
2023

Online learning during the COVID-19 pandemic: Does social connectedness and learning community predict self-determined needs and course satisfaction?

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Recommended Citation

Geary, E., Allen, K., Gamble, N., & Pahlevansharif, S. (2023). Online learning during the COVID-19 pandemic: Does social connectedness and learning community predict self-determined needs and course satisfaction?. *Journal of University Teaching & Learning Practice*, 20(1). <https://ro.uow.edu.au/jutlp/vol20/iss1/13>

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Abstract

The present study investigated whether online students' sense of community and self-determined need satisfaction predicted online course satisfaction during the COVID-19 pandemic. The sample consisted of 136 Australian university students who were studying online during the COVID-19 pandemic. Students completed online surveys for sense of community (i.e., social connectedness and learning community), self-determined need satisfaction (i.e., relatedness, competence, and autonomy), and online course satisfaction. The study results indicated that learning community and social connectedness significantly predicted the self-determined needs and online course satisfaction, with learning community having a large effect size. Autonomy partially mediated the relationship between social connectedness and online course satisfaction; autonomy was the only self-determined need to predict online course satisfaction. It was concluded that online university students require learning communities and social connectedness to meet their needs and have a satisfying learning experience. The self-determined need of autonomy was the most important for student's satisfaction with their course. These findings have implications for universities to build a sense of community in their courses to support students' needs and improve online course satisfaction.

Practitioner Notes

1. The COVID-19 pandemic changed the experience of university students in 2020.
2. Learning community and social connectedness significantly predicted relatedness, competence, and autonomy in the tertiary students sampled.
3. Need satisfaction of autonomy, competence, and relatedness significantly predicted online learning satisfaction
4. Autonomy mediated the relationship between social connectedness and online learning satisfaction, and learning community and online course satisfaction
5. During the COVID-19 pandemic, university students were more satisfied with their online courses when they were engaged in a learning community, socially connected to their peers and instructor, and felt their autonomy self-determined need was met.

Keywords

social connectedness; relatedness; competency; autonomy; online learning; higher education

Introduction

During the COVID-19 pandemic, face-to-face university students in Australia had to study online to prevent the community transmission of COVID-19 (Tertiary Education Quality Standards Agency [TEQSA], 2020). Online courses can provide students with more independence, freedom, and flexibility; however, prior to the COVID-19 pandemic, online courses' retention has been lower than face-to-face courses (Muljana & Luo, 2019). University students have reported a decreased sense of community (Wighting et al., 2008), satisfaction of needs (Mullen & Tallent-Runnels, 2006; Wang et al., 2019), and satisfaction with their online course (Filak & Nicolini, 2018) compared to face-to-face students.

Working within the Self-Determination Theory (SDT) framework, research has established the importance of community and meeting students' needs in face-to-face learning contexts (Brophy, 2004; Beachboard et al., 2011; Jang et al., 2009; Ryan & Deci, 2000; Sakiz et al., 2012; Sher, 2009; Tian et al., 2016; Zhao et al., 2012). However, only a few studies have explored these relationships in online settings (Chen & Jang, 2010; Hsu et al., 2019; Wang et al., 2019). Exploring students' needs and sense of community when learning online is particularly crucial during periods when students cannot attend campus due to unexpected events, such as the COVID-19 pandemic. Physical distancing measures and campus-wide lockdowns made students feel isolated, overwhelmed, and vulnerable (Clinton, 2020; Crawford, 2020). Psychological needs and a sense of community should be explored further so that online learning communities, particularly in times of uncertainty, can provide protective and satisfying student experiences.

The purpose of the current study is to investigate how sense of community and self-determined need satisfaction predict online course satisfaction for students who studied online during the COVID-19 pandemic. A deeper understanding of how these variables interact may indicate areas of improvement for universities and instructors (Peters et al., 2020) to improve student satisfaction for online courses. While this is directly relevant to university students during the COVID-19 pandemic who did not choose to study online, it may also have implications for students choosing to learn online as universities resume with face-to-face and online teaching options. It is important to gain an understanding of student experiences during COVID-19, to appreciate the strengths and weakness for future online learning environments.

Literature

The COVID-19 pandemic changed the experience of university students in 2020. In Australia, restrictions were put in place by the federal and state governments to prevent community transmission and to minimise the impact of COVID-19. Consequently, many Australian university students completed their studies online for part or all of the year, with lectures, tutorials, and meetings moved to an online platform (TEQSA, 2020). This change caused significant disruption and uncertainty for university students in Australia and worldwide (Neuwirth et al., 2021; Peters et al., 2020). Adjusting to online course delivery while also dealing with the impacts of the COVID-19 pandemic was challenging for students and staff (Brammer & Clark, 2020; Peters et al., 2020). However, this situation has provided universities and researchers an opportunity to consider possibilities for future university course delivery through new "digital, online and pedagogical possibilities" (Peters et al., 2020, p.17). Research is necessary to understand students' experiences of online learning and determine which variables affect their online course satisfaction given many students were not studying online by choice.

Prior to the COVID-19 pandemic, university online learning has been an attractive option for students; however, retention rates tended to be lower than face-to-face courses (Muljana & Luo, 2019). Research has indicated that students who study online report lower course satisfaction (Filak & Nicolini, 2018), motivation, engagement, and achievement (Chen & Jang, 2010; Mullen & Tallent-Runnels, 2006) than those who study face-to-face courses.

University instructors, students and faculties have experienced challenges with the swift transition to online learning during the COVID pandemic. University teachers have reported the biggest challenge to be staff readiness for online learning, which involves computer literacy skills and ability to incorporate technology into teaching practices (Almazova et al., 2020). Learning online can require different skills for success and satisfaction. Educators cannot assume that face-to-face learning techniques and materials will meet students' needs online (Almazova et al., 2020; Chen & Jang, 2010;). Furthermore, online learning during the COVID-19 pandemic is different from typical online learning (Hodges et al., 2020; Peters et al., 2020; Zimmerman, 2020). Traditionally, online learning was an intentionally planned activity with all parties aware of the online format from the outset. The transition to online learning during COVID-19 had minimal preparation time and, in many cases, limited access to resources and expertise to design and implement the online course (Hodges et al., 2020; Peters et al., 2020).

