Computers in Human Behavior Reports 16 (2024) 100540

Contents lists available at ScienceDirect

Computers in Human Behavior Reports

journal homepage: www.sciencedirect.com/journal/computers-in-human-behavior-reports

Friendship or feedback? – Relations between computer science students' goals, technology acceptance, use of an online peer feedback tool, and learning

Tuğçe Özbek [a,*], Martin Daumiller [b], Aida Roshany-Tabrizi [c], Tobias Mömke [c], Ingo Kollar [a]

[a] Department of Educational Psychology at the University of Augsburg, Germany
[b] Department of Psychology at the Ludwig Maximilian University of Munich, Germany
[c] Department of Computer Science at the University of Augsburg, Germany

ARTICLE INFO

Keywords:
Peer feedback
UTAUT
Technology acceptance
Achievement goals
Learning
Computer science

ABSTRACT

Computer-supported peer feedback offers great potential to enhance students' learning. Yet, students sometimes do not use computer-supported peer feedback opportunities, which partially can be the result of low technology acceptance. The UTAUT-model specifies performance expectancy, effort expectancy, and facilitating conditions as decisive factors for the intention to use a technology. From a motivational perspective, however, it can be expected that also students' achievement goals have an impact on the intention to use an online peer feedback tool. Therefore, we investigated the effects of learning approach, appearance approach, appearance avoidance, work avoidance and relational goals (besides performance expectancy, effort expectancy and facilitating conditions) on 155 computer science students' intentions and actual use of an online peer feedback tool and their performance in an end-of-course exam. Results of path modelling the longitudinal, student and log-data informed data showed that students' intentions predicted actual use, which predicted exam performance. Learning approach goals positively predicted the intention to use the tool, while performance and work avoidance goals did not predict intentions. Relational goals, however, negatively predicted intentions and end-of-course performance, shedding light on the importance of students' social motivations when using online peer feedback tools in their studies (e.g., peer feedback might be perceived as a social threat). Thus, the results point to the importance of an appropriate framing of online peer feedback tool use in educational settings as a learning opportunity and to reduce students' possible concerns about their social relationships when using online peer feedback tools.

1. Introduction

Peer feedback holds great potential to enhance learning and performance of students: Research indicates a wide range of positive effects of peer feedback on learning processes, for example to enhance writing skills (Baker, 2016; Huisman, Saab, Van Driel, & Van Den Broek, 2018; Nelson & Schunn, 2009; Noroozi et al., 2023; Shang, 2022), improve argumentation skills (Noroozi & Hatami, 2018), and learning performance in general (Double, McGrane, & Hopfenbeck, 2020). In this respect, research suggests that students' knowledge acquisition is more strongly linked to providing feedback rather than receiving it (Yu & Schunn, 2024; Zong, Schunn, & Wang, 2021). In higher education practice, peer feedback is often realized by aid of online tools, as they make it easier to implement peer feedback as a collaborative practice in large lectures (Rodríguez et al., 2022; Shi, 2019).

To exploit the potential benefits of online peer feedback, however, it is necessary for students to actively use such tools. Yet, students often do not use peer feedback tools or do so only with limited engagement (Elizondo-Garcia, Schunn, & Gallardo, 2019; Patchan, Schunn, & Clark, 2018; Usher & Barak, 2018; Zong, Schunn, & Wang, 2022; Zou, Schunn, Wang, & Zhang, 2018). However, it is unclear what learner-related factors are responsible for whether students use or do not use online peer feedback tools, especially when their use is voluntary (rather than mandatory).

To describe learner characteristics that may cause inter-individual differences in the use of online peer feedback tools, we resort to two

* Corresponding author. University of Augsburg, Department of Educational Psychology, Universitätsstraße 10, 86159, Augsburg, Germany.
E-mail addresses: tugce.oezbek@uni-a.de (T. Özbek), martin.daumiller@lmu.de (M. Daumiller), aida.roshany.tabrizi@uni-a.de (A. Roshany-Tabrizi), tobias.moemke@uni-a.de (T. Mömke), ingo.kollar@uni-a.de (I. Kollar).

https://doi.org/10.1016/j.chbr.2024.100540
Received 4 September 2024; Received in revised form 17 November 2024; Accepted 22 November 2024
Available online 28 November 2024

prominent theories. First, according to the Unified Theory of Acceptance and Use of Technology (UTAUT; Venkatesh, Morris, Davis, & Davis, 2003) two key factors influencing the intention to use a tool are the user's *performance expectancy* (i.e., the perception whether using the tool will lead to performance benefits) and *effort expectancy* (i.e., the perception of how much easiness is associated with the use of the tool). Second, besides such expectancy beliefs, also the values that students associate with peer feedback might matter for motivating them to use online peer feedback tools. Specifically, from the perspective of expectancy-value theory (Wigfield & Eccles, 2000), students' achievement goals can be expected to influence the intention to use online peer feedback tools (Daumiller, 2023; Elliot, 2005; Senko & Harackiewicz, 2005). The reasoning behind this assumption is that peer feedback is a key achievement context that entails demonstrating one's own and evaluating peers' competences, which may lead to positive or negative outcomes (Elliot, 1999). As prior research indicates, such processes are significantly influenced by students' achievement goals, which have been shown to shape the way individuals interpret and act in achievement situations (Elliot, 2005; Elliot & Hulleman, 2017; Hulleman, Schrager, Bodmann, & Harackiewicz, 2010): When using an online peer feedback tool, especially learning approach, appearance approach, appearance avoidance, work avoidance, and relational goals of students can be expected to have an impact on how and to what extent students make use of the tool. However, research exploring how different achievement goals of learners impact the acceptance and use of online peer feedback tools is still rare. The present study therefore analyzes how these different achievement goals (alongside with the UTAUT-related constructs "performance expectancy", "effort expectancy", and "facilitating conditions") relate to computer science students' intentions to use online peer feedback tools, their actual use, and their end-of-semester exam performance.

