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Crossing the distance: University student newcomer socialization in online semesters—a case study

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Abstract During the COVID-19 pandemic, emergency online learning impeded the pursuit of in-person activities that usually foster successful socialization in higher education. To investigate the effects of online learning on socialization, we asked two exploratory research questions: (1) How and to what extent does the level of socialization change during the first online semester? and (2) To what extent does level of change predict course dropout and academic performance? In our case study, using a sample of new students at a large German university, we ran an autoregressive three-factorial model of socialization (role, relationships, organization) with three measurements taken during the new students' first semester, which was the second semester in which emergency online learning took place. Our results show that the relationships component of socialization did not increase over the semester, while the role and organization components increased. Furthermore, our results support a negative effect of the organization component of socialization on course dropout

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and a positive effect of the relationship component of socialization on academic performance.

Keywords Socialization · Higher education · Online learning · Relationships · Academic performance · Dropout

Erfolg trotz Distanz: Sozialisierung von Studierenden während des Lockdowns. Eine Fallstudie

Zusammenfassung Während der COVID-19-Pandemie beeinträchtigte der Notfallfernunterricht die Durchführung von Präsenzaktivitäten, die normalerweise die Sozialisierung im Hochschulbereich fördern. Wir untersuchten, wie sich die Sozialisierung während des ersten Online-Semesters verändert und inwieweit diese Veränderung den Kursabbruch und die akademische Leistung vorhersagt. In einer Fallstudie mit Studienanfängern einer deutschen Universität analysierten wir ein autoregressives Modell mit drei Faktoren der Sozialisierung (Rolle, Beziehungen, Organisation), basierend auf drei Messzeitpunkten. Die Ergebnisse zeigen, dass nur die Faktoren Rolle und Organisation anstiegen. Weiterhin ergab sich ein negativer Zusammenhang zwischen dem Faktor Organisation und Kursabbruch sowie ein positiver Zusammenhang zwischen der dem Faktor Beziehungen und der Studienleistung.

Schlüsselwörter Sozialisierung · Hochschulbildung · Online-Lernen · Soziale Beziehungen · Studienleistung · Kursabbruch

1 Introduction

During the transition from secondary school to higher education, socialization is a vital process for newcomer students to adjust to their new learning environment (Baker and Siryk 1984; Fan and Wanous 2008; Feldt et al. 2011; Wang et al. 2013). From a psychological perspective, student socialization in higher education is a process within an individual (Morawski 2014) and typically involves learning and adopting academic and institutional norms, becoming integrated into the new social environment, and developing appropriate responses to emotional challenges (Bean 1985; Baker and Siryk 1984; Weidman 2020). To support socialization in higher education, most higher education institutions offer onboarding activities early on during the transition, for example by providing opportunities for newcomers to get in contact with peers and the new learning environment and/or by providing newcomers with essential information about the institution and effective ways of learning (Schilling et al. 2022). Most of these onboarding activities take place at the very beginning of study programmes and are meant to give students a head start in their socialization process, while their long-term socialization is expected to develop organically.

Yet, with universities shifting to emergency online learning during the COVID-19 pandemic, some potentially crucial factors for socialization in higher education changed. First, physical and social presence was severely restricted. Limited physical presence, as a major difference between face-to-face and online learning, restricts ways of communication and can result in different levels of perceived social connectedness (Grieve et al. 2013; Holmberg 2014). For instance, students have been found to make more positive judgments about each other in a face-to-face environment than in a solely online environment (Okdie et al. 2011). Physical presence, in contrast to virtual presence, is also beneficial for implicit and explicit learning (Sarasso et al. 2022). High social presence (i.e. the feeling of a person being there in virtual learning environments) can also positively affect active learning (Molinillo et al. 2018), and consequently, low social presence may have a negative effect on learning quality.

