International Journal of Educational Technology in Higher Education

RESEARCH ARTICLE Open Access

Social anxiety in digital learning environments: an international perspective and call to action

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Abstract

The research focused on digital learning environments has identified various challenges for learners, such as technical problems, lack of community, motivation, self-regulation, self-efficacy, and social anxiety. Social anxiety is conceptualized as an emotional disorder that may impede achievement in higher education. The project reported here investigates $N = 666$ students' social anxiety in digital learning environments at four higher education institutions located in Australia, Germany, Latvia, and Turkey. This range of contexts allowed the research to cover a wide variety of cultural and institutional idiosyncrasies. Findings revealed different levels of social anxiety in higher education digital learning environments across countries and their cultural contexts. In addition, gender plays a significant role in social anxiety for peer interactions with female students reporting higher social anxiety than male students. The findings suggest that it is worth tertiary educators pausing to consider social anxiety's role in reducing interactions within digital learning environments. Additional research is required to establish the causes of social anxiety in digital learning environments and, as a result, to develop strategies to minimise its effect.

Keywords: Social anxiety, Digital learning environment, Higher education, International comparison, Cultural context

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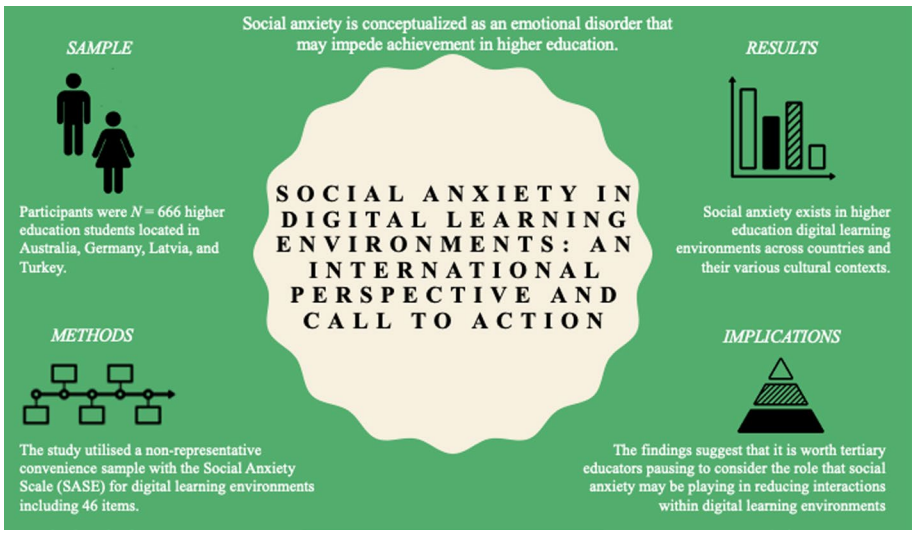
Graphical Abstract



Introduction

Economic imperatives in higher education have led to increased student–teacher ratios and this may result in a diminished quality of learning and teaching and less student retention, particularly among disadvantaged students (OECD, 2021). Additionally, universities are prioritising internationalisation to become world-class institutions (Hauptman Komotar, 2019) and this comes with necessary structural and cultural adaptations for all involved stakeholders (Blasco et al., 2021).

In response to the prospects and challenges of increased student enrolments in higher education (Vieira do Nascimento et al., 2022), online learning environments have been widely adopted and, in this way, learners can interact with learning opportunities wherever they are and at any time. In these online learning environments, learners interact with learning materials and related assessments as well as with peers or tutors and instructors. Both the student's experience in the learning environment as well as their academic performance are dependent upon these interactions (Garrison & Cleveland-Innes, 2005). On the one hand, it is expected that learners interact with learning materials and assessments to process information and reflect on their understanding (Heil & Ifenthaler, 2023; Schumacher, 2020; van Loon et al., 2012), on the other hand, it may result in anxiety in students if they are unable to follow the material and/or do not understand where to search for information. Activity in these environments extends beyond interacting with content and includes interactions with both peers and instructors. These latter interactions are essential in the processing of information and serve to aid student understanding of the phenomenon under study (Ifenthaler & Pirnay-Dummer, 2011; Şahin et al., 2020). Furthermore, although social engagement is a critical predictor of student success and retention (Tinto, 2005; Tinto, 2017) students' thoughts around these interactions with peers and teaching staff may contribute to the worries that are at the heart of social anxiety. This is likely to make it more difficult to participate

with peers or to seek help from the tutor and thus navigate the environment effectively (Brook & Willoughby, 2015).

Research in digital learning environments has also identified various barriers for learners, such as technical problems (Monteiro & Morrison, 2014), lack of community (Strayhorn, 2012), motivation (Zepke & Leach, 2010), self-regulation (Ifenthaler, 2012), self-efficacy (Panadero et al., 2017), or social anxiety (Armellini et al., 2021). Such barriers may limit the opportunities of digital learning environments for supporting learning (Hill et al., 2009; Muilenburg & Berge, 2005). The psychosocial barrier for learners, social anxiety, is likely to limit interactions with peers and tutors and this may impede achievement in higher education (Brook & Willoughby, 2015). There have been other research studies that support the contention that social anxiety is a factor that affects learning in both online and face-to-face learning environments (Grieve et al., 2017).