2. Students' technology acceptance regarding online peer feedback tools

Despite various potential benefits of peer feedback, research indicates that some learners are skeptical about peer feedback as a learning method, which may in turn decrease their readiness to use online peer feedback tools (Jongsma, Scholten, van Muijlwijk-Koezen, & Meeter, 2023; Kerman, Banihashem, & Noroozi, 2023). For example, students may distrust their peers' ability to provide valuable feedback (Kaufman & Schunn, 2011), feel discomfort about acting like a teacher (Azarnoosh, 2013), or find the comments of their peers not useful (Tsui & Ng, 2000). Generally speaking, attitudes towards peer feedback include all positive or negative perceptions and feelings that students have regarding this method (Kerman et al., 2023). These can, for example, pertain to the perceived usefulness (Harks, Rakoczy, Hattie, Besser, & Klieme, 2014; Kerman, Banihashem, Noroozi, & Biemans, 2022), or perceived learning (Lin, 2018; Noroozi & Mulder, 2017).

Previous research points to the importance of such perceptions and attitudes towards peer feedback (Kerman et al., 2023). For example, Zou et al. (2018) found that gender, academic background, and prior experience with peer feedback influence students' participation in online peer feedback. Moreover, they identified three distinct attitude factors that are relevant in this regard: positive attitude (i.e., approval of beneficial effects of peer feedback in general), interpersonal negative (i.e., concerns regarding negative effects on interpersonal relationships), and procedural negative (i.e., doubts about the reasonableness of the peer feedback process). Contrary to the authors' expectations, a negative view of interpersonal effects led to higher participation, while a positive attitude resulted in lower participation, potentially because students with a positive view invested more effort into fewer, high-quality reviews than many superficial ones. Therefore, the study provides evidence for the importance of attitudes towards peer feedback processes on students' participation in online peer feedback practices.

When peer feedback is realized by aid of online tools, a particular kind of attitude that may be relevant for whether and how students engage in peer feedback processes is students' *technology acceptance*. A prominent model to conceptualize technology acceptance is the Unified Theory of Acceptance and Use by Venkatesh et al. (2003, 2016). According to UTAUT, performance expectancy, effort expectancy and facilitating conditions are decisive for the intention to use digital tools, which in turn is assumed to predict the actual use of a tool. *Performance expectancy* describes the user's perception that using the tool will help them achieve performance benefits. For students, for instance, this might refer to the belief that the use of an online peer feedback tool will promote their learning. *Effort expectancy*, in contrast, describes the perception of how much easiness is associated with the use of the tool. For example, this might be a student's perception whether the online peer feedback tool has an intuitive user interface. Further, *facilitating conditions* describe the user's perception of the extent to which there is a supportive infrastructure for the use of the tool. This may, for instance, include the student's perception that assistance is available in case of technical problems. Furthermore, according to UTAUT, the *intention to use* a tool is assumed to predict the actual use of the tool (Dwivedi, Rana, Jeyaraj, Clement, & Williams, 2019; Venkatesh et al., 2003).

A central assumption of the model is that performance expectancy and effort expectancy predict the intention to use technology. This relation was empirically supported in many studies (e.g., some of which have utilized similar constructs, such as perceived usefulness and perceived ease of use of the original Technology Acceptance Model/TAM; Davis, 1989), which have been used in place of performance expectancy and effort expectancy, respectively (e.g., Al-kfairy, Ahmed, & Khalil, 2024; Dwivedi, Rana, Chen, & Williams, 2011, 2019; Or, 2023; Venkatesh et al., 2003, 2016). While the TAM primarily focuses on Perceived Usefulness (i.e., Performance Expectancy) and Perceived Ease of Use (i.e., Effort Expectancy) as key predictors, the UTAUT represents an extension of TAM. This is because UTAUT broadens the scope by incorporating additional factors, such as Facilitating Conditions, which encompass organizational structures and other contextual elements influencing technology usage, thereby ensuring a more comprehensive approach and higher predictive power (Venkatesh et al., 2003). For this reason, we used the UTAUT and its corresponding variables in the context of this study.

While in the original model, facilitating conditions were a predictor of actual use, some studies also suggest that this perception predicts the intention to use (Or, 2023; Venkatesh, Thong, & Xu, 2016). Regarding the prediction of actual use by the intention to use, however, it is often criticized that previous studies rarely capture actual use and only assess the intention to use (Dwivedi et al., 2011; Venkatesh et al., 2016) and/or fails to find significant effects of intention to use on actual use (Nistor, 2014). Thus, the present study also aims to address this research gap.

Although technology acceptance models have been extensively researched and applied across various contexts and with reference to a broad range of different kinds of technologies, there are relatively few studies that specifically investigate students' technology acceptance of online peer feedback tools. For example, some research has focused on the perceived usefulness of peer feedback itself (e.g., Kerman et al., 2023), while other studies examined different constructs, such as attitude (Zou et al., 2018). Additionally, some studies only addressed single components of technology acceptance, like perceived usefulness and perceived ease of use (Kuo, Chen, Chu, Yang, & Chen, 2017), rather than the model in its entirety.