Second, during emergency online teaching, opportunities for interactions with peers were limited to the online-only setting, and this was the case for both academic and personal interactions (Adnan and Anwar 2020). Typical strategies to promote socialization and integration into higher education in face-to-face-settings, such as participatory learning through peripheral participation (Eberle et al. 2014), were unlikely to occur organically in online settings since most students and faculty were not familiar with ways to foster socialization in these settings and likely not even aware of the importance of appropriate socialization strategies. Several onboarding activities (e.g. welcome events to provide initial information and give opportunities for students to mingle and get to know each other) may have existed in online or hybrid forms even before the shift to emergency online-teaching (Schilling et al. 2022). These could relatively easily be transferred to an online version. However, long-term socialization strategies, such as students' shift from peripheral to central participation in responsibilities and complex tasks in the university environment (e.g., joining a student association, becoming tutors), were less likely to occur. These activities contribute to a sense of belonging, which plays an important role in motivating students to persist in their studies (Hausmann et al. 2007). In particular, students' social integration is a crucial aspect of socialization that could impact dropout rates. Therefore, the change from face-to-face to online learning may have considerably restricted student socialization and had negative impacts on learning, belonging and dropout.

In this paper, we provide a case study of a cohort of newcomer students during emergency-online teaching. We explore, quantitatively, how these students' socialization developed over the course of their first semester and what impact this had on their performance and on course dropout in this unusual situation.

1.1 Socialization development in higher education

In general, socialization describes "the processes whereby individuals attain the behaviors, norms, beliefs, and ideologies that are needed for competent participation in society" (Morawski 2014, p. 1821). In the context of higher education, theoretical models of socialization in higher education have used adapted definitions, e.g. "adjustment to college" (Baker and Siryk 1984) and

"a set of processes whereby an undergraduate [e]nters college as a freshman [sic] with certain occupational values (...), [i]s exposed to various socializing influences while attending college, particularly normative pressures exerted via primary interaction with faculty and peers in the major department", Weidman (2020, p. 14).

In their review of socialization content that is relevant for newcomers, Cooper-Thomas et al. (2020) identify three core domains of socialization and, consequently, suggest a three-component socialization model that consists of *(1) role, (2) relationships*, and *(3) organization*. *(1)* The *role* component refers to the tasks the individual is responsible for, and how and to what standard the person is expected to perform these tasks. *(2)* The *relationships* component is about effective and satisfying relationships with colleagues that are essential for social integration. *(3)* The *organization* component covers the understanding of formal elements of the setting, such as values, history, and structure, as well as informal aspects, such as rituals and "stories that illustrate how to behave and who wields power" (Cooper-Thomas et al. 2020, p. 438). Applied to socialization in higher education, the degree of newcomer students' socialization success can be described by the extent that they understand their roles, responsibilities, tasks, and the norms associated with their tasks (i.e., *role*), establish effective and fulfilling relationships (i.e., *relationships*), and adapt to the norms and formal and informal aspects of the faculty (i.e., *organization*).

While earlier approaches viewed socialization in higher education as a "linear process with relatively fixed institutional boundaries" (Weidman 2020, p. 14), this idea has been continually challenged and revised. Now, socialization is seen as a complex, interactive process. The conceptual model of organizational socialization of students in higher education proposed by Weidman (2020) suggests a complex input-output approach in which socialization processes in higher education are influenced by individual factors of the student (background, predispositions, preparation) and occur in interaction with professional (practitioners, associations) and personal communities (family, friends, employers) to produce professional outcomes (knowledge, skills, dispositions).

Students' first year in higher education is considered the most important (e.g. Evans 2000; Beekhoven et al. 2002), with students usually deciding whether to persist or drop out during the first half of the year (e.g., Hayes 1974). In Germany, where public higher education is free, a higher proportion of students may commence their studies with the awareness that they can easily discontinue without incurring substantial financial costs. Consequently, socialization within the German higher education system becomes more crucial, given an increased number of students switching between programs and universities compared to other countries. Statistics show that before the pandemic, 5% of students in social sciences programs changed institutions and 11% changed study programs within the first year (Statistisches Bundesamt 2020). In addition, statistics show a general dropout rate in social sciences of 24% over students' whole study program (Heublein et al. 2022). This implies that students' decision to remain relies on successful socialization during the first weeks and months of their studies. Therefore, newcomer support in higher education usually takes place mainly in the first year of study, also framed as

first-year experience programs (e.g. Habley and McClanahan 2004; Robbins et al. 2009; Geertshuis et al. 2014; Schilling et al. 2022). In these programs, all components of socialization are present to a certain extent: information and socialization interventions help familiarize students with their learning responsibilities (role), get to know other students (relationships) and learn organizational norms (organization).