The research project currently under discussion utilised a standardised instrument, Social Anxiety Scale (Keskin et al., 2023), focussing on social anxiety in digital learning environments at four higher education institutions located in Australia, Germany, Latvia, and Turkey. A strength of this research method is that it allowed the researchers to examine social anxiety in a wide variety of cultural and institutional settings. With higher education institutions striving toward increased internationalisation, it may be important to reflect on the design of digital learning environments, the characteristics of students (e.g., culture, gender, age) within them, and the potential for pedagogical strategies to unintentionally cause social anxiety. As a result, a call to action for higher education institutions is provided based on the findings from this international and cross-cultural perspective.

Social anxiety

Jeffries and Ungar (2020) state that "social anxiety occurs when individuals fear social interactions in which they anticipate negative evaluations by others or perceive that their presence will make others feel uncomfortable" (p.1). Individuals that suffer from this condition will usually try to avoid these types of situations or else endure them while feeling great anxiety (American Psychiatric Association (2013). Anxiety, depression, and uncomfortable feelings are symptoms of social anxiety (Pierce, 2009) and the condition may be considered a disorder or phobia where symptoms are severe, frequent, recurring and persistent (Heimberg et al., 1999). In the digital world, people may feel social anxiety around their identity on social networking sites and this may distract them from being able to complete assigned tasks (Majid et al., 2020). It is. not a great stretch to extrapolate this beyond a work environment and to students and their studies where social anxiety is like to affect interactions in online learning (Agarwal & Karahanna, 2000). Although some researchers have found that individuals may feel more comfortable communicating online due to anonymity (Lee & Stapinski, 2012; Weidman et al., 2012), this anonymity is most often not present in digital learning environments where students are interacting with university staff or peers. These interactions may occur in both synchronous and asynchronous settings such as online forums, wikis, live online classes, presentations and so on.

Several variables have been identified by researchers as significantly related to social anxiety these are: Social norms, embarrassment, self-construal, gender roles, gender

role identification, and country of origin (Jefferies & Ungar, 2020; Zhong et al., 2007). For instance, an early meta-analysis highlights the systematic effects of anxiety in association with academic performance (Seipp, 2007). Russell et al. (2012) identified self-reported social anxiety among $N=787$ university students from the UK and suggest that for a significant minority of students, social anxiety is a persistent, hidden disability that impacts learning and well-being. In conclusion, they recommend that there is a need for enhanced pedagogic support for students with social anxiety. A more recent study by Demir et al. (2023) identified a significant impact of social anxiety among $N=272$ Turkish pre-service teacher students on active participation in asynchronous discussions, which, in turn, significantly affected academic achievement. Claes et al. (2023) examined the role of attentional control as a psychological factor involved in socioeconomic status-related social anxiety. The findings from a sample of $N=439$ French adults showed that low socioeconomic status individuals report higher social anxiety symptoms.

However, there is little research available concerning social anxiety in digital learning environments from an international perspective. Since digital learning environments are utilised globally by students from a variety of countries and cultural backgrounds (Loizzo & Ertmer, 2016) it is important to work toward closing this research gap.

Research questions and hypotheses

The aim of this international case study is a comparative investigation of students' self-reported social anxiety focussed on higher education digital learning environments in Australia, Germany, Latvia, and Turkey. Given previous research findings (Zhong et al., 2007), it is hypothesised that students' social anxiety in higher education digital learning environments differs based on their country of origin for learner-learner interactions (Hypothesis 1a) and learner-instructor interactions (Hypothesis 1b). Following previous findings (Weinstein et al., 2015), we assume that students' social anxiety in higher education digital learning environments differs across gender for learner-learner interactions (Hypothesis 2a) and learner-instructor interactions (Hypothesis 2b). To advance the previous perspectives on social anxiety in higher education (Weinstein et al., 2015; Zhong et al., 2007), we assume that students' social anxiety in higher education digital learning environments differs among combined constructs of the country of origin and gender for learner-learner interactions (Hypothesis 3a) and learner-instructor interactions (Hypothesis 3b).

Method

Research design

The study utilised a non-representative convenience sample with participants enrolled in higher education institutions from Australia, Germany, Latvia, and Turkey. The study was conducted by the co-authors of this paper using a self-report online survey to collect data from students at their respective higher education institutions. Although the institutions were quite different, as described in the following paragraphs, this diversity provided strength to the project in terms of investigating the hypotheses.

Background information: participating institutions and digital learning environments

The Australian higher education institution is a large university with courses in traditional, blended, and fully online modes. The School of Education in which the data for this project was collected is one of the largest such schools in Australia with students studying across all three of these modes. The university has approximately 38,000 enrolled students associated with the campus at which the data was collected with around 8000 students in the Faculty of Humanities within which the School of Education sits. Classes typically contain approximately 30 students and units run for 14 weeks.