Challenges for university students cross culturally were researched by Cifuentes-Faura et al. (2021). They reported a decline in student wellbeing during the COVID-19 pandemic in students from Nigeria, Oman, Cambodia, and Spain. Students expended more energy on their studies compared to their pre-pandemic studies and reported inadequate social support and security protection from their instructor when needed (Cifuentes-Faura et al., 2021). Lyons et al. (2020) reported similar results for Australian university students who experienced moderate distress and a deterioration in mental wellbeing during the COVID-19 pandemic. Furthermore, student readiness for online learning was a challenge for staff, including motivation of students to study online and students failing to meet deadlines (Almazova et al., 2020)

It has been recommended that university faculties and students collaborate to address the challenges evident when learning online and build engagement and wellbeing outcomes, especially during times of crisis like the COVID-19 pandemic (Neuwirth et al., 2021). The current research uses the SDT framework to focus on the satisfaction of student needs and the social contexts that support them when learning online during the COVID-19 pandemic (Ryan & Deci, 2012, 2017; Tian et al., 2016). This focus is particularly important for educational institutions.

Deci and Ryan's (1985) SDT is a well-established and empirically supported theory (Ng et al., 2012; Slempe et al., 2018; Vansteenkiste et al., 2020; Vasquez et al., 2016) that describes the interaction between an individual's external factors and their inner resources, motives, and needs (Ryan & Deci, 2000). *Need satisfaction* is when needs are fulfilled through provisions from external environments and resources cultivated by an individual internally (Sheldon & Elliot, 1999). SDT proposes that fulfilment of an individual's fundamental psychological needs contributes to their optimum growth, integrity, and well-being (Deci & Ryan, 1985, 2000; Ryan & Deci, 2000).

According to the SDT, there are three self-determined psychological needs. *Relatedness* is when individuals feel connected, cared for, and understood by other people (Ng et al., 2012). *Competence* describes effectively implementing desired behaviours and utilising capacity (Ng et al., 2012; Niemiec & Ryan, 2009). The third self-determined need is *autonomy*, which is behaving

and experiencing life consistently with an integrated sense of self (Deci & Ryan, 2012; Ryan & Deci, 2000). The SDT assumes that humans are active organisms with natural tendencies to grow through need satisfaction (Deci & Ryan, 1985, 2000; Ryan & Deci, 2000). Understanding the impacts of the social environment on an individual's behaviour can help to inform and build social contexts that optimise the growth and wellbeing of individuals (Ryan & Deci, 2000; Ryan & Deci, 2017; Vansteenkisi et al., 2010). There is extensive SDT research that reports positive relationships between social contexts, need satisfaction, and student outcomes (Garn et al., 2018; Jang et al., 2012; Tian et al., 2016; Yu & Levesque-Bristol, 2020; Zhou et al., 2019). The relationships between these variables have led to the development of an empirically tested General SDT Model (Deci et al., 2017; Yu et al., 2018), which includes need supportive social contexts as the independent variable; need satisfaction and motivation as the mediators; and wellbeing or behavioural outcomes as the dependent variables.

Rovai (2002b) posited that in educational environments, feeling a sense of community has two main elements: social connectedness and learning community. *Social connectedness* refers to whether community members feel they have trusting relationships and that others care for them. *Learning community* focuses on learning goals and behaviours shared and supported within the community (Rovai, 2002a; Wu & Gao, 2020). Social connectedness and learning communities have been reported to be significantly different between online and face-to-face learners (Wighting et al., 2008) and have also been implicated in retaining online students in their courses (Muljana & Luo, 2019). Further research in this area is needed to provide insight into factors that improve student experience and retain students in online courses of study.

Social connectedness can be challenging for online courses, as they involve more independent learning and less direct contact with an instructor than face-to-face learning (Solbrekke & Helstad, 2016). Students may be more likely to assume a partially anonymous identity and interact with others more superficially (Dietlin et al., 2019). This anonymity can limit the quality of relationships with other students and teachers, which can impact students' sense of community (Gunawardena, 2015). Often online learners are dependent on instructors to create opportunities for social engagement and spaces to feel connected and supported (Harris et al., 2011; Wu & Gao, 2020).

Learning online presents challenges for building learning communities. In a systematic literature review, Muljana and Luo (2019) identified learning community factors that impacted retention rates for online learning compared to face-to-face learning, such as clear communication, high quality instructional feedback, and high support to facilitate learning. Furthermore, Dow (2008) reported that instructor and other students' social presence in the online classroom were influential for course satisfaction, but not as crucial as a well-structured course with instructor feedback and clear expectations. These findings were similar to Dennen et al. (2007), who reported that student satisfaction was related to timely feedback, clear expectations, and personalised communication from the instructor. There are all factors that contribute to learning community.

Only a few studies have investigated the satisfaction of psychological needs and online course satisfaction (Chen et al., 2010; Filak & Nicolini, 2018). Chen et al. (2010) reported that affiliation, which was measured using a sense of community measure (South, 2006), was the strongest predictor of course satisfaction amongst online students. Autonomy and ability were also significant predictors of course satisfaction. (Chen et al., 2010). It must be noted that this study measured autonomy and ability without using specific SDT need satisfaction measures. Similarly, Filak and Nicolini's (2018) research found that in both face-to-face and online learning

environments, the satisfaction of autonomy, competence, and relatedness all independently predicted the course's positive evaluations. For online and face-to-face learning, competence was the strongest predictor.

The General SDT Model (Deci et al., 2017; Yu et al., 2018) has been utilised in online learning settings to examine relationships between social contexts, self-determined need satisfaction, and online course outcomes (Chen & Jang, 2010; Hsu et al., 2018; Wang et al., 2019). Wang et al. (2019) utilised a model with similar structure to the General SDT Model to assess the relationships between autonomy support, need satisfaction, need dissatisfaction, motivation, course grades, and perceived course transfer. They reported that autonomy-supportive environments predicted need satisfaction and the separate variable of need dissatisfaction. These variables then significantly predicted motivation and course grades, and perceived course transfer.