Besides, studies on attitudes towards online peer feedback tools are also criticized for often not examining the consequence of the attitude, that is, the actual participation in the peer feedback process (Zou et al., 2018). Given that research on technology acceptance also points to differences depending on the type of technology (Šumak, Heričko, & Pušnik, 2011), it seems worthwhile to examine the applicability of the UTAUT to online peer feedback tools. Further, incorporating the actual use of the online peer feedback tool may simultaneously address a critical issue identified within two distinct theoretical fields: the gap

between intention to use a tool and actual use highlighted in technology acceptance models (Dwivedi et al., 2011; Nistor, 2014), and the attitudes toward usage and participation specific to peer feedback tools (Zou et al., 2018). Additionally, in the field of educational technology, performance of learners is often considered as a result of the actual use of a tool. While existing research on online peer feedback also explores its impact on various performance indicators (Huisman, Saab, van den Broek, & van Driel, 2019; Jongsma et al., 2023), studies often seem to lack an objective, long-term assessment in a real educational context of tool use instead of self-reported use (Zou et al., 2018).

3. Achievement goals as a factor influencing technology acceptance and learning regarding the use of online peer feedback tools

Even though the UTAUT model has been expanded by many different factors, some research suggests that UTAUT might not fully cover the factors contributing to technology acceptance and use and that it does not sufficiently incorporate individual learner characteristics in its explanation of users' behavior (Dwivedi et al., 2019; Teo, Moses, Cheah, Huang, & Tey, 2023). As described, when looking at technology acceptance from an expectancy-value perspective (Wigfield & Eccles, 2000), it is conceivable that, in addition to users' expectations, their goals may also influence the intention or actual use (as a value component).

Achievement goals describe "the purpose for engaging in competence-relevant behavior" (Elliot & Hulleman, 2017, p. 44), providing an established motivational framework to conceptualize how learners interpret, experience and act within achievement contexts (Dweck, 1986; Elliot & Hulleman, 2017). During peer feedback, learners can acquire competencies, and these competencies become visible in the social learning situation and subject to evaluation by their peers. Moreover, learners directly observe and assess the competencies of their peers during peer feedback. This renders peer feedback a critical achievement situation in which not only goals focused on academic competence, but also goals focused on social competence come into play.

Commonly accepted among achievement goal theorists is a distinction between mastery approach, performance approach and performance avoidance goals. Mastery goals particularly focus on the fulfillment of tasks and the development of competencies (Elliot, Murayama, & Pekrun, 2011). Given that learning processes are particularly important in the context of peer feedback, the present study focuses on the latter aspect and refers to these as *learning approach goals*, describing the students' striving to develop their competencies during the peer feedback process (see Daumiller, Dickhäuser, & Dresel, 2019). Performance goals, instead, describe the focus on one's own performance in comparison with others and in the perception of others (Ames, 1992; Korn, Elliot, & Daumiller, 2019). In the present work, for increased clarity we focus on the perception by others as this is focally how one's competence is validated during peer feedback (definition of performance goals as appearance/demonstration goals, see Chung, Bong, & Kim, 2020; Daumiller et al., 2019; Grant and Dweck, 2003; Senko & Dawson, 2017). This end-state of (favorable or unfavorable) competence appraisal can be approached *(appearance approach goals*: goal to appear competent) or avoided (*appearance avoidance goals*: goal to avoid appearing incompetent). There are also two additional types of goals that come into play in achievement contexts, especially in contexts like peer feedback that are social and voluntary. Individuals pursuing *work avoidance goals* (the goal to get through the day with little effort) aim for minimal completion standards, and tend to avoid challenging tasks whenever possible (King & McInerney, 2014). During peer feedback processes, this could, for example, mean a general avoidance of participation. Lastly, *relational goals* are goals to strive for meaningful relationships with relevant others. As described above, such a social motivation might matter directly for students' behavior in social contexts such as peer feedback.

Despite the reasonable assumption that achievement goals play a significant role in engagement with online peer feedback tools, research in this regard still remains limited, not only regarding online peer feedback processes, but also in online learning in general (Daumiller, Rinas, & Dresel, 2023). Therefore, it is crucial to determine whether current findings are transferable to the intention to use peer feedback tools and to better understand the relationships of the two constructs, i.e., achievement goals and students' technology acceptance regarding online peer feedback tools. In the following, we specifically shed light on learning approach, appearance approach, appearance avoidance, work avoidance, and relational goals as influencing factors on the intention to use an online peer feedback tool and learning.