The German higher education institution is regarded as a traditional campus university with approximately 12,000 enrolled students. The blended-learning course offerings in the form of lectures (i.e., 200 + students) and seminars (i.e., max. 30 students) span over the course of a 16-week semester.

The Latvian higher education institution is the largest higher education institution in Latvia with more than 15,000 enrolled students. The Faculty of Education, Psychology and Art in which the data was collected is the largest structural entity where educators and psychologists are studying, and some programs are provided for art and sports education. The blended learning courses were not a typical form of studying before COVID-19 but now almost all the lectures are organized remotely, and seminars and practicums are organized in face-to-face mode.

The Turkish higher education institution is regarded as a traditional campus university with approximately 58,000 enrolled students. The blended-learning course offerings in the form of lectures and seminars span over the course of a 14-week semester.

All participating institutions utilised a comparable digital learning environment that integrated interactive learning opportunities and facilitated customised online instructional materials. The individual learning designs of courses in which the participants of this study were involved included identical features within the digital learning environment, such as course materials (literature, slides, case reports), self-assessments, glossaries, and discussion forums.

Participants

Participants included N = 666 (76% female and 24% male) undergraduate and graduate students from Australia ($N_{Aus} = 172$), Germany ($N_{Ger} = 140$), Latvia ($N_{Lat} = 199$), and Turkey ($N_{Tur} = 155$) (see Table 1). The student cohorts were studying in the broader

Table 1 Participants included in the international survey study (N = 666)

Country	Gender	*N*	%
Australia (AUS)	Female	102	15
	Male	70	10
Germany (GER)	Female	92	14
	Male	48	7
Latvia (LAT)	Female	183	27
	Male	16	2
Turkey (TUR)	Female	128	19
	Male	27	4
Total		666	100

context of education. The Australian participants were enrolled in child development and creative technologies, the German participants studied in the area of economic and business education, the participants from Latvia were enrolled in education and psychology, and the Turkish participants were in general education. The average age of participants was 24.55 years ($SD = 7.72$). Ethics approval for this study was achieved by the Ethical Review Committees of the involved higher education institutions.

Instruments

The Social Anxiety Scale (SASE) for the digital learning environments (Keskin et al., 2023) consists of two sub-scales and 46 items. The first sub-scale focuses on Learner-Learner interactions (23 items) and the second sub-scale focuses on Learner-Instructor interactions (23 items). Each sub-scale consists of three dimensions such as negative evaluation (9 items), somatic symptoms (4 items), and avoidance of interaction (10 items). The SASE uses a seven-point Likert scale (1 = strongly disagree to 7 = strongly agree).

Items from the original version of SASE were translated to the respective language of the participating institutions and back-translated for validation of the items' meaning. Each translation and validation procedure followed an identical protocol and involved bilingual language experts as well as experts in the field of research in each participating institution. While the procedure adds a labour-intensive involvement of various stakeholders, it can better assertation the validity and original meaning of the original version of SASE.

Cronbach's Alpha reliability coefficient for the two sub-scales was calculated as $\alpha = 0.96$ for Learner-Learner and $\alpha = 0.97$ for Learner-Instructor. Sample items of SASE are shown in Table 2. Further data collected included students' demographic information such as age, gender, and study course.

Procedure and data analysis

A data collection protocol was developed for the four participating international higher education institutions to guarantee a comparable data collection procedure. The survey was implemented and disseminated using Qualtrics (https://www.qualtrics.com/).

Table 2 Example items of the Social Anxiety Scale (SASE)

Sub-scale Dimension	Example item
Learner–learner Negative evaluation	In e-learning, I am afraid that my writing will be misunderstood on discussion pages
Learner–learner Somatic symptoms	In e-learning, I blush while communicating on discussion pages
Learner–learner Avoidance of interaction	I do not want to interact in writing on discussion pages
Learner–instructor Negative evaluation	In e-learning, blundering worries me when communicating with the instructor
Learner–instructor Somatic symptoms	In e-learning, I am sweating when communicating with the instructor
Learner–instructor Avoidance of interaction	In e-learning, I prefer not to communicate when I need to communicate with the instructor

Each participating institution used its instance of the local language-based survey, however, following the identical structure of survey sections and items. The survey platform included a cover letter outlining the scope of the research and information about data privacy and ethics. After agreeing to participate in the data collection, participants were asked to complete the SASE items. The instructions regarding the SASE asked the participants to relate their responses to their experience in their study programme and related courses in which digital learning environments are regularly utilised. Finally, participants stated demographic information such as age (number in years), gender (male, female, non-binary), and study course. Data collection took approximately 30 min.

As a standard research data-protection practice, all data were stored and analysed using an anonymized procedure. Data were cleaned and combined for descriptive and inferential statistics using SPSS version 27. All effects were tested at the 0.05 significance level and effect size measures were computed where relevant. The participating countries were coded as follows: Australia (AUS), Germany (GER), Latvia (LAT), and Turkey (TUR).