Only one study was found that investigated sense of community, need satisfaction, and online course satisfaction (Chen & Jang, 2010). Chen and Jang (2010) used a unitary measure for need satisfaction, which included items for perceived autonomy, relatedness, and competence. They reported that need satisfaction mediated the relationship between contextual support and motivation, indicating that student motivation was only improved through teachers supporting students' needs. Furthermore, contextual support significantly predicted need satisfaction and course satisfaction. However, student needs satisfaction did not predict their satisfaction with the course (Chen & Jang, 2010). This result indicates that online course satisfaction may relate to staff support more than need satisfaction.

Hsu et al. (2019) repeated the study by Chen and Jang (2010); however, they did not investigate course satisfaction and separated autonomy, competence, and relatedness from the broader variable of need satisfaction. Their findings revealed that self-determined needs mediated the relationship between autonomy support and self-determined motivation for online learners. Interestingly, autonomy support predicted autonomy, relatedness, and the outcome variables of learning gains and perceived knowledge transfer, but not competence. This is consistent with findings from face-to-face learning environments, which state that self-determined needs can be the mediator between social contexts and student outcomes such as engagement, motivation, or wellbeing.

Compared to face-to-face learners, online students have reported lower scores for social connectedness and learning community (Wighting et al., 2008), need satisfaction (Mullen & Tallent-Runnels, 2006; Wang et al., 2019), and online course satisfaction (Filak & Nicolini, 2018). At present, there is minimal research that has investigated the impact of sense of community and satisfaction of self-determined needs on student outcomes when learning online (Chen & Jang, 2010; Hsu et al., 2019; Wang et al., 2019). The role of community and SDT needs has been extensively researched in face-to-face settings (Brophy, 2004; Beachboard et al., 2011; Jang et al., 2009; Ryan & Deci, 2000; Sakiz et al., 2012; Sher, 2009; Tian et al., 2016; Zhao et al., 2012) but not in online learning settings. Given the unique opportunities and challenges for students when studying online (Bowers & Kumar, 2015; Harris et al., 2011; Wighting et al., 2008; Wang et al., 2019; Wu & Gao, 2020), more research is needed to understand the role of need satisfaction and sense of community for students completing online courses.

The current study

Using the General SDT Theory (Deci et al., 2017; Yu et al., 2018) as a framework, in the context of online learning during the COVID-19 pandemic, the current study aims to examine the ways students' social connectedness and learning community, as well as need satisfaction for autonomy, relatedness, and competence, predict online course satisfaction. This study will provide a deeper understanding of the impact of community and need satisfaction within university settings to increase student satisfaction with their online learning experience. During the COVID pandemic, students have reported increased distress, isolation, and vulnerability (Clinton, 2020; Lyons et al., 2020). Hence, universities and other online learning providers have a responsibility to understand how building community and connection can positively impact students during the current pandemic and for online learning environments in the future.

The study predicts (See Figure 1 for the conceptual model) that social connectedness and learning community will significantly predict self-determined needs (i.e., autonomy, relatedness, and competence), further that the self-determined needs: relatedness, competence, and autonomy will significantly predict online student satisfaction, and finally that self-determined needs will mediate the relationship between the sense of community (i.e., social connectedness and learning community) and course satisfaction.

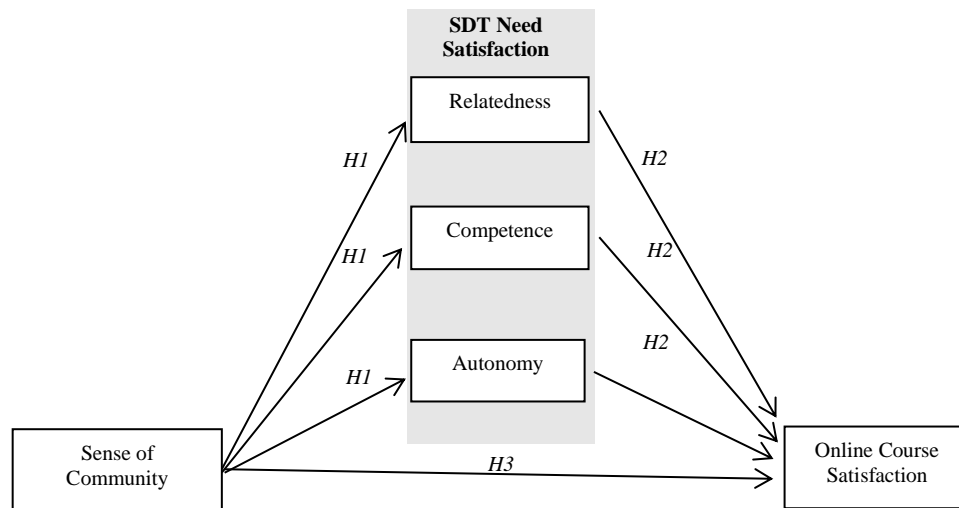


Figure 1
The conceptual model for the present study

Method

Participants

The current study sample was composed of university students enrolled in a full-time or part-time course in Australian universities. Participants were included if they were Australian university students who accessed online learning due to COVID-19 restrictions in 2020. There were 136 participants in total, including 112 females (82.4%) and 24 males (17.6%). The participants' age ranged from 17 to 47, with an average age of 24.8 years ($SD = 7.02$). The sample included 80.9%

domestic students and 19.1% international students. On average, students attended 3.37 classes per week ($SD = 1.92$) and predominately studied at the Bachelor (57.4%), Diploma (8.8%), or Masters (31.6%) level. The most common area of study for the participants was Psychology (25%), Education (23.5%), Science (including Biology and Social Science, 8.8%), Health Sciences (7%), Business (7.4%) and Engineering (5.9%). An a priori power analysis was conducted using G*Power 3 (Faul et al., 2007) for a fixed model linear multiple regression with four predictors, a large effect size ($f^2 = 0.15$), and an alpha of 0.05. The results revealed that to achieve a power of 0.80, a sample size of 85 was required; hence 136 participants were adequate to test the hypotheses.