3.1. Learning approach goals and online peer feedback

Given that learning approach goals describe the learners' ambition to develop their competencies (e.g., Hulleman et al., 2010), it seems reasonable that these might be associated with an increased participation in *voluntary* peer feedback processes in order to learn through the completion of tasks as well as the provided feedback from peers. There is substantial evidence indicating that learning approach goals are linked to favorable learning outcomes. For example, meta-analyses suggest that they enhance task performance (Van Yperen, Blaga, & Postmes, 2015) or academic achievement (Huang, 2012). Also, there are studies that suggest positive effects of learning goals on digitally supported learning processes. For example, a study by McGloin, McGillicuddy, and Christensen (2017) indicates that learning approach goals of students are positively associated with on-task usage behaviors, i.e., the use of educational technology that might help students to achieve their educational goals (McGloin et al., 2017). Another study by Bernacki, Byrnes, and Cromley (2012) also indicates that learning approach goals predict the use of beneficial features of educational technology. For instance, Xie and Huang (2014) investigated effects of students' achievement goals on participation and perceived learning in asynchronous online discussions in an online course. They found that learning goals positively predicted perceived learning and participation of students (Xie & Huang, 2014). A study by Yeh et al. (2019) also examined the effect of college students' achievement goals in various online courses on their expected online learning outcome and supportive online learning behaviors. The results showed that learning approach goals predicted supportive online learning behaviors in an online course. Those, in turn, predicted students' expected academic outcome (Yeh et al., 2019). In the context of peer feedback processes, it might also be beneficial to draw upon research on help-seeking of students, as these behaviors can be considered similar to the dynamics of peer feedback, where learners actively seek or are provided with assistance from their peers as both, a form of a learning strategy and social interaction (Roussel, Elliot, & Feltman, 2011). In this regard, a study by Hao, Barnes, Wright, and Branch (2017) investigated the effects of learning approach, learning avoidance, performance approach and performance avoidance goals of students on online help seeking of computer science students. Yet, the results showed no significant associations of the goals with help seeking (Hao et al., 2017). Thus, it seems questionable whether research on learning approach goals can be applied to peer feedback processes.

3.2. Appearance approach and avoidance goals and online peer feedback

Appearance approach and appearance avoidance goals refer to students' striving to demonstrate their competencies, or to avoid being perceived as incompetent, respectively. For this reason, it seems conceivable for appearance approach goals to be associated with positive effects on the participation in peer feedback processes, as students are interested in demonstrating their competencies towards their peers and therefore could use the tool more intensively or put more effort into

its use. Appearance avoidance goals, in turn, might lead students to not participate in the peer feedback process at all to avoid the risk of being perceived as incompetent.

Regarding research about performance goals in general, which include appearance approach and appearance avoidance goals, meta-analyses indicate that performance approach goals are associated with positive effects on (task) performance (Van Yperen, Blaga, & Postmes, 2014, 2015) and academic achievement (Huang, 2012). In line with this, a study by Holzer, Bürger, Lüftenegger, and Schober (2022) indicates that appearance approach goals display positive associations with engagement and perseverance (Holzer et al., 2022). In addition, a meta-analysis by Huang (2012) demonstrates that avoidance goals are associated with lower academic achievement. Yet, in terms of digitally supported learning processes, there is only little research on the effects of appearance goals or performance goals on digitally supported learning processes (Daumiller, Rinas, & Dresel, 2023). In the previously mentioned study by Bernacki et al. (2012), performance approach goals did not predict the use of beneficial features of educational technology, while performance avoidance goals functioned as a negative predictor. In the study of Yeh et al. (2019), performance goals were not associated with supportive online learning behaviors in online courses. Moreover, the study by Xie and Huang (2014) revealed that performance approach goals were not associated with perceived learning or participation in asynchronous online learning classes, performance avoidance goals had negative effects on perceived learning and non-posting participation (i.e., number of times logged in without posting). Finally, in terms of students' help seeking, a study by Yang and Cao (2013) revealed that performance approach goals may function as a positive predictor of help seeking in e-learning among online college students.

3.3. Work avoidance goals and online peer feedback

Work avoidance goals seem likely to be negatively associated with the participation in peer feedback processes. However, relative to the previously mentioned goals, work avoidance goals have received comparatively less attention in research (Daumiller, 2023; King & McInerney, 2014). Overall, the effects of work avoidance goals on learning processes of students appear to be predominantly negative (Daumiller, 2023; King & McInerney, 2014), as they have been shown to negatively predict students' achievement (Harackiewicz, Barron, Carter, Lehto, & Elliot, 1997; King & McInerney, 2014; Nicholls, Patashnick, & Nolen, 1985), and engagement (King & McInerney, 2014). Considering the use of online peer feedback tools, it therefore seems reasonable to infer that students with strong work avoidance goals would probably have a lower intention and actual use of a peer feedback tool compared to students with less pronounced work avoidance goals.

3.4. Relational goals and online peer feedback

Since relational goals describe the learners' aspiration to build close relationships with others, quite different mechanisms might come into play during the peer feedback process. On the one hand, they might function as approach goals (Butler, 2012; Butler & Shibaz, 2014) and lead students to use online peer feedback tools more actively in order to build (close) relationships with their peers. On the other hand, students may find themselves in a socially uncomfortable situation, for example, when criticizing the work of their peers or when getting criticized themselves (e.g., Baruah, Ward, & Jackson, 2017), and therefore might avoid engagement. Similar to work avoidance goals, relational goals also received relatively little attention in previous research (Daumiller, 2023). In academic settings, Roussel et al. (2011) distinguish between friendship approach (e.g., trying to deepen relationships with friends; evoking positive thoughts and feelings in relationships) and friendship avoidance goals (e.g., trying to avoid disagreements and conflicts with friends; threat appraisals, self-protective withdrawal) and investigated their effects on senior high school students' perceived costs of help seeking and instrumental help seeking. Interestingly, friendship approach goals had a positive direct effect on instrumental help seeking, whereas friendship avoidance goals had a negative direct effect on instrumental help seeking. Moreover, friendship approach goals negatively predicted perceived costs of help seeking and friendship avoidance goals positively predicted perceived costs of help seeking. Perceived costs of help-seeking, in turn, negatively predicted instrumental help seeking. Therefore, the results point to positive or negative associations of relational goals on students' help seeking depending on its focus on deepening relationships or avoiding threats for the relationships (Roussel et al., 2011). In addition, the perceived costs of help seeking also differed depending on the presence of friendship approach or friendship avoidance goals. In other words, the students' perception of help seeking as beneficial or threatening for relationships appears to be decisive for their actual help seeking.