To examine hypotheses one and three, one-way ANOVA was computed. For hypothesis two, an independent sample t-test was used. For hypothesis three, new variables were created by combining gender and country, i.e., Australian-Female (AUS-F), Australian-Male (AUS-M), German-Female (GER-F), German-Male (GER-M), Latvian-Female (LAT-F), Latvian-Male (LAT-M), Turkish-Female (TUR-F), and Turkish-Male (TUR-M). Normal distribution and homogeneity of variances were examined for one-way ANOVA and normal distribution for independent sample t-test as assumptions then analyses were conducted.

Results

Differences in social anxiety based on the origin of students (hypothesis 1)

Concerning hypothesis 1, ANOVA revealed significant differences in students' social anxiety for the learner–learner interaction (H1a), $F(3,664) = 12.53$, $p < 0.05$, $\eta^2 = 0.054$, and for the learner–instructor interaction (H1b), $F(3,664) = 35.65$, $p < 0.05$, $\eta^2 = 0.138$ (see Table 3 for descriptive statistics).

Tukey-HSD test was conducted to determine the source of the differences. Significant differences in social anxiety for Learner-Learner interaction were found between AUS ($M = 77.96$; $SD = 19.30$) and GER ($M = 69.89$; $SD = 22.56$), $p < 0.05$; AUS ($M = 77.96$; $SD = 19.30$) and LAT ($M = 62.31$; $SD = 22.80$), $p < 0.05$; TUR ($M = 76.56$; $SD = 39.38$) and LAT ($M = 62.31$; $SD = 22.80$), $p < 0.05$. In addition, significant difference for Learner-Instructor interactions were found between TUR ($M = 84.22$; $SD = 36.31$) and AUS ($M = 71.48$; $SD = 23.25$), $p < 0.05$; TUR ($M = 84.22$; $SD = 36.31$) and GER ($M = 67.43$; $SD = 24.38$), $p < 0.05$; TUR ($M = 84.22$; $SD = 36.31$) and LAT ($M = 54.94$; $SD = 23.53$), $p < 0.05$; AUS ($M = 71.48$; $SD = 23.25$) and LAT ($M = 54.94$; $SD = 23.53$), $p < 0.05$; GER ($M = 67.43$; $SD = 24.38$) and LAT ($M = 54.94$; $SD = 23.53$), $p < 0.05$.

Accordingly, the findings suggest that students significantly differ in their social anxiety when interacting with peers as well as with instructors in higher education digital learning environments.

Table 3 Means and standard deviations of students' social anxiety separated by SASE sub-scale and country

Sub-scale and country	*M*	*SD*
Learner–learner interaction		
Australia (AUS)	67.43	24.38
Germany (GER)	69.89	22.56
Latvia (LAT)	62.31	22.80
Turkey (TUR)	76.56	39.38
Learner–learner interaction/negative evaluation		
Australia (AUS)	31.35	7.76
Germany (GER)	27.80	9.64
Latvia (LAT)	24.69	10.03
Turkey (TUR)	32.16	16.08
Learner–learner interaction/somatic symptoms		
Australia (AUS)	10.97	4.33
Germany (GER)	10.29	4.92
Latvia (LAT)	9.50	4.53
Turkey (TUR)	11.77	7.57
Learner–learner interaction/avoidance of interaction		
Australia (AUS)	35.64	9.52
Germany (GER)	31.79	10.82
Latvia (LAT)	27.98	11.75
Turkey (TUR)	32.63	18.18
Learner–instructor interaction		
Australia (AUS)	71.48	23.25
Germany (GER)	67.43	24.38
Latvia (LAT)	54.94	23.53
Turkey (TUR)	84.22	36.31
Learner–instructor interaction/negative evaluation		
Australia (AUS)	29.89	9.46
Germany (GER)	26.73	9.79
Latvia (LAT)	23.95	10.70
Turkey (TUR)	36.90	14.58
Learner–instructor interaction/somatic symptoms		
Australia (AUS)	31.17	10.91
Germany (GER)	30.06	11.67
Latvia (LAT)	22.27	10.49
Turkey (TUR)	33.09	17.55
Learner–instructor interaction/avoidance of interaction		
Australia (AUS)	10.43	4.51
Germany (GER)	10.64	4.93
Latvia (LAT)	8.47	4.51
Turkey (TUR)	14.23	7.61

In addition, not only the main dimensions but also the differences according to the sub-dimensions were examined. ANOVA revealed significant differences in students' social anxiety for the Learner-Learner negative evaluation, $F(3,664) = 16.64$, $p < 0.05$, $\eta^2 = 0.069$, Learner-Learner somatic symptoms, $F(3,664) = 5.50$, $p < 0.05$, $\eta^2 = 0.024$,

Learner-Learner avoidance of interaction, $F(3,664) = 10.02$, $p < 0.05$, $\eta^2 = 0.043$, Learner-Instructor negative evaluation, $F(3,664) = 42.37$, $p < 0.05$, $\eta^2 = 0.160$, Learner-Instructor somatic symptoms, $F(3,664) = 33.18$, $p < 0.05$, $\eta^2 = 0.130$, and Learner-Instructor avoidance of interaction, $F(3,664) = 24.39$, $p < 0.05$, $\eta^2 = 0.099$ (see Table 3 for descriptive statistics).