There are benefits and drawbacks of an online education environment. In online learning, many aspects of the role and organization, such as the distribution of materials, class schedules, and academic expectations, can be effectively communicated and managed through online platforms, events, virtual orientations, and coaching sessions (Schilling et al. 2022). This may enable students to learn the two domains of their role and the organization. Yet, in comparison, students may struggle to build relationships, especially deeper and more meaningful connections, as this can be more challenging in an online setting compared to in-person interactions. Physical presence allows for non-verbal communication, casual encounters, and informal social interactions that are important for building strong social connections (Wilcox et al. 2005; Beins 2016). In online settings, students may have to make a more conscious effort to connect with their peers, and they may miss out on the spontaneous interactions that can occur in a physical classroom or on campus.

While qualitative aspects of first-year socialization have been extensively explored in previous research, it is still unclear how to best systematically capture students' socialization progress in higher education over time. We suspect that socialization does not necessarily increase continuously (Hua 2015; Kuhfeld and Soland 2021), since emotional support and engagement in the learning process may differ across time. To date, we do not know whether and to what extent any of the three components increases or decreases across a certain time span. In the context of emergency online teaching, efforts to address the absence of physical presence were still in the developmental stages and might not have adequately tackled every aspect of socialization with equal effectiveness. The strategies implemented may have varied in their ability to address different components of socialization. Therefore, we suspect that the components of socialization could have developed to a varying extent and in varying speed.

1.2 Socialization as predictor of performance and course dropout

Socialization is critical to higher education because it enables students to perform well in their studies (Atalay et al. 2022), and motivates them to continue (Wilcox et al. 2005; Field and Morgan-Klein 2012). Hence, in this study we focus on performance and course dropout.

To conceptualize *performance* (also sometimes referred to as academic achievement in previous literature), we use the definition from Steinmayr et al. (2014) "performance outcomes that indicate the extent to which a person has accomplished specific goals that were the focus of activities in instructional environments, specifically in school, college, and university". There is evidence that student socialization, directly or indirectly, impacts academic performance (Maina and Ibrahim 2019). Recent research confirms the vital contribution of class attendance to academic success (Kassarnig et al. 2018) and highlights the importance of positive social ties in the

first academic year (Stadtfeld et al. 2019). This evidence supports the value of both the role component (through attending class regularly) and the relationships component (through positive social ties) in predicting academic performance; however, the impacts of the organization component are unclear in relation to academic performance. It is possible that informal and formal elements of the setting, such as understanding rituals that affect student routines, also impact performance.

A second important student outcome is course dropout, which describes students' decisions not to persist with a specific course within their study program. For the emergency online teaching period, we adopt the definition of course dropout for situation when students "voluntarily withdraw from e-learning courses" (Levy 2007, p. 188). Depending on the course and study requirements, course dropout or failure in performance can also mean study program dropout, e.g. if the exam cannot be re-taken.

Student dropout rates, not only from specific courses but also from their study programs, are key performance indicators (KPIs) for higher education institutions (Chrysikos et al. 2017; Johnes 2016; Gunn 2018; Weingarten et al. 2019). The significance of these KPIs is evident from the fact that Harvard was dropped from Forbes' ranking of the top ten universities when its retention rate dropped from a three-year average of 98% in 2020 to 90% in 2021 (Whitford 2022). Thus, improvements in socialization may benefit not only students but also universities whose reputations are influenced by their KPIs.

Research evidence shows poor student socialization predicts dropout: students who are less socially and academically integrated in higher education are more likely to drop out (Neugebauer et al. 2019). This aligns with earlier research which suggests that socialization is an important factor in predicting higher education dropout (Spady 1970; Tinto 1975, 1988; Bean 1985; Allen and Nelson 1989; Stage 1989), as well as with more recent studies (Bernardo et al. 2016; Müller and Klein 2022). Students' sense of belonging plays an important role for them to persist or not (Hausmann et al. 2007), and is therefore a crucial aspect of socialization that could impact dropout rates. This suggests that the relationships component of socialization could have an impact on course dropout. But equally, the role and organization components may affect course dropout: if students do not fulfil their tasks in their role as participants in that specific course, or if they do not get to know the formal and informal aspects of the organization (e.g. when the registration for the exam is due), this may explain why students do not even take the exam and subsequently dropout.

A prominent difference between higher education from 2020 onwards, compared with earlier times, is that the majority of teaching and learning has become digitally supported; additionally, during the pandemic, nearly all delivery shifted online. Hence, it is necessary to consider that the characteristics inherent to the online setting may influence the various components of socialization and, subsequently, impact academic performance and course dropout.