Materials

An anonymous survey collected consent information and gathered demographic information including age, gender, domestic or international student status, and how many online classes students attended each week. The survey measured sense of community, using the Wu and Gao's (2020) adapted Classroom Community Scale (Rovai, 2002a) to investigate the social connectedness (reported internal consistency $\alpha = .94$) and learning community ($\alpha = 0.95$). The Balanced Measure of Psychological Needs (Sheldon & Helpert, 2012) was included to measure self-determined need satisfaction. It was developed in line with SDT to measure the level of satisfaction for each of the three needs: competence, autonomy, and relatedness (Sheldon & Gunz, 2009; Sheldon & Hilpert, 2012). Each of the three domains demonstrated appropriate reliability at conceptualisation (autonomy $\alpha = 0.78$, competence $\alpha = 0.77$, and relatedness $\alpha = 0.80$). Finally, online learning course satisfaction was measured using the General Satisfaction Subscale from Strachota's (2006) Student Satisfaction Survey. The General Satisfaction Subscale was reported to have high reliability (Cronbach's Alpha = 0.9) when measured with 249 online students from a Midwest Technical College in the United States (Strachota, 2006).

Procedure

Snowballing sampling was used to collect data via an online survey hosted by Google. University students known to the researchers were invited to complete the survey and invite their contacts to complete the survey. Facebook advertising was used to target people over the age of 18 who had indicated through their Facebook information they were university students. Participation in this survey was voluntary, and all data was stored securely to maintain confidentiality. Any identifying information, such as names and email addresses, was stored separately from the survey data.

Psychometrics

Cronbach's Alpha reliability coefficients were calculated for the current survey measures and are presented in Table 1. The internal reliability for the autonomy composite was not satisfactory (Cronbach's $\alpha = .38$). By deleting the item 'I had to do things against my will,' the autonomy composite's internal reliability increased to an adequate level of Cronbach's $\alpha = .68$ (Griethuijsen et al., 2014; Taber, 2018). The relatedness composite's reliability coefficient was in the lower range of acceptable (Cronbach's $\alpha = .59$). By deleting the item 'I had disagreements or conflicts with people I usually get along with,' the internal reliability of the relatedness composite (Cronbach's $\alpha = .80$) increased to the high range (Taber, 2018). In both cases, the low Cronbach's Alpha was due to poor correlation between the individual items and the rest of the scale. As there

was no option to revise the questions, the individual items were deleted to maintain the empirical integrity of the measure (Tavakol & Dennick, 2011). The remaining 16 items maintained the face validity of the measure and there were still an adequate number of items in the subscales for interpretation with caution.

Table 1
Cronbach's alpha of scales

	Descriptive Statistics			Correlation coefficients (r)				
	α	M	SD	1.	2.	3.	4.	5.
1. Relatedness	.80	25.51	6.58	-				
2. Competence	.77	26.84	7.16	.51***	-			
3. Autonomy	.68	22.73	5.55	.53***	.50***	-		
4. Social Connection	.83	19.58	6.68	.35***	.43***	.26**	-	
5. Learning Community	.77	24.65	7.17	.29***	.40**	.33***	.61***	-
6. Course Satisfaction	.94	21.88	9.51	.16*	.20*	.30***	.33***	.66***

Data analysis

The data was screened for missing data and outliers. Preliminary analyses were performed to generate a descriptive report of participant characteristics, descriptive statistics, and correlations and determine if the assumptions of normality and multicollinearity had been maintained. All data was appropriate for analyses as per Pallet's (2020) recommendations.

To test the hypotheses, two mediation analyses were performed using Hayes' (2017) PROCESS macro (Model 4) for SPSS, version 3.5. PROCESS macro is an observed variable ordinary least square and logistic regression path analysis modelling tool, which can estimate direct and indirect effects in multiple mediator (parallel) models. As PROCESS macro can only analyse models with one independent variable, two mediation analyses were conducted. The first analysis was conducted using Model 4 (for parallel mediation) with social connectedness (X_1) as the independent variable, Online Course Satisfaction as the dependent variable (Y_1), and the mediators were relatedness (M_1), competence (M_2), and autonomy (M_3).

Results

Preliminary analysis

Each variable analysed 136 cases, and the descriptive statistics and correlation coefficients are presented in Table 2.

Table 2
Correlations table

	Descriptive Statistics			Correlation coefficients (r)				
	α	M	SD	1.	2.	3.	4.	5.
1. Relatedness	.80	25.51	6.58	-				
2. Competence	.77	26.84	7.16	.51***	-			
3. Autonomy	.68	22.73	5.55	.53***	.50***	-		
4. Social Connection	.83	19.58	6.68	.35***	.43***	.26**	-	
5. Learning Community	.77	24.65	7.17	.29***	.40**	.33***	.61***	-
6. Course Satisfaction	.94	21.88	9.51	.16*	.20*	.30***	.33***	.66***

Note. * $p < .05$; ** $p < .01$; *** $p < .001$.

PROCESS macro analysis

Variables were entered as covariates to control for the effects of demographic variables on the investigation. The covariate variables for the two mediation analyses included age, gender, number of classes per week, and whether the participant was an international or domestic student.

Social connectedness model

The regression pathways and mediation analysis were first completed with the independent variable of learning community (X_1), mediators of relatedness (M_1), competence (M_2) and autonomy (M_3), and dependent variable of course satisfaction (Y_1). These analyses are presented in Table 3 and Table 4.

Table 3
Unstandardised coefficients for mediation model for social connectedness

Consequent																
	M ₁ (Relatedness)			M ₂ (Competence)			M ₃ (Autonomy)			Y ₁ (Course Satisfaction)						
Antecedent	Coeff.	SE	<i>p</i>	Coeff.	SE	<i>p</i>	Coeff.	SE	<i>p</i>	Coef f.	SE	<i>p</i>				
X ₁ (SC)	a ₁	.33	.08	<.001	a ₂	.46	.09	<.001	a ₃	.24	.07	<.001	c'	.41	.13	.003
M ₁ (Relatedness)	-	-	-	-	-	-	-	-	-	-	-	-	b ₁	-.13	.15	.385
M ₂ (Competence)	-	-	-	-	-	-	-	-	-	-	-	-	b ₂	-.04	.14	.76
M ₃ (Autonomy)	-	-	-	-	-	-	-	-	-	-	-	-	b ₃	.51	.18	.005
Constant	i _{M1}	17.11	4.00	<.001	i _{M2}	17.27	4.23	<.001	i _{M3}	15.52	3.48	<.001	I _y	6.93	6.40	.28
		R ² = .15				R ² = .20				R ² = .10				R ² = .17		
		<i>F</i> = 4.63; <i>p</i> < .001				<i>F</i> = 6.56; <i>p</i> < .001				<i>F</i> = 2.96; <i>p</i> = .015				<i>F</i> = 3.28; <i>p</i> = .002		

Note. SC = Social Connectedness. SE = standard error. Coeff = unstandardised coefficient. X = independent variable; M = mediator variables; Y = outcomes or dependent variables

The results in Table 3 show that relatedness, competence, and autonomy were all significantly predicted by social connectedness with moderate effect sizes overall. Social connectedness predicted 20% of the variance in competence ($b = .46, p < .001$), 15% of the variance of relatedness ($b = .33, p < .001$) and 10% of the variance for autonomy ($\beta = .24, p < .001$). In this model, autonomy significantly predicted course satisfaction ($\beta = .51, p < .01$). Relatedness ($\beta = -.13, p = .39$) and competence ($\beta = -.04, p = .76$) did not significantly predict the students' satisfaction with their course. The bootstrapping estimates for the first mediation model are presented in Table 4.

