFs.

1.1 Social anxiety in e-learning environments

Social anxiety is defined as “a persistent fear of embarrassment or negative evaluation while engaged in social interaction or public performance” (Heimberg et al., 1999, p. 199). There is reported to be a social anxiety prevalence of 10% (Russell & Shaw, 2009) and 33% (Joseph et al., 2018) among university students. According to Clark and Wells’ (1995) model of social phobia, socially anxious individuals follow a different communication style than others. According to this model, such individuals are inclined to perceive social situations as dangerous and have negative perceptions regarding their performance. This phenomenon is termed as *perceived social danger*. These negative appraisals lead to safety behaviors which can be described as precautions that individuals take to evade negative social consequences. The fact that online actions are more visible and sensitive due to aspects such as digital footprints and the irreversibility of actions, has the potential to exacerbate this state of affair. Consequently, this is most likely to facilitate *post-event processing* in Clark and Wells’s term.

Social anxiety is one of the most substantial impediments to active participation in e-learning (Keskin et al., 2020). It negatively affects the interaction performance of an individual within a particular social group (Heimberg et al., 1999; Keskin et al., 2020). However, despite some papers dealing with face-to-face modality (e.g., Pierce, 2009; Shalom et al., 2015), the body of research attempting to unearth the relationship between student participation and social anxiety in e-learning settings is very limited. Among these attempts, in terms of both face-to-face and online social interactions, it was evidenced that socially anxious individuals behave in a particularly controlled manner to avoid negative evaluation (Barnett et al., 2021; Hutchins et al., 2021). Moreover, in the study by Bahçekapılı (2021), it was found that there is a negative correlation between participatory behaviors and social anxiety in e-learning.

Yen et al. (2012) ascertained that there is less social anxiety in online interactions, particularly asynchronous ones, compared to face-to-face ones. Possible reasons for this are user anonymity and time-flexibility in replying to comments (Rahman et al., 2011). However, user anonymity is not always possible in educational environments. Furthermore, as Alkis et al. (2017) stated, the fact that written communications such as discussion posts are stored and can be seen anywhere and anytime in e-learning environments may amplify the influence of social anxiety and keep learners away from interaction, especially if they use their real identities. That's why the effect of social anxiety on interpersonal interactions in the context of e-learning is considered not to be completely eliminated. This aspect also constitutes one of the starting points behind the current study.

1.2 Participation styles for online discussion

From a socio-cultural perspective, an ADF is one of the means of communication which foster collaborative knowledge construction in e-learning (Vygotsky, 1978). The style of student participation is the key factor that determines the quality of this knowledge-building process. Hrastinski (2006) defines learner participation as a learning process during which learners engage in learning activities and continue their interaction with others. Participation styles in online discussions emerge as all characteristics of individuals such as tendencies, expectations, preferences, motivation, attitudes, etc. (Pala & Erdem, 2020). In this regard, these authors classified participation styles in online academic discussions in terms of two basic dimensions: *Why* and *How*. These can be characterized into four subgroups: to socialize/connective, to get information/analytical, to discuss/innovative, and to fulfill requirements/practical. In another form of classification, there are generally two types of participants. The first type of participant actively participates in discussions (*contributes to* as in Ruthotto et al. (2020) or *speaks* as in Wise et al. (2014)) by writing posts in addition to reading them. The second type of participant passively participates (also known as *lurking* or *listening*) by merely reading others' posts. Generally speaking, active participation is preferred to passive participation. This is because learners are required to engage in discussions cognitively by producing ideas and content so as to get the most out of the e-learning process. Indeed, the messages read and sent, the analysis and synthesis of information, and noticing the nuances and use of emojis in ADFs are

concrete indicators of the participants' cognitive engagement (Zhu, 2006). In short, cognitive engagement is required to co-construct knowledge. In this context, studies show that there is a relationship between the number of messages posted (i.e., active participation) in ADFs and academic achievement, yet this is not the case for passive participation (e.g., Palmer et al., 2008; Wei et al., 2015; Zheng & Warschauer, 2015). For example, in Palmer et al.'s (2008) study, learners generally show passive participation by reading posts and then posting and replying in ADFs to a minimal extent. The researchers also found that only active participation predicted academic achievement. In a study using actual-use logs, Wei et al. (2015) found that active participation had a decisive role to play on online learning performance. Corroborating this, Zheng and Warschauer (2015) revealed that English learners' online participation in writing and reading improved their academic performance.

1.3 Justification for and purpose of the study

Online discussion environments give learners the opportunity to engage in critical thinking, to take part in a community of inquiry (Garrison et al., 2000), and to contribute to common knowledge building whenever they are available beyond physical boundaries (Sun & Gao, 2017; Şahin et al., 2020). However, it is unreasonable to postulate that every student engages adequately in the discussions or benefits equally from their educational advantages. Therefore, individual traits should be considered while managing the flow of discussion so as not to miss its pedagogical affordances.