1.3 Research questions

The purpose of this case study is twofold:

First, we ask: How and to what extent does the level of socialization—across the three domains of newcomer students' socialization (role, relationships, organization)—change during the second COVID-19 online semester (RQ1)? Based on previous research on socialization into workplaces under non-pandemic conditions (Kammeyer-Mueller et al. 2013), we would normally anticipate students' learning to have increased over the course of the semester across all three components of socialization. Thus, by the end of the semester, students would have better understood their role as students, gotten to know their peers, and learnt more organizational norms compared to the first measurement. Yet, due to the restrictions imposed by emergency online learning, it seems very likely that the socialization process has been negatively impacted. We specifically assume that the relationships domain might be most affected by emergency online learning and lockdown measures compared to the other two components, since the main goal of these measures was to reduce social contact.

Second, we ask: To what extent does the level of change—across the three components of socialization—predict student academic performance and course dropout during the second COVID-19 online semester (RQ2)? Under non-pandemic conditions, previous research indicates that all three components of socialization (role, relationships, organization) should positively predict academic performance (Robbins et al. 2009) and negatively predict course dropout (Neugebauer et al. 2019). However, as suggested above, in the context of emergency online learning conditions, there is a possibility that the outcomes could differ, particularly with regard to the importance of the relationships component, which is likely to be affected by the lockdowns.

2 Methods

2.1 Sample and procedure

The study investigates a cohort of newcomer students in a B. A. Educational Studies program in a large German university who were enrolled in a course on empirical research methods during the second semester with emergency online learning during the COVID-19 pandemic (winter semester 2020/2021). The study was non-interventional and took place in accordance with the university's privacy and ethics policies. Hence, no ethical approval was required. Participation was voluntary and could be declined without providing a reason.

A total of $N=137$ students (all participants of the course) contributed data to this case study. For most students (85%), this was their first semester at university. Among the participants, 87% were female and the average age was 21.17 years (SD = 2.96). Due to the pandemic, the start of the winter semester 2020/2021 was postponed to November 2nd. From semester week 1 (T1) to week 5, social gathering in public spaces and even on private properties was only permitted with members

of one's own household and members of one other household for a maximum of ten people. From semester week 6 (December 9th), the state of emergency was declared. At universities, there were no in-person events taking place until March 2021, except for practical training sessions, along with events in special laboratories or workspaces, provided a minimum distance of 1.5 meters was maintained. For our student cohort, this meant that the whole course took place online and there were no physical meetings within the study program. Casual conversations between peers that would naturally occur in on-site lectures could not take place. Therefore, social interaction between our newcomer students of winter semester 2020 was largely restricted to online contact.

The 12-week course on empirical research methods was designed as an online course following the online inverted classroom concept (Tolks et al. 2021). It was delivered as a lecture, one part of which consisting of asynchronous online lecture videos, online exercises (mostly multiple-choice questions supporting student self-assessment), and an online discussion forum, which was used primarily to interact with the instructors. The other part consisted of synchronous videocall sessions. In these sessions, students discussed and completed more complex exercises under the guidance of the lecturers. In addition, there was an initial live session in week 1 to introduce the course and three live sessions (weeks 5, 8, and 12), in which students could ask questions about the online lecture videos.

Data collection started at the beginning of the first session in week 1 (T1) and was continued in the synchronous videocall sessions in weeks 8 (T2) and 12 (T3). In these sessions, surveys were conducted online via the sosci-survey website (Leiner 2019). Following informed consent, participants answered demographic questions (age, gender) and responded to socialization questions. A unique identifier was used to link responses to each other and to outcomes (academic performance and course dropout). Total participation took about 2–3 min per session.

2.2 Measures

2.2.1 Student socialization

Student socialization was measured using an adapted version of the Newcomer Understanding and Integration Scale (Cooper-Thomas et al. 2020). The scale assesses newcomer socialization using 15 items covering the three components of role, relationships, and organization. The items were adapted from their original workplace context, and translated into German, to represent higher education students' socialization in their role as students (e.g., "I understand how to complete the tasks that make up my studies"), their relationship with peer students in the course (e.g., "My relationships with other peers in this course are very good"), and their socialization in the specific course as an equivalent to organization (e.g., "I am familiar with the unwritten rules of how things are handled in this course"). Students rated their agreement with these statements on a Likert scale from 1, *strongly disagree*, to 7, *strongly agree*. One of the items assessing socialization relationships component ("I believe most of my peer students like me") was not used in the first measure-

ment because the students had not had significant contact before and, therefore, the item was unlikely to provide a valid measurement.