Table 4

Standardised Total, Direct and Indirect Effects, and 95% Bias-corrected Confidence Interval Predicting Course Satisfaction Scores for Social Connectedness Model

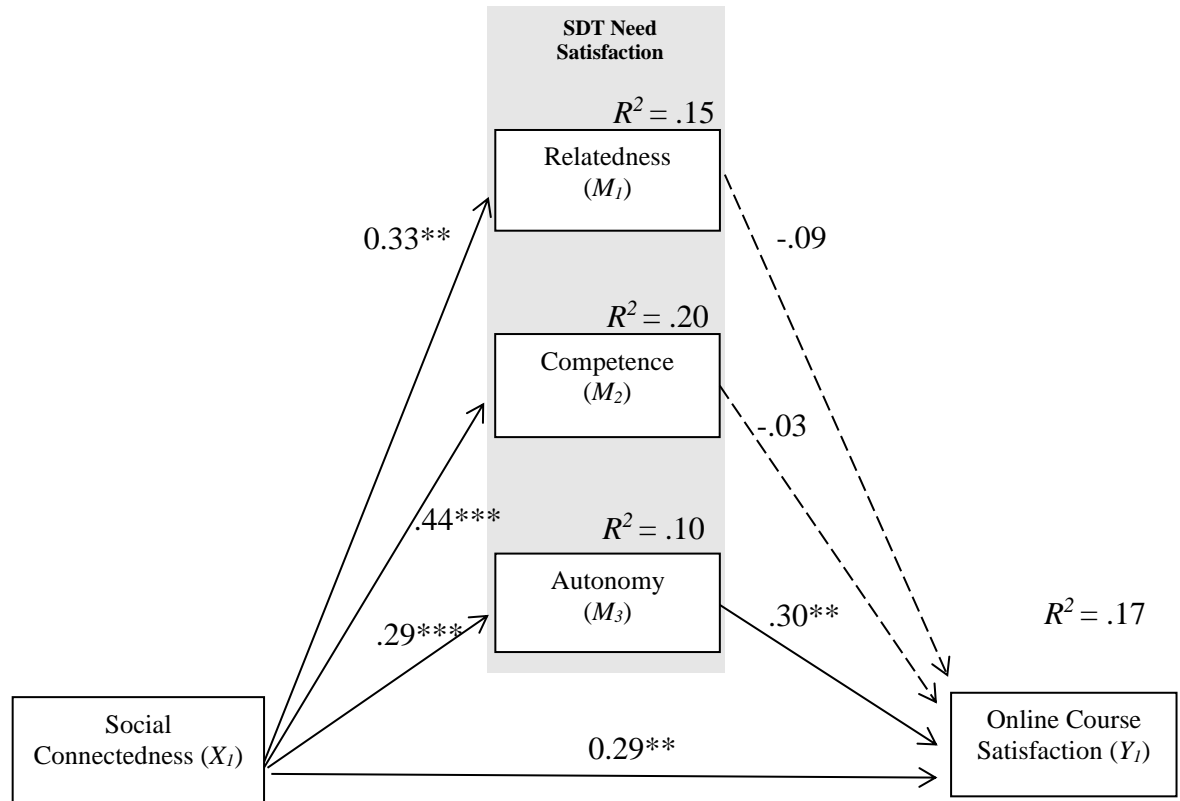
Path	Effect	SE	BootLLCI	BootULCI
Total effect	.327	.121	.226	.705
Direct effect	.286	.133	.1448	.670
Total indirect effect	.041	.045	-.071	.143
SC -> Relatedness -> Course Satisfaction	-.030	.041	-.117	.048
SC -> Competence -> Course Satisfaction	-.014	.047	-.107	.081
SC -> Autonomy -> Course Satisfaction	.085	.04	.010	.169

Note. SC = Social Connectedness. SE = standard error. Number of bootstrap samples for percentile confidence intervals: 5000.

The mediation analysis confirmed that autonomy partially mediated the effect of social connectedness on course satisfaction, as the indirect effect was significant (indirect effect = 0.09, SE = 0.04, 95% CI [0.01, 0.17]). All other indirect paths were not significant; hence no other mediators were identified from the model. Table 4 and Table 6 contain the standardised total, direct and indirect effects, and 95% bias-corrected confidence intervals. The standardised coefficients between variables and R^2 of the social connectedness model can be found in Figure 2.

Figure 2

Social Connectedness (X_1) Model Indicating the Standardised Coefficients Between Variables



Note. $*p < .05$; $**p < .01$; $***p < .001$.

Learning community model

The second mediation analysis was completed with the independent variable of learning community (X_2), mediators of relatedness (M_1), competence (M_2), and autonomy (M_3), and dependent variable of course satisfaction (Y_2). The unstandardised coefficients for the second mediation analyses are presented in Table 5.