Being aware of the downsides of the online environment, participants might be expected to be socially anxious, adversely affecting their interaction performances and patterns (Hutchins et al., 2021). When the educational literature is examined, there are a limited number of studies on social anxiety, phobia, or fear in the context of ADF (e.g., Alkis et al., 2017; Alsudais et al., 2022; Drange & Van Wyk, 2019; Keskin et al., 2020). These studies tended to focus on set conceptual grounds or the development of measurement tools related to this new research area. Besides, it is known that there is a relationship between social anxiety and learner behaviors (Bahçekapılı, 2021; Barnett et al., 2021; Hutchins et al., 2021). However, the extent to which the sub-dimensions of social anxiety predict active participation in ADF is unknown. On the other hand, the relevant literature has commonly concentrated on the cognitive aspects of learning as part of the evaluation of the pedagogical implications of e-learning platforms, including online discussions (Almusharraf & Almusharraf, 2021). For this reason, socio-emotional and cognitive characteristics beyond behavioral outputs should be considered together in order to understand students' participation behaviors, and in order to further design a discussion network to promote interpersonal interactions. Providing students with appropriate and effective interaction conditions significantly increases the efficiency of discussions (Kurnaz et al., 2018). Taken all together, handling social anxiety considering participation styles might produce more comprehensive results. In this regard, the present study examined the effects of social anxiety and participation styles on active participation in ADFs

by adopting Keskin et al.'s (2020) three-factor social anxiety model and the four-factor participation style model proposed by Pala and Erdem (2020). In addition, the effect of active participation on academic achievement was also explored. To this end, the following research questions were framed.

To what extent does

- 1) Social anxiety predict active participation in an asynchronous discussion forum?
- 2) Participation style predict active participation in an asynchronous discussion forum?
- 3) Active participation in an asynchronous discussion forum predict academic achievement in terms of test results?

2 Method

In this predictive correlational study (Fraenkel et al., 2019), path analysis was used to test the effect of the participation style and social anxiety on active participation, and the effect of active participation on academic achievement. Path analysis, also known as causal modeling, examines the causal relationships between two or more variables (Olobatuyi, 2006). Path analysis, a special type of Structural Equation Modeling (SEM), deals with only observed variables.

2.1 Participants and settings

To begin with statistical power calculation, a-priori sample size calculation based upon power is recommended in the literature (e.g., Gerard et al., 1998). Accordingly, aiming to detect medium effects, $f^2 = 0.15$ (Cohen, 1988), we accepted the alpha level as 0.05, and set the target power to the conventional value of 0.80. In addition, as we have seven predictors in the model, the minimum sample size needed was calculated as 103. Furthermore, drawing on the *Inverse Square Root Method* (Kock & Hadaya, 2018) of estimating minimum sample size requirements for SEM, it is recommended that at least 160 observations be undertaken for complex models such as the present one. The sampling of the current study surpassed both thresholds. The sample comprises first-year pre-service teachers at two state universities in Turkey. Students taking the *Information Technologies in Education* course were invited to participate in the research and 345 of them filled in the data collection tools. Some 272 students (78.84% of the initial participants) who fully submitted the data collection forms and engaged in e-learning discussions constitute the study group. While 178 of the participants were female (65.44%), 94 of them were male (34.55%).

Due to the restrictions imposed during the COVID-19 pandemic, the students continued their education through emergency remote teaching. In fact, these students started their university education with distance education and came together

online for the first time. Therefore, they had to get familiar with each other within the online academic setting.

2.2 Measurements

In this study, the data were obtained from four different sources. The first was the active participation score, simply calculated using the number of messages sent per discussion thread. The others were the academic achievement test, the social anxiety scale for e-learning environments, and the participation style scale for online academic discussions.

2.2.1 Participation score

The participation score was obtained from ADF. While determining the topics for discussion, the balance of the content distribution was taken into consideration. Initially, 24 different topics were determined as per the suggestions of Woods and Bliss (2016). Following the cross-checks performed by the authors, ten discussion topics were presented to the learners via the learning management system. Considering that the students did not have any noteworthy experience regarding ADF, the first discussion topic was designed to familiarize them with the environment, and to teach them how they would use this platform. Therefore, the data obtained from the first discussion topic were excluded from the scope of the research. At the end of the term, the participation score variable was created by coding the active participation frequency of each student in the academic discussions. The active participation score was simply the average number of messages sent to academic discussions by students, in a similar approach to that of Zheng and Warschauer (2015). Also, in order to check the reliability of the measurements in terms of active participation scores, students' perceptions with respect to their passive, verbal and written participation in ADFs were measured using three Likert-type questions. The result of the Pearson correlation test yielded a strong correlation between actual and perceived participation according to Fraenkel et al. (2019) ($r_p = 0.711$, $p = 0.000 < 0.001$). This substantiated the reliability of the measurement of participation.