As shown in Table 1, all components showed acceptable to good internal consistencies across all measurement time points. For a complete list of original items, adaptation to the university context, and German translation, see the Open Science Framework repository for this work (https://osf.io/p3zw2/?view_only=af97ead941f24341902f3cbcfab57575).

2.2.2 Performance

We evaluated student performance using 30 multiple choice questions, each with four answer choices of which only one was correct. For each correctly chosen answer, the students received one point. We chose to construct a test that covers a broad range of knowledge areas taught in the course and does not necessarily aim for the unidimensionality or high internal consistency of the items, since our goal was to capture a realistic and comprehensive picture of domain knowledge. Therefore, the overall performance variable was built using the sum score.

2.2.3 Course dropout

All students who were enrolled in the course but did not take the final exam were considered course dropouts, given also that they had no additional chance to complete the course and achieve a grade.

2.3 Statistical analysis

To test for changes in student socialization over time (RQ1), we conducted repeated-measures analyses of variance that modeled changes in mean socialization for each aspect (role, relationships, organization) separately (effect at time point). In the case of a significant main effect, we conducted Tukey-corrected post-hoc tests to determine the specific mean differences. Data preparation and analyses to investigate RQ1 were conducted in R 4.0.2 (R Core Team 2020). In accordance with common practices in the modeling of longitudinal data, we have chosen to consider all relevant paths in our model. This approach is often described as exploratory in the research literature, as it allows for the discovery of previously unknown or unexpected relationships between variables. Our goal is to obtain a more comprehensive understanding of dynamic relationships by including these paths, thereby gaining insights that can contribute to further theory development.

To examine RQ2, the prediction of student performance and course dropout by student socialization, we modeled student socialization in a fully-crossed autoregressive path mode. This was appropriate since our sample size was too small for a complex structural equation model. In this auto-regressive model, each measure of socialization at T_{n+1} is predicted by all measurements of socialization at time T_n to account for pre-existing individual differences in socialization. In addition, constructs were assumed to be correlated within a time-point. Performance and course

dropout are predicted by socialization across the three components at T3, controlling for levels of each socialization domain at previous time points.

In our model, we control for previous manifestations of the three socialization factors (role, relationship, organization) to capture the dynamic nature of students' social integration over time. This approach is crucial for understanding changes in socialization and how these changes influence academic performance and dropout. The control for previous manifestations in our model serves two important purposes: First, by incorporating previous manifestations of socialization factors, we can account for individual differences in socialization at the beginning of the study. This is important because students with different initial levels of socialization may respond differently to the challenges of online learning during the pandemic. Second, controlling for previous manifestations allows us to better understand the development of socialization over time. By considering how previous manifestations of socialization factors influence subsequent manifestations, we can capture dynamic changes in socialization that are crucial for understanding their impact on academic outcomes.

As course dropout is an ordered categorical variable, a pseudo-R^2 is computed as an indicator of prediction quality (McKelvey and Zavoina 1975). Model fit is determined by conducting chi-square tests as well as the Comparative Fit Index (CFI) and Root Mean Square Error of Approximation (RMSEA). Full Information Maximum Likelihood (FIML) generally provides a more efficient handling of missing data in continuous data structures, yet FIML is not possible in MPlus for models with categorical dependent variables (i.e. course dropout in our case); therefore, we opted for pairwise deletion to exclude missing values. Path analyses were performed using MPlus 8.5 (Muthén and Muthén 1998–2017).

3 Results

3.1 RQ1: Changes in newcomer students' socialization

To examine RQ1, we compared average socialization for the three components across the three time points. Table 1 shows the descriptive statistics, correlations, and internal consistencies for all variables.

Socialization in the role component increased over time ($F_{2,102} = 6.5$; $p = 0.002$; $\eta^2 = 0.52$) with a significant increase from T1 to T2 ($p_{Tukey} = 0.036$) but no substantial increase from T2 to T3 ($p_{Tukey} = 0.587$). Also, socialization in the organization component increased ($F_{2,102} = 10.1$; $p < 0.001$; $\eta^2 = 0.05$) with a significant increase from T1 to T2 ($p_{Tukey} < 0.001$) but no substantial increase from T2 to T3 ($p_{Tukey} = 0.961$). Socialization for the relationships component did not increase over time ($F_{2,102} = 2.4$; $p = 0.094$; $\eta^2 = 0.02$). Thus, while the organization and role components increased, the relationships component showed no increase.