Tukey-HSD test was conducted to determine the source of the differences. Significant differences in social anxiety for Learner-Learner and Learner-Instructor in all sub-dimensions.

- Learner-Learner Negative evaluation: AUS ($M = 31.35$; $SD = 7.76$) and TUR ($M = 32.16$; $SD = 16.08$) > GER ($M = 27.80$; $SD = 9.64$) and LAT ($M = 24.69$; $SD = 10.03$), $p < 0.05$.
- Learner-Learner Somatic symptoms: TUR ($M = 11.77$; $SD = 7.57$) > LAT ($M = 9.50$; $SD = 4.53$), $p < 0.05$.
- Learner-Learner Avoidance of interaction: AUS ($M = 35.64$; $SD = 9.52$) > GER ($M = 31.79$; $SD = 10.82$) and LAT ($M = 27.98$; $SD = 11.75$), $p = 0.05$; TUR ($M = 32.63$; $SD = 18.18$) > LAT ($M = 27.98$; $SD = 11.75$), $p < 0.05$.
- Learner-Instructor Negative evaluation: TUR ($M = 36.90$; $SD = 14.58$) > and AUS ($M = 29.89$; $SD = 9.46$), GER ($M = 26.73$; $SD = 9.79$) and LAT ($M = 23.95$; $SD = 10.70$); AUS ($M = 29.89$; $SD = 9.46$) and LAT ($M = 23.95$; $SD = 10.70$), $p < 0.05$.
- Learner-Instructor Somatic symptoms: TUR ($M = 14.23$; $SD = 7.61$) > GER ($M = 10.64$; $SD = 4.93$), AUS ($M = 10.43$; $SD = 4.51$) and LAT ($M = 8.47$; $SD = 4.51$); GER ($M = 10.64$; $SD = 4.93$) and AUS ($M = 10.43$; $SD = 4.51$) and LAT ($M = 8.47$; $SD = 4.51$), $p < 0.05$.
- Learner-Learner Avoidance of interaction: TUR ($M = 33.09$; $SD = 17.55$), AUS ($M = 31.17$; $SD = 10.91$) and GER ($M = 30.06$; $SD = 11.67$) and LAT ($M = 22.27$; $SD = 10.49$), $p < 0.05$.

A posteriori analysis focussed on differences between Learner-Learner and Learner-Instructor social anxiety within the respective countries. Independent sample t-test revealed significant differences in Latvian students for Learner-Learner ($M = 62.31$; $SD = 22.80$) and Learner-Instructor ($M = 54.94$; $SD = 23.53$) social anxiety, $t(396) = 3.17$, $p < 0.05$, $d = 0.318$. No significant differences were found for students from Australia, Germany, and Turkey. Accordingly, the social anxiety of Latvian students is higher concerning their peers than about instructors.

Gender differences in social anxiety (hypothesis 2)

Concerning hypothesis 2, independent-sample t-tests were conducted. Regarding hypothesis 2a, there was a significant difference in social anxiety for Learner-Learner interaction between female students ($M_F = 72.62$; $SD_F = 27.76$) and male students ($M_M = 66.70$; $SD_M = 28.80$), $t(664) = 2.34$, $p < 0.05$, $d = 0.008$. Regarding hypothesis 2b, no significant difference in social anxiety for Learner-Instructor interaction between female students ($M_F = 69.34$; $SD_F = 29.65$) and male students ($M_M = 67.52$;