Table 5
Unstandardised Coefficients for the Mediation Model for Learning Community

Consequent																
	M ₁ (Relatedness)			M ₂ (Competence)			M ₃ (Autonomy)			Y ₂ (Course Satisfaction)						
Antecedent	Coeff.	SE	p	Coeff.	SE	p	Coeff.	SE	p	Coeff.	SE	p				
X ₂ (LC)	a ₁	.23	.08	<.01	a ₂	.39	.08	<.001	a ₃	.26	.06	<.001	c'	.90	.10	<.001
M ₁ (Relatedness)	-	-	-	-	-	-	-	-	-	-	-	-	b ₁	-.08	.12	.521
M ₂ (Competence)	-	-	-	-	-	-	-	-	-	-	-	-	b ₂	-.18	.10	.111
M ₃ (Autonomy)	-	-	-	-	-	-	-	-	-	-	-	-	b ₃	.32	.14	.029
Constant	i _{M1}	19.81	3.99	<.001	i _{M2}	19.60	4.19	<.001	i _{M3}	15.28	3.32	<.001	I _y	2.47	5.08	.628
	R ² = .11			R ² = .17			R ² = .13			R ² = .68						
	F = 3.09; p = .012			F = 5.27; p <.001			F = 3.96; p = .002			F = 13.92; p <.001						

Note. LC = Learning Community. SE = standard error. Coeff = unstandardised coefficient. X = independent variable; M = mediator variables; Y = outcomes or dependent variables

Learning community significantly predicted relatedness, competence, and autonomy with moderate effect sizes overall. Learning community predicted the most variance for competence ($b = .39, p < .001$), accounting for 17% of the variance. The effect size of learning community predicting relatedness and autonomy was significant and in the low-moderate range. Learning community predicted 11% of the variance of relatedness ($b = .23, p < .01$) and 13% of the variance of autonomy ($b = .22, p < .001$). In this model, autonomy was the only self-determined need to predict course satisfaction significantly ($b = .32, p < .05$). Relatedness ($b = -.08, p = .52$) and competence ($b = -.18, p = .11$) did not significantly predict the students' satisfaction with their course. Table 6 contains the standardised total, direct and indirect effects, and 95% bias-corrected confidence intervals.

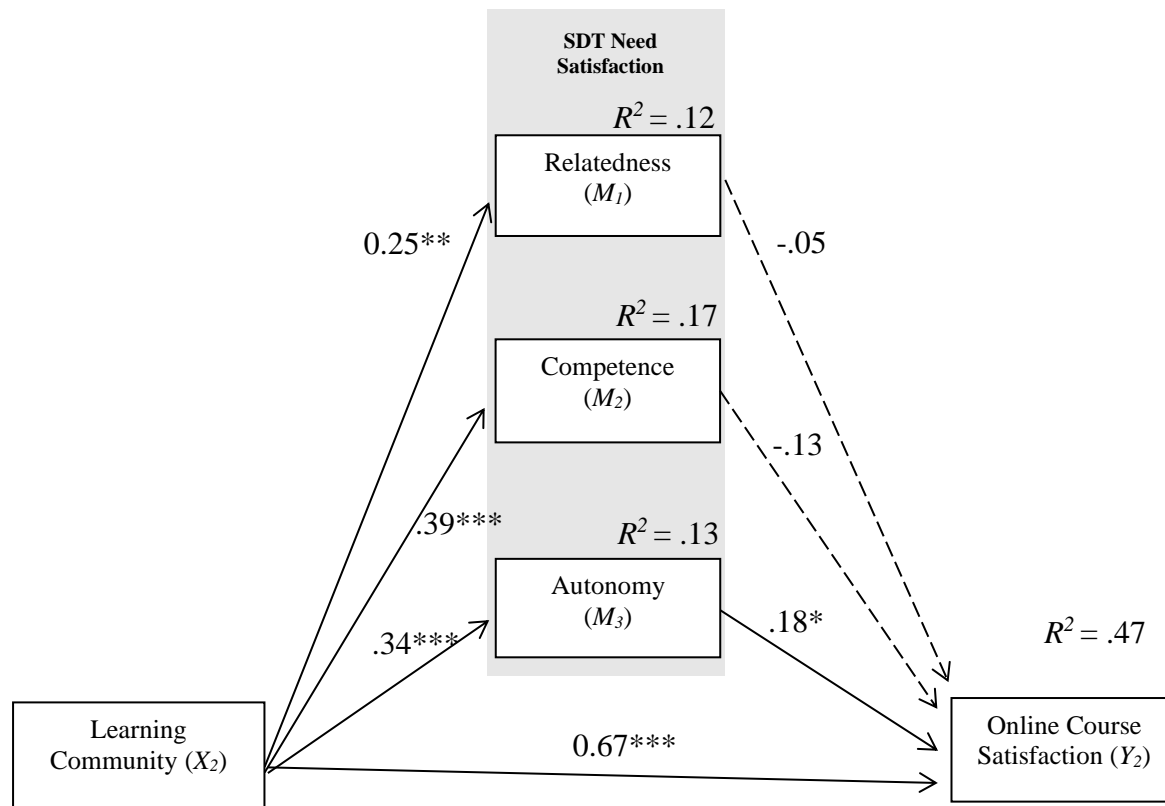
Table 6

Standardised Total, Direct and Indirect Effects, and 95% Bias-Corrected Confidence Interval Predicting Course Satisfaction Scores

Path	Effect	SE	BootLLCI	BootULCI
Total effect	.674	.090	.718	1.072
Direct effect	.678	.097	.706	1.091
Total indirect effect	-.003	.036	-.078	.063
LC -> Relatedness -> Course Satisfaction	-.013	.028	-.071	.048
LC -> Competence -> Course Satisfaction	-.052	.036	-.128	.011
LC -> Autonomy -> Course Satisfaction	.062	.038	-.012	.139

Note. LC = Learning Community. SE = standard error. Number of bootstrap samples for percentile confidence intervals: 5000.

The second mediation analysis confirmed that relatedness, competence, and autonomy did not mediate learning community's effect on course satisfaction. All indirect paths were not significant; hence no other mediators were identified from the model. The standardised coefficients between variables and R^2 of the learning community model can be found in Figure 3.



Note. * $p < .05$; ** $p < .01$; *** $p < .001$.

Figure 3
Learning Community (X_2) Model Indicating the Standardised Coefficients Between Variables

Discussion

The current study aimed to examine the relationships between students' social connectedness, learning community, need satisfaction for autonomy, relatedness, competence, and online course satisfaction. These relationships were examined during the COVID-19 pandemic when many students and universities were required to convert face-to-face studies into an online format.

The first hypothesis stated that social connectedness and learning community would significantly predict self-determined needs. The results supported this hypothesis as learning community and social connectedness both significantly predicted each of the self-determined needs (relatedness, competence, and autonomy) with moderate effect sizes. Student learning community and social connectedness predicted the most variance for competence, explaining 17% and 20% of the variance, respectively.