3.2 RQ2: Students' socialization predicting performance and course dropout

To investigate RQ2, whether student socialization predicts performance and course dropout, we modeled the development of socialization in a fully-crossed autore-

Table 1 Descriptive statistics and manifest correlations for all variables[a]

Variable	M	SD	1	2	3	4	5	6	7	8	9
(1) Role T1	4.64	1.03	(0.78)	–	–	–	–	–	–	–	–
(2) Role T2	4.70	0.90	**0.46**	(0.77)	–	–	–	–	–	–	–
(3) Role T3	4.84	0.97	0.18	**0.54**	(0.96)	–	–	–	–	–	–
(4) Relationships T1	5.00	1.26	**0.34**	**0.24**	0.12	(0.78)	–	–	–	–	–
(5) Relationships T2	4.90	1.19	**0.26**	**0.32**	0.03	**0.46**	(0.90)	–	–	–	–
(6) Relationships T3	5.06	1.07	0.08	0.22	0.23	**0.50**	**0.70**	(0.96)	–	–	–
(7) Organization T1	3.91	1.10	**0.47**	**0.33**	0.20	**0.27**	**0.37**	0.12	(0.75)	–	–
(8) Organization T2	4.21	1.07	**0.38**	**0.50**	**0.54**	0.18	**0.23**	0.17	**0.48**	(0.76)	–
(9) Organization T3	4.38	1.28	0.19	**0.41**	**0.65**	0.10	0.12	**0.23**	**0.53**	**0.73**	(0.92)
(10) Performance	17.06	4.80	0.12	0.13	-0.04	0.15	0.14	0.18	0.01	0.11	0.02
(11) Course Dropout	0.14	0.35	-0.03	-0.07	0.08	-0.11	-0.13	-0.04	-0.12	-0.12	-0.13

Course dropout is coded with 1 for "course dropout" and 0 for "retention"

M Mean, *SD* Standard deviation, *Tx* time point x

[a]McDonald's Omega is given on the diagonal for all scales; there were no students with both performance and course dropout data, so no correlation is computed
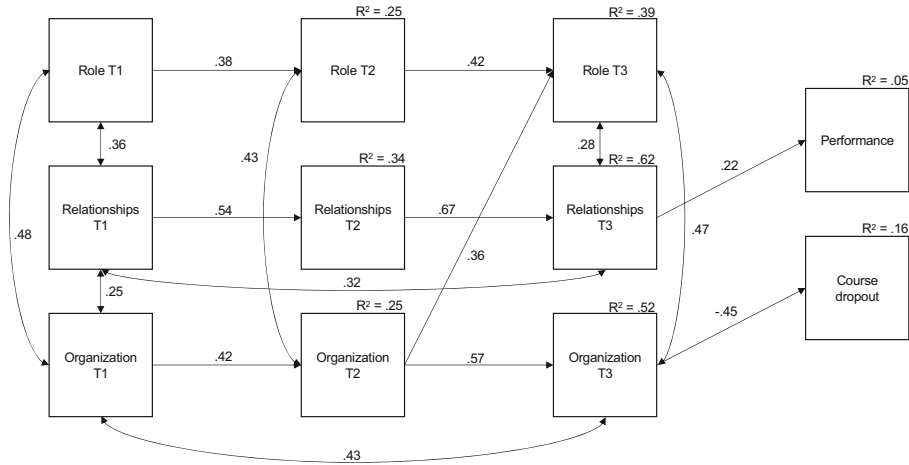
Fig. 1 Autoregressive model of socialization predicting performance and course dropout. Only significant paths are provided (see above for a description of all paths tested)

gressive model, with socialization components at T3 (adjusted for prior levels of socialization) predicting both outcomes. Figure 1 illustrates the final model, showing significant paths and effect sizes. Individual differences within socialization were fairly consistent across the three measurement time points for all components, as indicated by the medium to large effects in predicting subsequent measures (i.e., T2 regressed on T1 and T3 regressed on T2). In particular, consistency increased with stronger relations between T2 and T3 than between T1 and T2. The only cross-component relationship was found at T2, with the T2 organization component positively predicting the T3 role component ($\beta = 0.36$; $p = 0.002$).