2.2.2 The academic achievement test

The academic achievement test was prepared by the researchers to cover the learning contents offered within the scope of the three-week curriculum. First of all, an item pool was created, and was then cross-checked and improved by the researchers. As a result, a pilot-form was developed consisting of 27 multiple-choice questions. We made sure that each question in the pool mapped onto the instructional objectives of the course taught. The pilot form was administered to 290 undergraduate students online. In order to prevent cheating, it was announced that the students would not be graded by this test. As a result, three items were discarded from the test due to low item discrimination, low difficulty index, and low reliability index. The final version of the academic achievement test consisted of 24 questions. The average test point,

the average item difficulty index and the average item discrimination index was found to be 14.423, 0.601, and 0.350, respectively. The KR-20 of the test was 0.792.

2.2.3 Social anxiety scale for e-learning environments (SASE)

The SASE scale was used to determine the social anxiety of students in the discussion threads in the e-learning environment. The 7-point type SASE consisted of two basic sub-scales, named learner-learner interaction and learner-instructor interaction, and considered the interpersonal interactions in e-learning. In this study, the learner-learner interaction subscale was used since peer interactions in instructional discussions were considered. Liebowitz (1987), who developed one of the first data collection tools for social anxiety, operationalized the social anxiety concept as *fear* and *avoidance behavior*. Hinging on this operationalization, according to Keskin et al. (2020), social anxiety in e-learning environments can be classified in terms of three factors. Keskin et al.'s sub-scale consists of a total of 23 items including *Negative Evaluation*, *Somatic Symptoms*, and *Avoidance of Interaction* factors.

- Negative evaluation includes negative thoughts and feelings regarding what others in the e-learning environments might think about a learner's actions in the form of aspects such as questions, replies, and emojis.
- Somatic symptoms measure physical reactions (discomfort, sweat, heart rate, etc.) that learners exhibit during e-learning.
- Avoidance of interaction means avoiding communication, interaction, and socializing with others.

Finally, SASE was found to be a valid and reliable measurement tool according to the 0.7 benchmark of Nunnally and Bernstein (1994) (Cronbach alpha: 0.95, 0.92, and 0.95 for sub-factors, respectively).

2.2.4 Participation style scale for online academic discussions (PSOD)

A 5-point Likert-type PSOD developed by Pala and Erdem (2020) was used to determine students' participation styles in online academic discussions. The scale consists of two sub-scales named *Why*, which explains the usage purposes of academic discussions, and *How*, which explains usage behaviors. Both subscales also have four factors. In the scale, each factor in the *Why* and *How* subscale is paired and interpreted together. These paired factors are *To socialize/connective*, *To get information/analytical*, *To discuss/innovative*, and *To fulfill requirements/practical*.

- To Socialize / Connective: They like to receive attention and to get feedback. They ponder other's posts and try to motivate others.
- To Get Information / Analytical: They post less, read more. They try to understand thoroughly before posting so as not to make mistakes.

- To Discuss / Innovative: They participate in discussions only if they have something different to say. They make authentic contributions to discussions and propose subjective solutions to problems.
- To Fulfill Requirements / Practical: They find practical ways to complete the task with less effort such as sending a minimal number of posts. They are unwilling participants and try to look as if they are participating.

Cronbach Alpha reliability coefficients of these sub-factors were calculated as 0.81, 0.83, 0.85, 0.70, and 0.89 (overall), respectively. These coefficients are accepted as being satisfactory (Nunnally & Bernstein, 1994).

2.3 Study procedure

The ethical approval prior to conducting the study was obtained from the academic ethics commission of Van Yuzuncu Yil University (decision number: 2021/05–27). The main reason why the data were collected for only three weeks was that it was our experience that during the very first weeks students would undergo the novelty effect due to their inexperience in online discussions, while after a few weeks discussion fatigue would emerge. In these three weeks, students interacted with teaching materials such as presentations, and participated in instructional discussion forums. At the end of three weeks, the data were collected from the students using the achievement test, SASE and PSOD.

2.4 Data analysis procedure

G*Power (ver. 3.1.9.7) was used for a priori statistical power analysis. Covariance-based path analysis with the maximum likelihood estimation method was performed using LISREL (ver. 8.80) software. Social anxiety and participation styles were the independent variables, while active participation and cyber-awareness achievement scores were the dependent variables. Harman's single factor test (Podsakoff et al., 2003) revealed that there was not any indication of *Common Method Bias* in the dataset (variance explained = 21.129%). Composites were created by using exploratory factor analysis. Data were described in terms of mean, standard deviation, frequency, and percentile by using IBM SPSS Statistics software (ver. 24). A minimum of ten observations for each parameter in the model are necessary to conduct this analysis (Raykov & Marcoulides, 2006). Since there were nine variables in the current study and the division of 272 by 9 yields 30.22, which is much larger than 10, the adequacy of the sample size was met. Concerning the assumptions of path analysis, we relied on a visual analysis of histograms, and skewness and kurtosis values abiding by the guidelines provided by Kim (2013). The data were seen to ensure meeting the multicollinearity (Variance Inflation Factor < 2.5) and autocorrelation ($1.5 < \text{Durbin-Watson} < 2.5$) assumptions. This study used effect size (ES) f^2 to interpret R^2 as recommended by Cohen (1992). f^2 values lower than 0.02, between 0.02 and 0.15, between 0.15 and 0.35, and larger than 0.35

were interpreted as no, small, medium, and large effect size, respectively. The p -value threshold for statistical significance was set to 0.05.