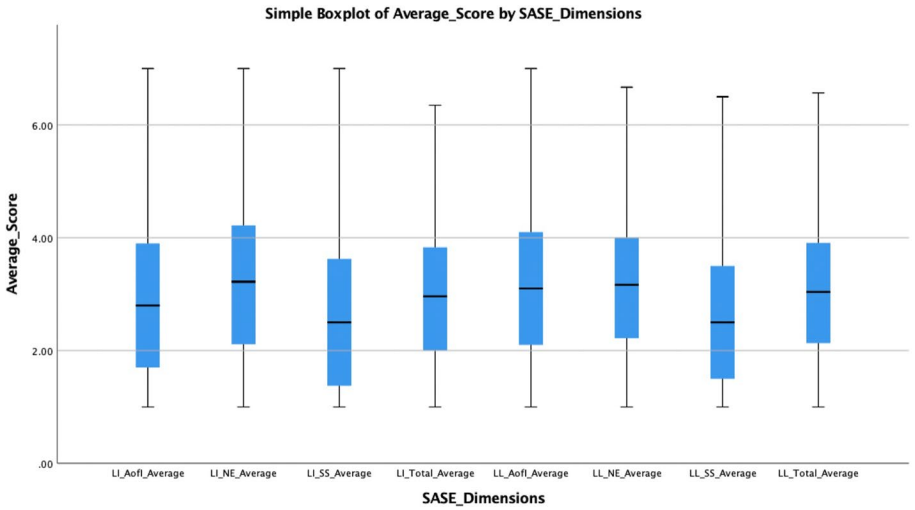


Fig. 1 Average score of the dimensions of the SASE scale

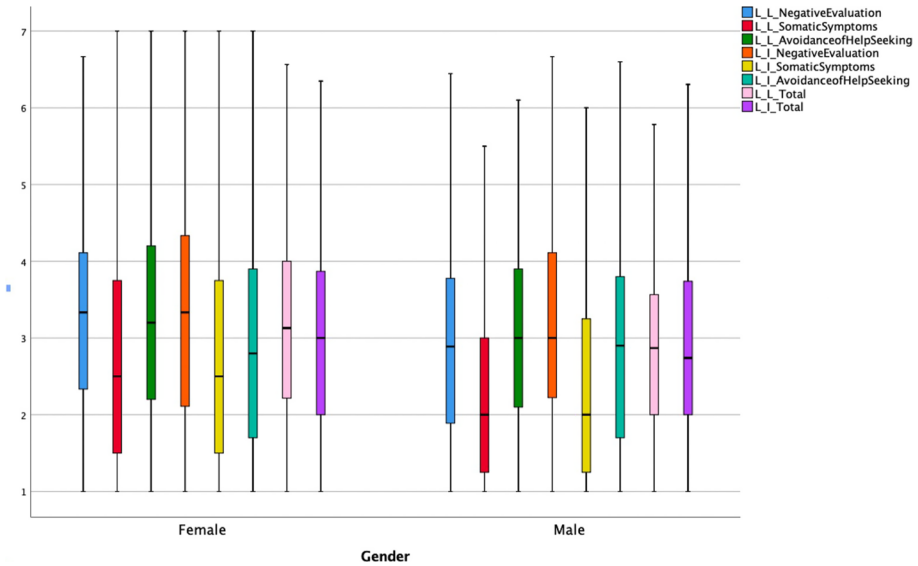


Fig. 2 Average score of sub-dimensions separated by gender of the SASE scale

$SD_M = 29.48$) was found, $t(664) = 0.68$, $p = 0.49$. Figures 1 and 2 illustrate average ratings of the SASE dimensions as well as sub-scales for female and male students.

In addition, not only the main dimensions but also the differences according to the sub-dimensions were examined (see Table 4). Independent sample t-test revealed significant differences in students' social anxiety for the learner–learner negative evaluation, $t(664) = 2.64$, $p < 0.05$, $d = 0.234$, learner–learner somatic symptoms, $t(664) = 2.46$, $p < 0.05$, $d = 0.222$, and learner–instructor somatic symptoms, $t(664) = 2.09$, $p < 0.05$, $d = 0.191$.

Table 4 Means and standard deviations of students' social anxiety separated by SASE sub-scale and gender

Sub-scale and gender	*M*	*SD*
Learner–learner interaction		
Female	72.62	27.76
Male	66.70	28.80
Learner–learner interaction/negative evaluation		
Female	29.50	11.55
Male	26.70	12.39
Learner–learner interaction/somatic symptoms		
Female	10.89	5.55
Male	9.66	5.55
Learner–learner interaction/avoidance of interaction		
Female	32.22	13.46
Male	30.34	13.15
Learner–instructor interaction		
Female	69.34	29.65
Male	67.52	29.49
Learner–instructor interaction/negative evaluation		
Female	29.43	12.41
Male	28.73	12.50
Learner–instructor interaction/somatic symptoms		
Female	11.14	6.04
Male	10.01	5.79
Learner–instructor interaction/avoidance of interaction		
Female	28.77	13.75
Male	28.78	13.51

A posteriori analysis focussed on differences between learner–learner and learner–instructor social anxiety for female and male students. Independent t-tests did not reveal any significant differences for the posterior analysis.

Accordingly, the findings suggest that female students have higher social anxiety when interacting with peers in higher education digital learning environments.

Country and gender differences in social anxiety (hypothesis 3)

One-way ANOVA revealed significant differences in social anxiety for Learner–learner interaction, $F(7, 659) = 7.845$, $p < 0.001$, $\eta^2 = 0.077$, and Learner-Instructor interaction, $F(7, 659) = 18.743$, $p < 0.001$, $\eta^2 = 0.164$ (see Table 5 for descriptive statistics). Tukey-HSD test showed significant differences in Learner–learner social anxiety between TUR-F ($M = 90.79$; $SD = 39.67$), AUS-F ($M = 79.66$; $SD = 19.10$), LAT-F ($M = 62.68$; $SD = 23.29$), and LAT-M ($M = 56.44$; $SD = 16.81$), $p < 0.05$. TUR-F and AUS-F students reported higher levels learner–learner social anxiety than LAT-F and LAT-M students. In addition, significant differences in learner–instructor social anxiety were found between TUR-F ($M = 90.79$; $SD = 35.66$), TUR-M ($M = 74.64$; $SD = 35.35$), LAT-F ($M = 54.75$; $SD = 23.90$), LAT-M ($M = 53.94$; $SD = 18.87$), and between TUR-M ($M = 74.64$; $SD = 35.35$), AUS-F ($M = 73.14$; $SD = 23.26$), as well as LAT-F ($M = 54.75$; $SD = 23.90$), LAT-M ($M = 53.94$; $SD = 18.87$), $p < 0.05$. TUR-F and