Of the three components, only the relationships component predicted student performance ($\beta = 0.22$; $p = 0.038$; $R^2 = 0.05$) with a higher level of the relationships component being associated with better performance. Course dropout was only predicted by the organization component of socialization ($\beta = -0.45$; $p < 0.001$; $R^2_{pseudo} = 0.16$) with a higher level of the organization component associated with a lower likelihood of course dropout. The final model fits the data very well ($X^2 = 9.96$; $df = 18$; $p = 0.933$; CFI $= 1.00$; RMSEA < 0.001).

4 Discussion

The purpose of this study was twofold: First, to examine the development of a cohort of newcomer students' socialization during their first semester during emergency online learning and, second, to empirically examine associations between socialization components and performance and course dropout during emergency online learning.

First, a comparison of the three measures across the semester supports the assumption that the development of socialization during emergency online learning is complex and that the developmental trajectories of the three socialization components differ. As expected, both *role* and *organization* components showed an increase

from T1 to T2. Notably, the *organization* component's increase was sharper than that of *role*, suggesting a more rapid assimilation of the university's norms and values during the early phase of the semester. Although mean scores increased from T2 to T3, this rise did not achieve statistical significance, suggesting that the development of both components may have stabilized during this interval. By T2, it appears students had attained a level of *role* and *organization* that was relatively consistent, with any further evolution being subtle and less consistent across individuals, and thus did not manifest in significant statistical changes. The progression pattern observed—marked initially by a sharp increase and then a more gradual, non-significant increase—resonates with the notion of a steep learning curve that levels out, reflecting heightened interest and engagement as individuals initially grasp the unwritten norms and values of the university and course expectations. Yet, as the semester moves forward and familiarity grows, the pace of socialization slows and becomes less marked. The observed progression can be attributed to the structure of the lecture. The sharper increase in the *organization* component could be explained by the introductory phase, which establishes the course's fundamental norms and values. From T2 to T3, the plateau in *role* suggests students may have been focusing on exam preparation, having already integrated their *role* understanding. These findings indicate that the socialization process in an online lecture with a final exam might be more intense at the outset, as students navigate new expectations, and then tends to consolidate.

It is notable that across all time points, the *relationships* component did not increase. Instead, *relationships* remained at a moderate level over time (on the 7-point scale, the mean was about 5 = "approximately slightly agree"). This can be explained by the lack of face-to-face-opportunities due to the pandemic lockdown, but it also suggests that emergency online learning without a specific design to encourage social interaction did not foster the development of student peer relationships.

Second, moving to prediction of outcomes, an autoregressive correlation model provided evidence that academic performance during emergency online learning is best predicted by the degree of socialization in the relationship component. Thus, students who were able to establish satisfying and effective relationships with other students were more likely to perform well academically. This finding, together with the results of the first research question that the relationship component did not increase over the course of the semester, supports the importance of instructionally designing for collaborative interactive learning processes (Chi and Wylie 2014; Chi et al. 2018), especially in online settings and when higher education students have no opportunities to meet each other physically such as in regular distance education. Collaborative interactive learning processes have been shown to positively impact academic performance and are more likely to occur among students who trust one another (Barczak et al. 2010). It also confirms the findings of Di Malta et al. (2022), who found a positive relationship between social connectedness and academic performance.

In contrast, course dropout was best predicted by the organization component. This finding suggests that students who have difficulty understanding the norms and rules of the university are more likely to drop out of the course. Since we did not find that the emergency online learning situation was especially harmful for the

development of the *organization* component, this finding points to a satisfactory implementation of organization-related information for the students, so that they did get to know the values and unwritten rules of the university (e.g. via online materials, lectures or synchronous meetings). Dropout was not predicted by either the *role* or *relationships* components, indicating that, despite the shift to online learning, these factors did not significantly influence their decision to drop out. Even if they may not have fulfilled all their tasks or have not found supportive social contact, they decided to take the exam. We suggest this may be different in a face-to-face setting, where social contact might impact dropout, since students may, through casual interactions, join study groups and exchange ideas about passing or failing the exam and decide together if they take the exam later.