3 Findings

In this section, findings and interpretations are presented. First, descriptive statistics (see Tables 1 and 2), and then, measures of data-model fit (see Table 3) and factor correlations (see Table 4) are given. Finally, the structural model shaped by path analysis was introduced (see Table 5).

In Table 1, somatic symptoms ($M=2.542$, $SD=1.607$) appeared to be lower than those of other factors. In addition, all the means were found to be less than the critical mid-level of 4. Regarding participation in ADFs ($M=0.414$, $SD=0.411$), the standard deviation appears to be large given its mean. Furthermore, descriptive in relation to participation styles, are given in Table 2.

Table 1 Descriptive of social anxiety, participation, and academic achievement

Descriptives	Social anxiety ^a			Participation	Academic achievement ^b
	Negative evaluation	Somatic symptoms	Avoidance of interaction		
M	3.062	2.542	3.055	.414	14.456
SD	1.424	1.607	1.553	.411	3.479

^a It is a 7-point Likert type scale

^b The academic achievement test contains 24 items

Table 2 Descriptive of participation styles

Dimension	Participation styles ^a			
	To socialize	To get information	To discuss	To fulfill requirements
Why				
How	Connective	Analytical	Innovative	Practical
M	2.231	3.843	3.523	2.368
SD	.799	.765	.769	.691

^a It is a 5-point Likert type scale

Table 3 Fit indices of the proposed model

Value	p	χ^2 / df	RMSEA	S-RMR	GFI	NNFI	CFI	IFI
Calculated	.157	1.52	.044	.029	.99	.97	.99	.99
Acceptable*	>.05	<5	<.060	<.080	>.95	>.95	>.95	>.95

$\chi^2 = 10.61$, $df = 7$

*West et al. (2012)

Table 4 Correlation matrix of the observed variables using Pearson correlation coefficient

Variables	Factors	Social Anxiety			Participation Styles			
		1	2	3	4	5	6	7
Social Anxiety	1 Negative evaluation	1	.586**	.601**	.261**	.021	.016	.233**
	2 Somatic symptoms	.586**	1	.597**	.169**	-.015	-.030	.201**
	3 Avoidance of interaction	.601**	.597**	1	-.002	-.189**	-.195**	.223**
Participation Styles	4 To socialize / Connective	.261**	.169**	-.002	1	.381**	.447**	.360**
	5 To get information / Analytical	.021	-.015	-.189**	.381**	1	.590**	.110
	6 To Discuss / Innovative	.016	-.030	-.195**	.447**	.590**	1	.181**
	7 To fulfill requirements / Practical	.233**	.201**	.223**	.360**	.110	.181**	1

** Significant at the level of .01

Table 5 The results of the model with regard to the effects of social anxiety and participation styles on participation

Statistics	Social Anxiety			Participation Styles			
	Negative evaluation	Somatic symptoms	Avoidance of interaction	To socialize Connective	To get information Analytical	To discuss Innovative	To fulfill requirements Practical
<i>t</i>	2.06*	1.73	-5.42***	-1.32	3.11**	1.52	1.67
<i>B</i> ^a	.045	.032	-.11	-.046	.11	.058	.060
<i>β</i> ^b	.16	.13	-.43	-.09	.21	.11	.10
<i>R</i> ²	.026	.017	.185	.008	.044	.012	.010
<i>f</i> ²	.026	.017	.227	.008	.046	.012	.010
ES ^c	Small	No	Medium	No	Small	No	No

* Significant at the level of .05, ** Significant at the level of .01, *** Significant at the level of .001,

a, b, c Unstandardized estimates, standardized estimates, and effect size interpretation, respectively

Table 2 draws attention to the fact that the means of to get information / analytical ($M=3.843$, $SD=0.765$) and to discuss / innovative ($M=3.523$, $SD=0.769$) factors were larger than those of to socialize / connective ($M=2.231$, $SD=0.799$) and to fulfill requirements / practical ($M=2.368$, $SD=0.691$) ones.

First, the proposed model needs to be proven to reasonably fit the data before interpreting the relationships among the variables (Ockey & Choi, 2015). To this end, fit indices are used. The ratio of χ^2 / df (degree of freedom), root mean square error of approximation (RMSEA), standardized root mean square residual (S-RMR), goodness-of-fit index (GFI), non-normed fit index (NNFI), comparative fit index (CFI) and incremental fit index (IFI) are frequently reported to determine the fit of the model (DiStefano & Hess, 2005; Jackson et al., 2009). Consequently, these seven indices are reported in Table 3.