The results for social connectedness were consistent with the literature that autonomy-supportive learning communities (which also include trust and feeling cared for by instructor) support the self-determined need satisfaction of students (Ng et al., 2012; Slemp et al., 2018; Vansteenkiste et al., 2020; Vasquez et al., 2016; Williams et al., 2006). Furthermore, these results support meta-

analyses reporting that autonomy-supportive environments predict need satisfaction for autonomy, competence, and relatedness (Ng et al., 2012; Slemp et al., 2018; Vasquez et al., 2016) and that autonomy-supportive social contexts nurture competence and relatedness, in addition to autonomy (Vansteenkiste et al., 2020; Williams et al., 2006).

The feeling of trust and care from peers and instructors in the course may have provided students with the efficacy to manage difficulties and confidence to encounter challenges in their learning (Niemiec & Ryan, 2009). Brophy (2009) stated that struggling students need ongoing support and scaffolding to feel competent, which may have been relevant during the COVID-19 pandemic. Furthermore, feeling connected to the instructor may have predicted autonomy satisfaction as it internalised regulation for learning challenges and self-efficacy (Niemiec & Ryan, 2009; Rovai, 2002b; Sakiz et al., 2012).

Learning community most strongly predicted competence and it also predicted 13% of the variance for autonomy and 12% of the relatedness variance. When students feel they are part of a learning community, they get help in class, feel encouraged to ask questions, feel a desire to learn, and receive feedback (Wu & Gao, 2020). Feedback can provide information for students to evaluate their perceived competence, which may be validating and build competence (Deci & Ryan, 2012; Schunk & Zimmerman, 2006). This finding provides evidence that when students felt supported through their learning, they build competence rather than feelings of confusion or anxiety (Hartnett, 2015; Reeve, 2009). Furthermore, when instructors offer positive, targeted, and authentic feedback, students understand how to improve and feel appropriately challenged (Deci & Ryan, 2012). According to the current study, this could be a reason competence was predicted most strongly by learning community.

The current results indicate that when students feel safe in their learning environment, they are more likely to feel appreciated and a sense of connection in their learning. Asking questions and feeling a desire to learn (Wu & Gao, 2020) may lead to more collaborations and communication with their peers and instructors, which could then enhance the relatedness satisfaction in online students.

The second hypothesis stated that need satisfaction of autonomy, competence, and relatedness would significantly predict online learning satisfaction. This hypothesis was partially supported as only autonomy significantly predicted variance in online learning satisfaction for the social connectedness model and the learning community model. This finding was inconsistent with past research that investigated need satisfaction and online course satisfaction (Chen et al., 2010; Filak & Nicolini, 2018), and student outcomes in face-to-face settings such as motivation, engagement, wellbeing, and satisfaction (Deci & Ryan, 1985, 2000; Ryan & Deci, 2000; Sun et al., 2019).

The current results provide evidence that supporting student autonomy is vital for online course satisfaction (Ng et al., 2012; Slemp et al., 2018). Online learning requires more independence, freedom, and flexibility from students than face-to-face learning settings (Kauffman, 2015; Solbrekke & Helstad, 2016). Furthermore, online students are more likely to experience success in their online learning when they are self-efficient, self-aware, and self-reflective (Kauffman, 2015). These qualities are aligned with self-determined autonomy (Lynch & Dembo, 2004). Students who had high autonomy need satisfaction are likely to have found it easier to be independent, connect their behaviours with their values, and make choices (Calvo et al., 2020; Porat et al., 2020). These qualities may have been incredibly beneficial for a satisfying online learning experience during the

COVID-19 pandemic, where students' sense of freedom was confined in their everyday lives through government-imposed restrictions.

Relatedness or competence did not explain significant variance in online learning satisfaction. These results were inconsistent with past research in face-to-face settings (Deci & Ryan, 1985, 2000; Ryan & Deci, 2000; Sun et al., 2019). This inconsistency could reflect the difference between face-to-face and online learning, with lower competence and relatedness reported for online learning (Filak & Nicolini, 2018).

The third hypothesis stated that each of the self-determined needs would mediate the relationship between social connectedness and online learning satisfaction, and learning community and online course satisfaction. This hypothesis was partially supported, as only autonomy partially mediated the relationship between social connectedness and online course satisfaction. This result is consistent with findings from face-to-face students, which have identified autonomy as a mediator for autonomy support and student outcomes such as engagement (Jang et al., 2012), subjective wellbeing (Tian et al., 2016), motivation (Yu & Levesque-Bristol, 2020) and positive and negative affect (Garn et al., 2018). Furthermore, studies on online student have indicated that self-determined needs can act as a mediator for social contexts and student outcomes (Chen & Jang, 2010; Hsu et al., 2019).

The mediation analysis revealed that students' need satisfaction for relatedness and competence did not act as mediators for social connectedness and online course satisfaction. Furthermore, none of the self-determined needs mediated the relationship between learning community and online course satisfaction. This finding does not support the General SDT Model (Deci et al., 2017; Yu et al., 2018), which posits that the self-determined needs mediate the relationship between social contexts and student outcome and wellbeing variables. While wellbeing as an outcome variable is a different construct to satisfaction, wellbeing measures tend to encompass satisfaction in addition to the emotional and purposeful components of wellbeing (Steptoe et al., 2015). Hence, satisfaction measures can be indicative of the evaluative component of wellbeing, however the results did not support this connection. The present study results indicate that further investigation is required to determine if online course satisfaction is an appropriate dependent variable for the General SDT Model. Furthermore, online course satisfaction during COVID-19 pandemic may have affected the lack of support for the General SDT Model.

Social connectedness positively and significantly predicted online learning satisfaction. This result is consistent with research by Chen et al. (2010) and a meta-analysis by Richardson et al. (2016), which reported social presence and student satisfaction had a moderately large positive correlation. The COVID-19 pandemic had an impact on university student social connectedness (Lyons et al., 2020). With the increased isolation of online learning during the COVID-19 pandemic, the results demonstrate that social support is likely to have played an even more critical role than before the COVID-19 pandemic (Clinton, 2020).