There are also other indications of adverse effects associated with relational goals. For instance, in a study by Daumiller, Fritz, González Cruz, C. Rudert, & Janke (2023), social goals (i.e., aims to build meaningful relationships with peers) predicted academic second-party cheating (i.e., supporting peers in cheating; Daumiller et al., 2023). This might indicate that students, in favor of social goals, may also ignore institutional rules (Ashworth, Bannister, Thorne, & Unit, 1997). In this regard, Urdan and Maehr (1995) illuminate how the need for affiliation may conflict with, surpass or even stand in opposition with the need for achievement. In addition, the study by Hao et al. (2017) revealed that computer science students significantly more frequently searched online for help-seeking purposes than they asked teachers, peers or unknown experts online, possibly indicating a reluctance of the students to ask their peers for help. When comparing online and offline interactions in general, research indicates that young adults perceive online interactions with their friends as more controllable and accessible, yet less intimate and meaningful as face-to-face interactions (Scott, Stuart, & Barber, 2022).

Therefore, overall, research indicates a rather mixed picture for the influence of relational goals on learning processes and highlights the need for further research (King & Watkins, 2012). Considering prior research on peer feedback has revealed students' concerns regarding their friendships (Azarnoosh, 2013; Topping, 2003), challenges of and hesitation towards providing criticism (Baruah et al., 2017), or the adoption of a teacher-like role (Azarnoosh, 2013; as opposed to a role equivalent to their peers; Urdan & Maehr, 1995), it seems conceivable that students' strong relational goals may have a negative association with the intention and actual use of online peer feedback tools.

3.5. A heuristic model on the relations of achievement goals and technology acceptance in online peer feedback processes

In summary, the current state of research suggests that learning approach goals exhibit stronger positive associations with achievement, performance and engagement in comparison to performance approach goals and performance avoidance goals (Holzer et al., 2022; Huang, 2012; Van Yperen et al., 2014, 2015). Yet, performance approach goals also show positive associations with achievement and performance (Huang, 2012; Van Yperen et al., 2015). Additionally, appearance approach goals display positive associations with engagement (Holzer et al., 2022). Concerning avoidance goals in general and appearance avoidance goals in particular, a relatively mixed picture emerged. Yet, meta-analytic findings suggest a negative association with achievement (Huang, 2012; Van Yperen et al., 2015). Considering online peer feedback tools as technologies that provide a learning opportunity, it is plausible to suggest learning approach and appearance approach goals might be positively related to both the intention to use and the actual use of online peer feedback tools. Similarly, drawing from meta-analytic findings, a negative association might also be presumed between appearance avoidance goals and both the intention to use and the actual use of online peer feedback tools. It further seems reasonable to assume

that students with strong work avoidance goals, since they want to minimize their effort (e.g., King & McInerney, 2014), would probably display a lower intention to use and online peer feedback tools and also use them less often than students with low levels of work avoidance goals. Regarding students' relational goals, there is evidence for both, potentially positive and negative effects (Roussel et al., 2011). Yet, given a rather unique situation in peer feedback processes and concerns of students (Baruah et al., 2017; Topping, 2003; Urdan & Maehr, 1995), it seems reasonable to assume negative associations of relational goals with learners' intention to use and actual use of online peer feedback tools.

Overall, there are indications that these findings can generally be applied to the use of educational technology (e.g., Bernacki et al., 2012; McGloin et al., 2017; Xie & Huang, 2014; Yeh et al., 2019), but there are also some indications of missing effects in digitally supported learning processes (e.g., Daumiller, Rinas, & Dresel, 2023; Hao et al., 2017; Xie & Huang, 2014). So far, however, there are no studies that examine the effect of specific achievement goals on the technology acceptance and use of online peer feedback tools. To explore the aforementioned assumptions, our study investigated the impact of learning approach, appearance approach, appearance avoidance, work avoidance, and relational goals on the intention to use and the actual use of a peer feedback tool and students' exam performance.

4. Research questions and hypotheses

Previous research on online peer feedback indicates beneficial effects of such tools on learning in various contexts. However, these studies often do not account for the extent to which students actually use online peer feedback tools. Additionally, the use of the tool might be significantly influenced by learners' achievement goals, but this aspect has not been investigated yet. Furthermore, the UTAUT can serve as a useful model to explain the use of peer feedback tools. For this reason, the present study combines UTAUT with learners' achievement goals (i.e., learning approach, appearance approach, appearance avoidance, work avoidance and relational goals) as influencing factors on students' intention to use an online peer feedback tool. Moreover, within the natural setting of a course of computer science students on a mathematical topic, we explore whether the use of an online peer feedback tool predicts students' end-of-semester exam scores.

Our first research question was: How does the UTAUT explain computer science students' intention to use and actual use of an online peer feedback tool in a university lecture? Based on prior research of UTAUT, we hypothesized that performance expectancy should positively predict intention to use (H1), that effort expectancy should positively predict intention to use (H2), and that facilitating conditions should positively predict intention to use (H3). Additionally, we assumed that students' intention to use positively predicts actual use (H4). Based on research regarding online peer feedback tools (e.g., Double et al., 2020; Yu & Schunn, 2024), we hypothesized that actual use positively predicts students' end-of-semester exam scores (H5).