In SEM, the p value for χ^2 statistics needs to be insignificant to support good model fit (Byrne, 1994). In this study, it was calculated as 0.157 ($p > 0.05$). As seen in Table 3, all the other fit indices (RMSEA=0.044, S-RMR=0.029, GFI=0.99, NNFI=0.97, CFI=0.99, IFI=0.99) yielded acceptable values according to West et al. (2012). In addition to fit indices, since Ockey and Choi (2015) emphasized that a correlation matrix of all observed variables should be provided in SEM studies, the result of the matrix is reported in Table 4.

Among the results of the Pearson tests in Table 4, we draw attention that to fulfill requirements / practical factor of participation styles yielded statistically significant positive results with the negative evaluation ($r_p=0.233, p<0.01$), somatic symptoms ($r_p=0.201, p<0.01$) and avoidance of interaction ($r_p=0.223, p<0.01$) factors of social anxiety. After the correlation matrix, the results of the path analysis are presented in Table 5.

As reported in Table 5, the negative evaluation factor contributed to the model at the 0.05 significance level ($t=2.06>|1.96|$), whereas avoidance of interaction factor contributed to it at the 0.001 level ($t=-5.42>|3.29|$). The effect of the avoidance of interaction factor on participation was the only relationship with a medium effect size ($\beta=-0.43, R^2=0.185, f^2=0.227>0.15$). The direction of the relationship was negative. Moreover, the effects of the negative evaluation factor with regard to social anxiety ($\beta=0.16, R^2=0.026, f^2=0.026>0.02$) and the to get information / analytical factor of participation styles ($\beta=0.21, R^2=0.044, f^2=0.046>0.02$) were the sole ones with small effect sizes. The directions of both relationships were positive. All the other variables had no statistically significant effect size on participation ($f^2<0.02$). Regarding the total explanation of social anxiety and the participation style in terms of participation, the coefficient of determination (R^2) was calculated as 0.22 ($\mathcal{E}=0.78$). When it comes to the effect of participation on achievement, it also significantly contributes to the model at a significance level of 0.01 ($t=2.59>|2.58|$). The standardized path coefficient between them was found to be 0.16 ($\mathcal{E}=0.97$ (0.9744 to be exact), $R^2=0.026, f^2=0.026>0.02$, small effect size). Figure 1 is provided to help the reader grasp the results of the path analysis.

4 Discussion

The present study probed the active participation behaviors of students in ADFs handled as an antecedent of academic achievement and as an outcome of a synthesis of social anxiety and participatory styles. The study modeled student activities in academic discussions based on both cognitive (i.e., achievement, participation) and affective (i.e., social anxiety) indicators. This eclectic approach constitutes its unique aspect.

4.1 The predictive relationship between social anxiety and active participation (RQ 1)

In the study, the effect of social anxiety on participation is considered in terms of three factors: *negative evaluation*, *somatic symptoms*, and *avoidance of interaction*. According to the average factor scores, students generally experienced

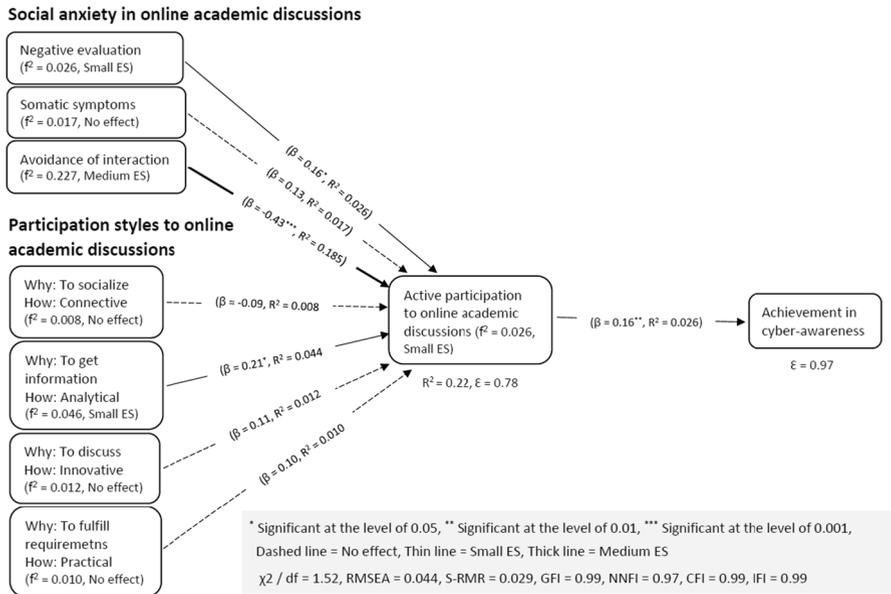


Fig. 1 The path analysis model

social anxiety at below medium-level (<4) across all three factors, which means that students underwent relatively low social anxiety in ADFs. This is not a surprising result, especially considering that social interactions took place in online environments. In the literature, it is highlighted that online environments alleviate social anxiety (e.g., Lee & Stapinski, 2012; Yen et al., 2012). In addition, the realization of social interactions in an asynchronous way might also facilitate a reduction in social anxiety.