Learning community was the strongest predictor of course satisfaction out of all variables. This is consistent with past findings that well-structured learning environments with clear communication and feedback are pivotal for online course satisfaction (Dennen et al., 2007; Dow, 2008; Trello, 2007). These findings indicate that online courses where learning instructors and peers create an environment where students felt safe and guided in their learning experience were the most important variable for predicting online course satisfaction.

Limitations

A snowball sampling technique and social media advertising were used to recruit participants, limiting sampling validity as the sample did not accurately reflect university students in Australia. The sample contained mainly females completing a bachelor's degree, and most participants were from Victoria. Therefore, the sample does not adequately represent the gender, university level, and location of Australian university students. Although the sample size of 136 students was above the recommendation for adequate power for this analysis (Faul et al., 2007), increasing the sample size and generalisability would increase the validity of the study conclusions.

The participants did not choose the online learning delivery, they completed online classes due to university campus closures during the COVID-19 pandemic. This is likely to have impacted their impressions of online course satisfaction (Hodges et al., 2020) for the General Satisfaction Subscale (Strachota, 2006), particularly for taking another online course, recommending online learning to others, and online class preference over face-to-face classes. Some students may have been satisfied with the course in the context of what was possible during the COVID-19 pandemic; however, still prefer face-to-face learning and will not intend to retake an online course in the future. This would have led to a low score in the online course satisfaction measure. Considering the context of the COVID-19 pandemic is necessary when interpreting the results of online course satisfaction in the current study. Furthermore, each student would have been impacted by the COVID-19 pandemic differently based on their unique circumstances, such as where they lived in Australia, their paid employment, financial circumstance, living situation, and family situation (Brammer & Clark, 2020; Lyons et al., 2020). These potentially complex situations may have affected the way a participant answered the measures in this study.

Future research

Future research could explore the relationships between a sense of community, self-determined needs, and student outcomes beyond online course satisfaction. While relatedness and competence did not significantly predict online course satisfaction in the current study, these self-determined needs are likely to have a positive impact on other student outcomes, such as engagement (Chen et al., 2010; Sun et al., 2019), intrinsic motivation (Hsu et al., 2019), achievement outcomes (Chen et al., 2010), and general wellbeing (Ng et al., 2012). Furthermore, according to the General SDT Model (Deci et al., 2017; Yu et al., 2018), motivation is likely to have a mediating role in the model (Filak & Sheldon, 2008; Zhou et al., 2019), which may provide more insight into online course satisfaction. Further exploring the relationships between sense of community, the self-determined needs, and variables related to motivation and student outcomes will provide more information to enhance student online university experiences.

Factors relating to instructors and students would also benefit from further analysis. To prepare for online learning during the COVID-19 pandemic, instructors may have had limited time and access to resources to design and implement courses that create a sense of community and satisfy the needs of students (Hodges et al., 2020). Further research could identify skills and strategies used by instructors and universities to create student-centered learning communities and social connectedness. Furthermore, student demographics such as their study area, level of study, and study load may influence the way social connectedness and the learning community impacts their online learning experience. Advancing knowledge in these areas could help universities incorporate student support into online courses (Lee et al., 2011; Thorpe, 2002), which likely to benefit student satisfaction based on the present study's findings.

University programs and policy

The current study results may have implications for online students and universities that offer online classes or courses. Students who learn online experience more challenges with feeling engaged and a sense of belonging (Aversa & MacCall, 2013; Shah & Cheng, 2019) and retention rates are lower for online students than in face-to-face courses (Muljana & Luo, 2019). The present findings provide more insight into relevant factors that can increase student satisfaction when learning online.

Universities are encouraged to develop etiquette for online learning to build behavioural engagement and manage student and faculty expectations in the event of a crisis or for hybrid models of face-to-face and online learning (Neuwirth et al., 2021). Based on the results of the current study, universities need to ensure their programs and policies support student autonomy, social connectedness, and learning community when designing and delivering online courses. A sense of community is essential to retaining online students, and students, instructors, and administrators all have a role in enhancing the online sense of community (Muljana & Luo, 2019).

Universities are encouraged to develop programs and policies that include training staff in how to support students during crises and how to maximise engagement with online teaching pedagogy to support student wellbeing and learning during emergency remote teaching (Cifuentes-Faura et al., 2021). Instructors must have adequate professional learning to be aware of the skills and strategies to cultivate a robust online learning community with social connectedness and learning communities that scaffold competence, support autonomy, and provides effective feedback approaches (Ryan & Deci, 2019). Furthermore, universities need to provide online students with explicit and engaging opportunities to connect and collaborate with their peers socially and feel supported and acknowledged by instructors within their learning communities (Kauffman, 2015; Lee et al., 2011; Thorpe, 2002).

Conclusion

According to the present study, during the COVID-19 pandemic, university students were more satisfied with their online courses when they were engaged in a learning community, socially connected to their peers and instructor, and felt their autonomy self-determined need was met.

Students' sense of community moderately predicted the self-determined needs of relatedness, competence, and autonomy. Creating a social context with a strong learning community supported the satisfaction of self-determined needs.

Mediation analyses found that only autonomy mediated the relationship between sense of community and online course satisfaction; this was inconsistent with the General SDT Model (Deci et al., 2017; Yu et al., 2018) and similar to results from online studies (Chen & Jang, 2010; Hsu et al., 2019; Wang et al., 2019). This finding highlighted the importance of autonomy compared to relatedness and competence when predicting online learning satisfaction during the COVID-19 pandemic.

Learning community strongly predicted online learning satisfaction, and the self-determined needs did not mediate this relationship. The results indicate that interacting with instructors and peers through the learning process and feeling part of the learning community was crucial for students' online learning experience (Wu & Gao, 2020).

Further research is required to develop a deeper understanding of how a sense of community and SDT contribute to students' satisfying online learning experiences. The findings have implications for online university courses to create environments that encourage social connectedness and healthy learning communities to support student need satisfaction and course satisfaction.

Declarations

Funding: Not applicable

Conflicts of interest/Competing interests: Not applicable

Availability of data and material: Data not available due to ethical restrictions.

Code availability: Not applicable

Ethics approval: The work undertaken for this thesis was duly authorised by the Monash University Human Research Ethics Committee (MUHREC) on 25/5/20: Project ID:24357

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