Our second research question was: What are the relationships between computer science students' achievement goals and their intention to use, as well as their actual use of an online peer feedback tool? Based on prior research on attitudes towards peer feedback and achievement goals, we hypothesized that learning approach goals positively predict intention to use (H6), that appearance approach goals positively predict intention to use (H7), that appearance avoidance goals negatively predict intention to use (H8), that work avoidance goals negatively predict intention to use (H9), and that relational goals negatively predict intention to use (H10). All hypothesized relations are summarized in Fig. 1.

5. Method

5.1. Participants and design

$N = 155$ computer science students from a university in Southern Germany participated in the study. The participants were on average in their second semester ($M_{Sem} = 1.74$, $SD_{Sem} = 1.63$) and mostly male (approximately 80.9%), which reflects a rather common gender composition found in computer science (Wagner, 2016). The study was part of a lecture titled "Discrete Structures and Mathematical Logic". This is a mandatory course on mathematical foundations that students are encouraged to enroll in from their first semester (see Table 1).

We invited all students enrolled in that specific lecture to voluntarily participate in our survey. Therefore, the sample reflects a typical

Table 1
Demographic data.

Variables		
$N = 155$		
Gender		
Female	17.8 %	
Male	80.9 %	
Non-binary	1.3 %	
	M	***SD***
Studies		
Semester	1.74	1.63

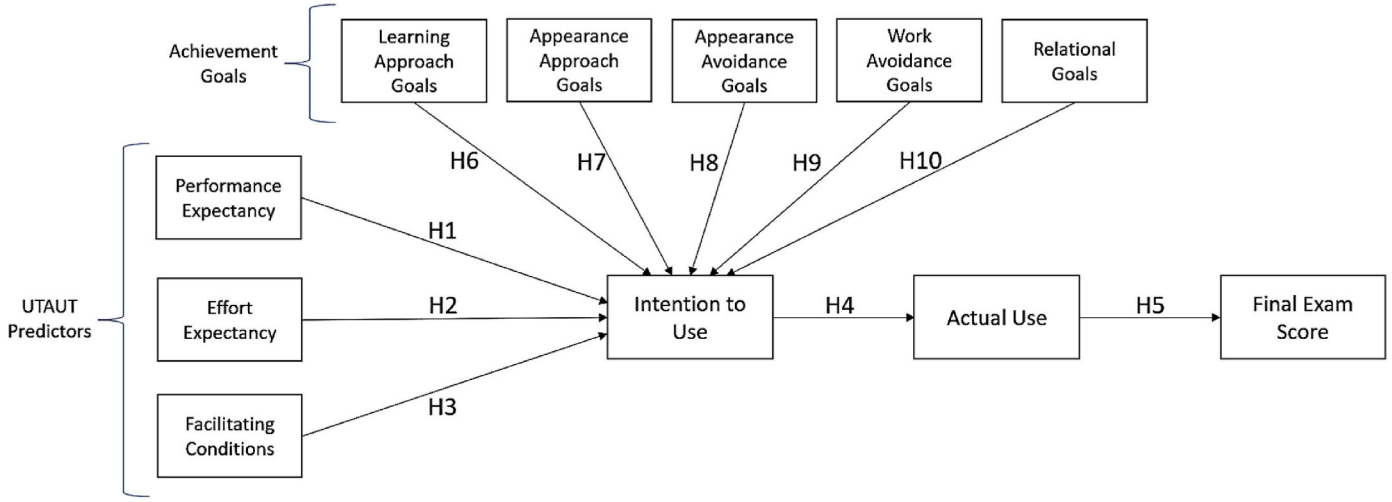

Fig. 1. Visualization of the hypotheses.

composition of the student population within the study program computer science. All students who were attending the lecture were invited to complete weekly assignments using the digital peer feedback tool "getFeedback!" that was implemented in the university's learning management system.

The weekly assignments demanded students to develop proofs for mathematical problems (for an example task, see Fig. 3). First, each student was supposed to develop an individual solution to each problem. Subsequently, the "getFeedback!" tool randomly assigned each student's work to a peer who was asked to assess their reasoning for its correctness and readability. Participants were granted bonus points on their final exams as a reward for using the peer feedback tool to complete their assignments. In total, students could use the tool for 12 assignments over the course of the semester. Following this, the lecture concluded with a final exam covering the contents of the lecture. Hence, the data encompasses quantitative data about the students' perceptions and intentions as well as their actual behavior and performance in a real-world educational context. Participation in the data collection for the study was voluntary, and participants were compensated with a book voucher. Before data collection for the study began, students were provided with a privacy statement explaining that their data would be used for research purposes. Only after consenting to this statement, students were granted access to the study's questionnaire. Participants were free to withdraw from the study at any time, decline participation, or request the deletion of their data at a later stage. Furthermore, they could opt out of the study or the data collection without facing any disadvantages. To ensure anonymization of data, students generated their own personal codes.

5.2. Procedure

Fig. 2 illustrates the procedure of the study and the variables that were captured in each phase. During the first session of the lecture, the teacher gave an overview over of the course of the lecture with the online peer feedback tool and how the students could improve their grades if they would use the tool. For this, the instructor described results from empirical research that demonstrates the beneficial effects of participating in online peer feedback practices on academic achievement, before he explained that students could improve their grades in the final exam by using the tool continuously throughout the semester. Afterwards, the instructor explained the tool and its functions. The students then completed a sample task and filled in an online questionnaire. For this, they first provided demographic data and were then surveyed regarding their technology acceptance of the online peer feedback tool and their achievement goals while using the tool. Subsequently, over the course of 12 weeks, the students had the opportunity to voluntarily use the tool to compose mathematical proofs and assess the proofs submitted by their peers. In week 13, the lecture ended with a final exam.