One of the results of this study was that *negative evaluation* positively predicts active participation. This gives the impression that students did not refrain from participation behavior despite their negative evaluations as was the case in some groups (Topham et al., 2016). This result might stem from the students' efforts to make themselves known in their first year. According to Topham and others, some individuals primarily focus on negative feelings and their anxiety has limited or no change during social situations, while others take steps and pursue active strategies to overcome their concerns. In fact, asynchronous interaction environments in e-learning have limited external cues or feedback from the social environment regarding the behavior performed, compared to face-to-face and/or synchronous e-learning environments. Therefore, external negative evaluation indicators limit the responses and emotional expressions to one's posts (Clark & Wells, 1995; Hutchins et al., 2021). In addition to external stimuli (e.g., feedback), the perception of how others will evaluate one's performance, the representation of how such a performance looks, and norms regarding how one's behavior will be evaluated by others, determine the possibility of negative evaluation with regard to the social environment and to its social consequences (Rapee & Heimberg, 1997).

The fact is that the participants of this study had never seen each other face-to-face due to the COVID-19 pandemic. As is known, peer pressure also positively influences learners' intentions with regard to participation in online discussions (Yang et al., 2007). Indeed, our results supported the view that the fear of negative evaluation by peers had a positive effect on discussion interactions. It is possible that the participants refrained from lagging behind their classmates in participating in discussions. In addition, the presence of the instructor in the discussions probably affected the participatory behaviors of the students, albeit with the instructors maintaining a low profile. Whether taking a low or dominant profile, the presence of the instructor influences student participation in different ways in asynchronous discussions (Mazzolini & Maddison, 2007). The instructor's role in discussions, as well as the frequency, timing, and nature of his/her messages, are just a few of the parameters that need to be taken into account. In addition, extra point incentives given to students to ensure their participation may have increased students' active participation by causing them to put more emphasis on the quantity rather than the quality of messages. The incentives or rewards attenuate social anxiety against online interpersonal interactions (Yen et al., 2012). In fact, these incentives trigger one's behavioral activation as an extrinsic motivation factor. Another issue which is considered critical in the emergence of this result, is the low-level degree of student–student interaction. Students mainly focused on replying to discussion questions rather than replying to the comments of their peers. Such a flow of discussion might have reduced the social anxiety of students owing to a consequent lack of criticism. Through the mechanics described above, *perceived social danger*, in Clark and Wells' (1995) term, seems to have led to an increase in behavioral output, which clearly contradicts their cognitive model of social phobia. The fact is that *safety behavior* was perceived to be in terms of participation, rather than avoidance on the part of the students.

The factor of *somatic symptoms* did not have a decisive effect on students' active participation behaviors. In fact, somatic symptoms had the lowest factor score among the factors associated with social anxiety. Accordingly, during the ADF interactions, students did not intensively experience physical symptoms as an indicator of social anxiety. During social interaction, physiological arousal signs such as flushing, heart throbbing, sweating, trembling caused by high distress have a specific place in the evaluation of social anxiety as a psychological disorder as well as the clinical management of its treatment (Campbell-Sills et al., 2015). Such physiological arousal is accompanied by other indications such as difficulty in focusing and increased tension; however, the person does not lose awareness of the anxiety factors or sources (Caglar et al., 2012). In addition, discussion boards are among those text-based communication tools that are considered to alleviate social anxiety compared to audiovisual tools. In parallel to this, a study that compared text and voice conversations on students' speaking competence and anxiety in foreign language instruction, reported text-based chat tools to cause less anxiety in students (Namaziandost et al., 2022). When all is taken into consideration, students were not expected to undergo somatic symptoms in e-learning due to the fact that the discussion had taken place through text-based asynchronous communications rather than audio or visual dialogues.

The *avoidance of interaction* factor significantly predicted active participation in online discussions. It has a moderately negative effect on students' active involvement in discussions. Among the factors associated with social anxiety, the avoidance of interaction had the strongest effect on participation behaviors. The avoidance of interaction is about consciously avoiding interaction. Therefore, it is also interpreted as the behavioral output of social anxiety. The individuals' *negative evaluations* are more substantial in the perseverance of social anxiety because the driving force of social anxiety are perceptions, prejudices, and beliefs, rather than in-situ feedback from the environment (Keskin et al., 2020). In this regard, the finding of the current study corroborated Clark and Wells's (1995) theory.