As a limitation, these results relate specifically to a cohort of students in the context of the pandemic-induced online setting. Thus, they need to be interpreted cautiously, especially with respect to any conclusions on causality and transfer to other cohorts and academic contexts. The relatively low R^2 statistics indicate that these three socialization components accounted for a relatively small amount of variance in the outcomes of academic performance and dropout, and therefore other factors may be equally or more important in predicting these outcomes, as well as socialization change. These could include personal circumstances, external stressors, cognitive load, cognitive engagement, adaptivity of learning materials, frequency of social interactions and course-specific characteristics. Another noteworthy limitation of this study relates to the challenge of systematically controlling for the adjustments students made in the emergency online learning setting in comparison to students in regular higher education settings. This limitation arises from the absence of a control group subjected to similar conditions but engaged in face-to-face lectures on campus. Furthermore, the generalizability of our findings is constrained by the case study design with a relatively modest sample size and the homogeneity within the student cohort, all of whom were enrolled in the same program and attended identical lectures. Finally, we recognize the need for a more detailed exploration of non-linear socialization growth. This necessitates the rigorous testing of regression-based analytical models to facilitate a more comprehensive understanding of the dynamics of socialization.

Having acknowledged the limitations of the current study, we next extrapolate beyond it because health pandemics, as well as global climate emergencies, and other unknown future factors may disrupt students' university experiences. Therefore, we aim to leverage our research to suggest ideas that may be useful for the future. First, in order to learn from the current study for future conditions, we ask: How can students be better supported in their socialization process during unanticipated situations that disrupt university learning? Due to the urgent need for a swift response nationwide to mitigate the spread of COVID-19, neither the university nor the academic teaching staff of these classes in 2020/2021 had time to develop resources to compensate the lack of personal contact of students with teaching staff and peers in their first year. Our results indicate that introductory phases at the start of lectures can aid students in enhancing their role and organizational aspect of socialization. However, our approach was not particularly effective in strengthening the aspect of

student relationships. The following suggestions—that also apply for online learning in general—may help students in their socialization processes:

First-year experience program To help improve the "first-year experience" and, in turn, support student performance, we recommend extracurricular socialization training and digitally supported onboarding activities targeting the relationship part of organization, such as livestreams with interactive group chat (Robbins et al. 2009; Schilling et al. 2022). According to our analysis, course dropout can be explained in significant part by the organizational component of socialization which refers to rules and norms specific for the course. To prevent course dropout, introductory courses that address technical tools and organizational practices and norms could be implemented (Gong and Fan 2006; Fan and Wanous 2008; Hua 2015; Edmunds et al. 2021), with this being done equally in online learning environments (Bolliger and Martin 2018; Schilling et al. 2022).

Online communities of practice Communities of practice (Eberle et al. 2014) can help create a supportive framework for interaction and collaboration. Using technology, these online communities of practice could either be comprised of peers only, or of a mixture of teaching staff, tutors, and students. This could be set up to mimic the in-person experience. By fostering a sense of community, universities can support socialization processes (Tucker 2012), so learners will build effective relationships, not only with their peers, but also with staff (Tucker 2012; Balboni et al. 2018). An online community can be achieved, for instance, through peer-mentoring, virtual small-group meetings, online forums, and digital academic advisor sessions (Schilling et al. 2022), and fostered by using student engagement strategies (Bolliger and Martin 2018).

Overall, our findings suggest that, for this cohort of students who predominantly were attending university for the first time during the emergency online setting, it was crucial to receive information early in the course relating to the values and norms of the organization to remain in the course through to taking the exam. Furthermore, a stable social environment proved beneficial for students' academic performance. In the absence of physical presence and casual encounters with peers and academic staff, students who initially had a limited social connection with their peers experienced a disadvantage throughout the semester, achieving poorer results than students who started the course with a more robust social connection. An emphasis on establishing relationships and understanding the organization can enable students achieve better academic performance and lower dropout in online learning.

Data availability The data that support the findings of this study are openly available in the Open Science Framework of the Center for Open Science at https://osf.io/p3zw2/?view_only=0beca6fa847248a1b9186b 9392a48013.

Declarations

Conflict of interest S. Berger, M. Stadler, M. Sailer, J. Eberle, H.D. Cooper-Thomas and K. Stegmann certify that they have no affiliations with or involvement in any organization or entity with any financial interest or non-financial interest in the subject matter or materials discussed in this manuscript.

Ethical standards The study was non-interventional and took place in accordance with the university's privacy and ethics policies. Hence, no ethical approval was required. Participation was voluntary and could be declined without providing a reason.

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