5.3. Variables

5.3.1. Technology acceptance

To assess technology acceptance, we used an established scale by Venkatesh et al. (2003) and slightly adapted the items to make them refer to the online peer feedback tool "getFeedback!". Students rated performance expectancy, effort expectancy, facilitating conditions, and intention to use regarding the peer feedback tool. They answered three items to measure performance expectancy (e.g., "Using getFeedback! increased my productivity", Cronbach's $\alpha = .81$), four items for effort expectancy (e.g., "I found getFeedback! easy to use", $\alpha = .90$), four items for facilitating conditions (e.g., "I have the resources necessary to use getFeedback!", $\alpha = .52$), and four Items for intention to use (e.g., "I think I will use getFeedback! this semester", $\alpha = .91$). Reliabilities were good to very good for all scales, except for facilitating conditions. However, this scale sometimes exhibits a comparatively low reliability among the variables of UTAUT, as observed in other studies (Dwivedi et al., 2011). This is likely because the scale assesses rather heterogeneous aspects, i.e., the degree to which a person believes that organizational and technical resources exist to assist with the use of the tool (e.g., the compatibility of the tool with other tools and the availability of support; Venkatesh et al., 2003). Thus, for reasons of content validity, we still included the scale despite its rather low reliability.

5.3.2. Actual use

To assess students' actual use of the online peer feedback tool, we recorded for each week whether the students had actually used the tool. Students who did not submit an initial draft during a given week were excluded from providing feedback that week, since the tool does not allow these students to progress. This approach ensured that peer pairings consisted of students actively using the tool. If students completed their assignment, they received one point. If they did both, they received two points; if students did not participate at all during a specific week, a code of 0 was assigned for that week. Subsequently, a cumulative score for the entire semester was calculated by adding up these codes. Due to technical issues, the data from week 10 was not available. Therefore, we could only include data from the remaining 11 measurement points in our analyses. Thus, students could have used the tool from 0 to a maximum of 22 times during the semester. Fig. 3 displays a sample task that the students were required to complete within the peer feedback tool and its sample solution.

5.3.3. Final exam score

We assessed students' learning by using the points they obtained in the final exam for the lecture. It consisted of 8 questions. For each question, they could achieve 10 points. Thus, they could score a maximum of 80 points. Five of the eight questions were of the proof type, requiring students to apply their knowledge to construct a valid proof. In the mathematical proof, they needed to clarify why a logical statement is true and demonstrate the solution to the problem, thereby

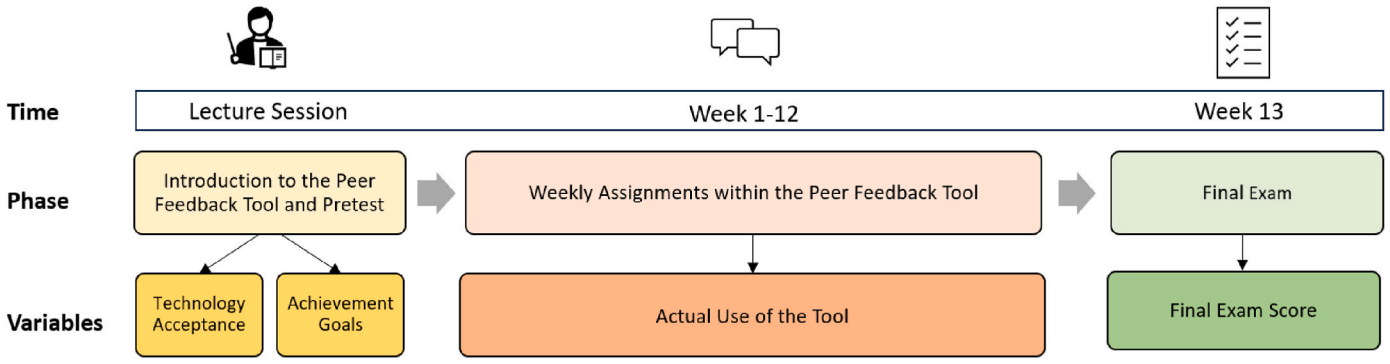

Fig. 2. Visualization of the study procedure.

Exercise: Show that all nodes in Q_n have the same eccentricity.

Solution: We show that each node of Q_n has eccentricity n. As discussed in the lecture, we identify the nodes of Q_n with n-tuples of zeros and ones. Two tuples are adjacent if they differ in exactly one position. Therefore, each edge represents a "bitflip", by which one tuple can be transformed into another. A path in Q_n is then a sequence of such flips, and the length of the shortest path between two tuples corresponds to the minimum number of flips needed to transform one tuple into another.

The distance between two tuples $u = (u_1, ..., u_n)$ and $v = (v_1, ..., v_n)$ is precisely the number of positions where u and v differ:

$$dist(u, v) = |\{i \in [n]; u_i \neq v_i\}|.$$

Now let u be any arbitrary node. We show that the eccentricity of u is exactly n. The entries of u can differ in at most n positions from those of any other tuple. Thus, the eccentricity of u is at most n. For each u, there is also a tuple u' such that the entries of u' differ in all n positions from those of u. We obtain u' by replacing each 1 in u with a 0 and each 0 with a 1. Therefore, $dist(u, u') = n$; this implies that the eccentricity of u is at least n. Together, we conclude that u must have an eccentricity of n.