4.2 The predictive relationship between participation styles and active participation (RQ 2)

Our results also indicated that participation style is a determinant of active involvement in discussions. Herein, participation style is established on the intention *Why*, and strategy on the *How* of participation. The *to get information/analytical* style, which is the most dominant among other the participant styles, has a small, but significant positive effect on active participation in discussions. In other words, participants who attended the discussions to gain information and who adopted an analytical approach, had a tendency to contribute more to discussions. Participants with this style focus more on subject-matter, read threads seriously, and have a tendency to make conceptual interpretations and engage in informative posting (Pala & Erdem, 2020; Poellhuber et al., 2019). In addition, the presence of the instructor in the environment is an important source of motivation for this group. Although those participants were expected to send fewer posts due to refraining for fear of making mistakes (Pala & Erdem, 2020), our findings contradicted this argument. The visits of participants who are involved in discussions in a more analytical way take longer in ADFs (Wise et al., 2014). This also gives them more opportunity to engage with the content and make inferences, thus creating more space to contribute to the content. In addition, though they are not adopting an evaluative or judgmental approach, the presence of the instructors in the environment seemed to have alleviated their reservations when it came to making mistakes. Other participation styles with the exception of *socialization / connective* are also positively related to active participation in discussions, but none of these relationships were statistically significant in the present study. In fact, the relatively low reply rates with regard to the participants' comments are indications that the students who are participating in order to socialize did not contribute much to the discussions because these participants focus more on contributors than on contributions.

4.3 The predictive relationship between active participation and academic achievement (RQ 3)

Students' contributions to the discussion were found to have a small positive effect on academic achievement test results. ADFs are argumentation-based

knowledge-building environments. The discussions provide fruitful pedagogical outcomes, such as critical and reflective thinking (Abawajy & Kim, 2011). Online discussions provide learners with considerable flexibility when it comes to also embracing the informal dimension of learning. Students follow the posts, make inferences and judgments with regard to the comments, and share the reflections about the discussion topic in such an environment. They further engage not only cognitively, but also metacognitively, and use various interpersonal communication strategies (Calderon & Sood, 2020). A growing body of studies emphasize the authentic relationship between student active participation such as the number of messages posted and learning outcomes in discussions (e.g., Delaney et al., 2019; Goldberg et al., 2015; Palmer et al., 2008; Wei et al., 2015). To illustrate, in e-learning, the number and quality of messages sent to the discussion forum also have a positive effect on student achievement (Song et al., 2019). According to Palmer et al. (2008), although students mostly participate in discussions in the form of reading (i.e., passive participation), only their active participation predicts their achievement. To sum up, our findings are consistent with previous reports about the effect of active participation in the ADF on academic achievement.

Active participation in ADFs has some impact on the academic achievement test, but this impact seems not to be substantial in our study. This outcome is expected given the multifaceted characteristics that underlie academic achievement. Besides, this study examines the effect of a single variable on academic achievement, namely active participation in discussion boards. There are also many other factors—including individual characteristics, group set-up, and type of ADF—that influence the effect of active participation in the ADF on academic achievement. When the literature is examined, it cannot be denied that some demographic characteristics such as age and ethnicity affect participatory and non-participatory behaviors in online discussions (Mercado-del-Collado et al., 2019; Ruthotto et al., 2020).

The structure of communication environments impacts the type of participatory behaviors among students (Sun et al., 2018). Some studies also argue that class size constitutes an important determinant for shaping the types of participation in discussions, as well as for learning outcomes (e.g., Afify, 2019; Ruthotto et al., 2020). Although the number of participants per discussion session in our study was quite variable (between 30 and 150), class size never fell below 30. In the literature, active participation on the part of the students was reported to decrease and the rate of lurking behaviors to increase in online discussions, in cases of large class size ($> \sim 20\text{--}30$) (Afify, 2019; Rovai, 2007). This phenomenon brings to mind the concept of *Diffusion of Responsibility* (Latane & Darley, 1970). The increase in the number of people in the learning environment alleviates the pressure on students to post messages and encourages them to impute responsibility to others in this regard (Markey, 2000). Therefore, it is considered that class size also has a moderating effect on the relatively limited effect of active participation on student achievement.

Asynchronous discussions take place in an order in which it is not necessary to capture simultaneous context-awareness throughout the discussion process, since the interactions are recorded and accessible at any time. The inclusion of each post in the flow of the discussion provides students with flexibility with regard to such aspects as being discontinuous or continuous readers, the way they position their

posts (Andresen, 2009), and provide the flexibility to act in accordance with their emotional and cognitive status. Furthermore, the scattered timing of the messages affects the students' ability to follow up the content and focus on the topic (Dringus & Ellis, 2010). This gives them the option to engage in their own way. Specifically, this enables them to exhibit multiple approaches while participating.

5 Conclusion

Social anxiety is one of the major academic impediments that prevents students from correctly portraying their competencies. Unfortunately, the management of social anxiety is usually left to the students themselves in learning settings (Topham et al., 2016). On the other hand, what participants expect from discussions and how they behave to achieve it, shape their social interactions in ADFs. Taken together, awareness of students' social anxiety levels and participation styles is crucial to better understand the underlying reason for their participation behaviors, and, accordingly, to determine instructional interventions that might leverage participation and academic achievement. It would also contribute to the alleviation of chronic problems in e-learning such as transactional distance, and high drop-out rates. In this context, the current study examined the role of social anxiety and participation styles in terms of active participation in online discussions, which directly affects interaction performance (Hutchins et al., 2021).