Table 5 Means and standard deviations of students' social anxiety separated by SASE sub-scale, country, and gender

Sub-scale and country	Gender	*M*	*SD*
Learner–learner			
Australia (AUS)	Female	76.66	19.10
	Male	69.93	18.51
Germany (GER)	Female	71.85	23.51
	Male	66.13	20.32
Latvia (LAT)	Female	62.68	23.29
	Male	56.44	16.81
Turkey (TUR)	Female	82.31	39.67
	Male	68.19	37.69
Learner–instructor			
Australia (AUS)	Female	73.14	23.26
	Male	63.63	21.95
Germany (GER)	Female	69.29	24.41
	Male	63.85	24.17
Latvia (LAT)	Female	54.75	23.90
	Male	53.94	18.87
Turkey (TUR)	Female	90.79	35.66
	Male	74.64	35.35

TUR-M students reported higher level learner–instructor social anxiety than LAT-F and LAT-M students. In addition, TUR-M and AUS-F students reported higher levels Learner-Instructor social anxiety than LAT-F and LAT-M students.

Accordingly, the findings suggest that students' social anxiety level in digital learning environments differs according to their country of origin and their gender.

Discussion

Research has shown that digitally-supported learning increases the accessibility of tertiary education due to its capacity to overcome the spatial and temporal limitations of traditional teaching settings (Bates, 2005; Braun, 2008). Open access to higher education (Greenland & Moore, 2014) and different modes of distance learning (Bailey et al., 2015, 2018; Cohen, 2003) have thus become critical long-term strategies for international universities to encourage higher education participation (Allen & Seaman, 2006; Ziguras & McBurnie, 2011).

The findings of this international survey study indicate different levels of social anxiety in higher education digital learning environments across countries and their cultural context. More specifically, the country's (cultural) context appears to be a significant driver of social anxiety within the peer (student-to-student) interaction and student-to-instructor interaction (Zhong et al., 2007). As a reference to previous findings administering an identical instrument focussing on social anxiety levels among Turkish teacher education students, the lowest sub-scale in social anxiety has been somatic symptoms which corresponds with the findings of our present study (Demir et al., 2023).

The findings around social anxiety and culture are not surprising and confirm the seminal work of Hofstede (1986) who believed that teacher/student interaction is deeply

rooted in a society's culture and although it was considered a cross-cultural situation it is not unreasonable to assert that interactions within one culture would be different to those within another and this is what we perceive regarding social anxiety within this data as seen in Table 5. What is not very clear is what the cultural factors are that lead to these differences in social anxiety levels. This may be best determined through qualitative research with more explanatory power.

In terms of peer interactions and social anxiety, Cohen et al. (2019) investigated active learning instructional techniques and demonstrated that social anxiety is experienced by many tertiary students and that this is particularly associated with active learning environments in which peer-to-peer interactions occur. In online learning environments, this type of active learning is often encouraged via both synchronous and asynchronous peer interactions most often within an LMS (Learning Management System). Thus, this data supports Cohen's work, as seen in Table 5. However, again further research is needed to determine why the levels of social anxiety in peer-to-peer interactions should vary across cultures.

In addition, gender plays a significant role in social anxiety during peer interactions. On a descriptive level, female students reported higher social anxiety than male students. These findings are in line with previous research indicating that females reported higher levels of social anxiety than male students, for instance, general avoidance of social interaction as well as more physiological symptoms (Asher & Aderka, 2018; Pickering et al., 2020; Stănculescu & Griffiths, 2022; Storch & Masia-Warner, 2004). Higher level of anxiety of female students could be caused by gender stereotypes and gender discrimination which they have faced during compulsory education as it was concluded in the research by Gunderson et al. (2012) as well as Leaper and Brown (2008), concluding that the majority of girls have to face gender discrimination in one of its forms as early as their teenage years and, while this is most often from their peers, it is often also from adults with whom the children are together with daily—teachers, school staff, and even parents. This experience can be the reason why female students feel anxiety as they are afraid of mistakes which can be seen in an online learning environment where students are not anonymous. In response to the overarching phenomena of social anxiety of female students, supporting positive social relationships and welcoming peer interactions could help to overcome such barriers which may pre-exist before students enter higher education (Pickering et al., 2020). The current study's findings in this regard are likely reflecting this general difference between gender as related to social anxiety. Table 5 illustrates that for all countries and across both sub-scales that female students experience the highest average level of social anxiety.