This study indicated that social anxiety did not have an impact on active participation behaviors in ADFs in a monolithic way. As a conclusion to this piece of academic work, while students' negative evaluations stimulated participation, the avoidance of interaction behaviors prevented participatory actions in discussions. Considering the impact of participation styles on online discussions, individuals operating with the aim of obtaining knowledge approached the threads analytically, and made relatively more contributions to the discussions. In addition, the increase in participation positively predicted the academic achievement test score.

All the relationships with the exception of avoidance of interaction had small effect sizes ($0.02 < f^2 < 0.15$). In fact, considering that there tends to be a limited number of socially anxious individuals in a social group (Russell & Shaw, 2009), this resulted in findings in the current study with a lower effect size. In spite of the fact that this could seem impractical in terms of results, small effect sizes are prevalent in the education literature due to the sheer number of confounding variables (Ewert & Sibthorp, 2009). Consequently, we are of the opinion that the findings this study unveiled, give birth to a couple of implications for enhancing the use of ADFs.

6 Limitations

This study has a number of limitations. First, participation quality in discussions could not be measured due to an excess of discussion threads. Since a high level of participation in discussions does not guarantee quality contributions (Naranjo et al., 2012), further studies should focus on the quality of contributions. Second,

active participation was considered only in terms of the number of posts. Third, in this study, passive participation or *lurking* (Ruthotto et al., 2020), or *listening* (Wise et al., 2014) were neglected. Studies in the future could operationalize passive participation through a consideration of emojis. In this way, the relationship between students' emotions and active participation can also be unearthed. Fourth, students were informed that they would not be graded based on the academic achievement test in order to prevent cheating. Indeed, cheating would be an issue since the test was employed online. Nonetheless, not being graded might have created less anxiety during the exam. Hence, the generalizability of these results to official examinations appears to be limited. Fifth, this study neither deals with social anxiety in the context of a mental disorder nor classifies people as socially anxious or not. Therefore, it does not go beyond the educational context. Lastly, the study was underpowered when it came to ascertaining relationships whose standardized regression weights were lower than ~ 0.151 (calculated using the *inverse square root method* (Kock & Hadaya, 2018). This rendered “nonsignificant” weights obtained in the current study that were lower than this threshold as being actually *inconclusive*. Nonetheless, we hesitantly still accept these inconclusive findings as nonsignificant because their *t* values were not critically close to turning to significant.

7 Future Directions

Our findings might pave the way for scholars to design novel academic studies in the field of e-learning, particularly with regard to student profiling and user analytics. For instance, first, the influence of teachers' presence and activity in ADFs on social anxiety and active participation quality could be investigated. Second, the underlying reasons for students' replying to discussion questions directly instead of to their peers' comments may also be explored in an attempt to alter this discussion pattern. Third, the anonymous reviewer of this paper articulated in his/her critique that social anxiety might be more prevalent in live sessions compared to ADFs, which seems to be a sound research topic for academic endeavors in the future.

As for professional practitioners, some of our results might be useful for them when it comes to swaying learners towards discussion. For example, instructors should decide upon appropriate intervention types and generate conflict points accordingly, such that discussions appeal to students of all participation styles. Especially in order to assist the ones with a *to get information/analytical* participation style to find related posts, knowledge-building scaffolds (Resendes et al., 2015; Scardamalia & Bereiter, 1983) could be considered. The most obvious behavioral response on the part of socially anxious individuals is avoidance of interaction for fear of negative evaluation (Barnett et al., 2021; Clark & Wells, 1995; Hutchins et al., 2021). As a matter of fact, in our research, the avoidance of interaction dimension of social anxiety was found to be the most important predictor of active participation. Based on these findings, it could be recommended that institutions provide socially anxious students with anonymity options and more teacher support in ADFs to encourage interaction. Additionally, some precautions such as ice-breaking activities, warm-up discussions, and a high tolerance for diversity of ideas may be taken

in an attempt to alleviate social anxiety, and to reduce the avoidance of interaction to be exact, undergone in discussions.

Appendix 1

Sample academic discussion questions

1. What are the effects of restrictive precautions for internet access on its correct and effective use?
2. *Loneliness/Happiness/Inquisitiveness/Sadness/Joyfulness*
Do you think the above-mentioned moods have an effect on compulsive technology usage? Write your thoughts on this subject.
3. What are the positive and negative effects of the anonymization of communications in online social environments?
4. While some people are strictly against stealing hardware products, they may not be against stealing software products. What could be the underlying reasons for people's two-faced ethical stances between these two product types?

Funding This work was supported by Van Yuzuncu Yil University, Scientific Research Projects Coordination Unit [Grant numbers SYD-2021–9505], Van, Turkey.

Data availability The datasets generated during and/or analysed during the current study are available from the corresponding author on reasonable request.

Declarations

Conflict of interest The authors declare that they have no conflicts of interest.

Ethics statement Ethical approval for the study was obtained from the academic ethics commission of Van Yüzüncü Yıl University.

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