In summary, the findings of this international case study are unique concerning the investigated empirical basis. The findings confirm previous research that social anxiety exists within digital learning environments in higher education and well-designed interventions are required to overcome the barriers of social anxiety which may also impact the academic achievement of higher education students (Brook & Willoughby, 2015).

Implications

As higher education institutions move toward more online delivery, our findings suggest that a pause to consider the impact that social anxiety may be having on students is

appropriate. Students participating in digital education are not anonymous to university staff or other students in the unit being studied (Giacumo & Savenye, 2020). This means that interactions within common elements of online courses such as discussion boards, or other online tools through which students contribute responses visible to university staff and/or peers, may be producing social anxiety at a level that impedes participation and hence lowers the educational effectiveness of these tools.

Accordingly, higher education educators often lament the lack of interaction in digital learning environments and an often overlooked factor in this may well be social anxiety levels (Beuchota & Bullen, 2005). In recent research on social anxiety in higher education it was found that social anxiety was negatively related to communication with instructors, socio-emotional functioning, and student experiences, and academic communication accounted for significant variance in the links between social anxiety and student experiences (Archbell & Coplan, 2022). Therefore, intervention programmes are required to support the development of social interaction competencies (Pickering et al., 2020). Such interventions may include strategies to manage and resolve negative social experiences. Further, interventions shall promote safe and trusted social interactions among peers as well as teaching staff.

In addition, professional learning opportunities for teaching staff may include measures for identifying socially anxious students and strategies for helping these students accordingly. For instance, teaching staff may implement safe digital learning environments, highlighting learning experiences rather than focusing on comparing performance among the study group (Pörhölä et al., 2019). Such social-emotional guidance may be introduced in special offerings throughout the course of study and at different levels of the student lifecycle. The establishment of such professional learning offerings may also call for multi-professional exchange and dialogue between students, teaching staff, and counselling professionals for promoting well-being at higher education institutions.

The question of how to better design online learning to encourage maximum participation while minimizing anxiety requires further investigation. If nothing else, as individual educators, it is important to reflect on the online courses being taught, the characteristics (e.g., culture, gender, age) of students within them, and the potential for our pedagogical strategies to cause social anxiety unintentionally.

Limitations and research outlook

This international case study is not without limitations. These findings may not apply to the general population of higher education students as they were based on convenience sampling. Further, the self-report data may be biased as individuals tend to have different answers when they report their own experiences. Further, data was collected during the first cycles of the COVID-19 pandemic when the unfamiliar situation could cause some amount of social anxiety. While the SASE instrument has been previously tested for reliability and validity (Keskin et al., 2023), further outside criterion and mixed-methods designs may provide further robust empirical insights into students' social anxiety in digital learning environments. Therefore, our current research expands to samples from additional countries and adds a qualitative investigation focussing on students and

teaching staff concerning their perceptions of social anxiety and what pedagogical practices they are familiar with.

It is further suggested that longitudinal research designs may investigate possible state vs. trait social anxiety in digital learning environments (Rachman, 2013). Such designs could include different social learning situations utilising various digital tools, such as forum activities, video and voice chats, synchronous presentations, or exams. Tracing the possible development of social anxiety over time and investigating the effectiveness of interventions would further contribute to practical implications in higher education. Future research designs may also control for prior academic performance of students, and their individual characteristics (e.g., achievement motivation, study interest), and compare different areas of study about social anxiety. Another focus of future studies may include intervention designs and their impact on students' social anxiety as well as on the awareness and pedagogical behaviour of university staff. A benchmarking for measures of social anxiety may be developed in future research. Such benchmarks may function as pointers for implementing interventions related to social anxiety.

This study was concerned with identifying levels of social anxiety in online learning environments. People with various traits such as shyness or perhaps an anxiety disorder may suffer from social anxiety as an ongoing issue in their lives independent of the learning environment. That is, the root cause of the anxiety may not be the learning environment itself. This study did not attempt to identify students with these kinds of conditions. However, designing online learning environments to minimise social anxiety will likely benefit all students regardless of any pre-existing conditions.

Conclusion

Looking ahead, higher education institutions may further embrace and utilise the well-documented advances of learning analytics, such as the personalisation of learning and interaction opportunities as well as an adaptation toward individual dispositions of students to ameliorate the challenges related to social anxiety in digital learning environments.

Acknowledgements
Open Access funding enabled and organized by Projekt DEAL—bundesweite Lizenzierung von Angeboten großer Wissenschaftsverlage (https://www.projekt-deal.de).

Author contributions
All authors participated in planning the study, designing the data collection tools, collecting and analyzing data for the study. The first author (corresponding author) led the writing up process, with contributions from the second, third and fourth authors. All authors read and approved the final manuscript.

Funding
Not applicable.

Availability of data and materials
The data supporting this study's findings are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

Declarations

Ethics approval and consent to participate
All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent
Informed consent was obtained by the participating institutions.

Competing interests
The authors declare no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper. The authors declare no competing interest.

Received: 8 April 2023 Accepted: 28 July 2023
Published online: 28 August 2023

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Publisher's Note
Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

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