Fig. 3. Sample Task within the Peer Feedback Tool and its Sample Solution.

ensuring the readability and coherence of the proof.

5.3.4. Achievement goals

To capture students' achievement goals, we used a scale from Daumiller et al. (2019). With four items each, we assessed learners' learning approach ("[When using the getFeedback! tool] … I want to constantly improve my competences", Cronbach's $\alpha = .93$), appearance approach ("… I want to be perceived as competent", $\alpha = .80$), appearance avoidance ("… I want to avoid being perceived as incompetent", $\alpha = .89$), work avoidance ("… I want to have as little to do as possible", $\alpha = .94$) and relational goals ("… my main concern is to have a friendly relationship with students", $\alpha = .93$).

5.4. Statistical analyses

Due to the small sample size and the fact that we used established scales, a manifest path model was computed to address the hypotheses, and the means of the scales were included as manifest variables in the model using the Lavaan package in the R software. A maximum likelihood estimation with robust estimation of standard errors and Yuan-Bentler scaled χ^2 test statistic in case of violation of normal distribution was used. The model was structured as follows: Intention to use regressed on goals, expectancies and facilitating conditions; actual use regressed on intention, goals, expectancies and facilitating conditions; final exam score regressed on expectancies, facilitating conditions and goals. Besides that, (residual) correlations in between the goals, and in between expectancies and conditions were modeled.

Table 2
Descriptive statistics.

Variable	*M*	*SD*	1	2	3	4	5	6	7	8	9	10	11
UTAUT													
1. PE[a]	3.44	0.73	–										
2. EE[a]	3.59	0.92	.36	–									
3. FC[a]	3.48	0.56	.22**	.52**	–								
4. ITU[a]	3.87	0.87	.55*	.25**	.32**	–							
5. AU[b]	10.65	6.39	−.07	−.10	.06	.11	–						
Achievement Goals													
6. LAp[c]	6.64	1.31	.22**	.19*	.25**	.36**	.10	–					
7. AAp[c]	3.99	1.56	.00	.10	.13	.01	.21	.19*	–				
8. AAv[c]	4.16	1.84	−.01	.08	.18*	.07	.13	.16*	.55**	–			
9. WAv[c]	4.08	1.91	−.02	.09	.04	−.07	−.01	−.20*	.13	.20*	–		
10. R[c]	5.27	1.76	.12	.12	.14	−.07	.13	.32**	.40**	.34**	.09	–	
11. Sc[d]	23.74	17.38	−.08	−.2	.02	.02	.31**	−.03	.02	.02	−.11	−.18	–

Note. Abbreviations represent the following: *M* = mean, *SD* = standard deviation, PE = performance expectancy, EE = effort expectancy, FC = facilitating conditions, ITU = intention to use, AU = actual use, LAp = learning approach goals, AAp = appearance approach goals, AAv = appearance avoidance goals, WAv = work avoidance goals, R = relational goals, Sc = final exam score. *$p < .05$; **$p < .01$.

Theoretical minimum-maximum

[a] 1–5.

[b] 0–22.

[c] 1–8.

[d] 0–68.

6. Results

Table 2 presents the descriptive statistics for all variables. The constructs of the UTAUT model all scored (slightly) above the theoretical mean (3) of the scale. This suggests a rather positive tendency, indicating that our participants displayed predominantly positive attitudes towards the online peer feedback tool. Furthermore, students used the tool about 11 (out of possible 22) times for their assignments or for providing feedback, respectively. Considering that the maximum number of participations was 22, it appears that, on average, students seized about half of the opportunities to use the peer feedback tool.

When examining the mean values of students' achievement goals, we found rather high values for learning approach and relational goals, and rather low values for appearance approach, appearance avoidance, and work avoidance goals.

Finally, the mean final exam score (appr. 24) with a maximum score of 68 indicates rather low scores in the final exam. This indicates that the exam was rather difficult for the students to pass.

To test our hypotheses, we calculated a manifest path model according to our visualization presented in Fig. 1. In addition, we checked whether there were direct effects of the predictors of intention to use on the other outcome variables. The model showed a good fit to the data, $\chi^2 = 0.304$, $p = .58$, RMSEA <.001, TLI >.99, CFI >.99, SRMR <.001. Fig. 4 illustrates the results of the path modeling.

Regarding our first research question, the results support hypotheses H1, H3, H4, and H5, but not H2. This means that performance expectancy (H1) and facilitating conditions (H3) significantly predict intention to use ($p < .05$), with performance expectancy functioning as a stronger predictor than facilitating conditions. Furthermore, intention to use significantly predicts actual use (H4; $p < .10$) and students' performance in the final exam is significantly predicted by the actual use of the tool (H5; $p < .05$). However, we found no significant effect of effort expectancy on intention to use (H2).

Regarding our second research question, the results support hypotheses H6 and H10: learning approach goals of students are positively associated with intention to use (H6), and relational goals are negatively associated with intention to use (H10). Contrary to H7, though, appearance approach goals are not associated with intention to use. Finally, there are no significant associations of appearance avoidance or work avoidance goals on the one hand and intention to use on the other (H8 and H9). In addition, we found a direct negative effect of relational goals on students' final exam score ($p < .05$).

7. Discussion

The present study aimed at uncovering the relative importance of different learner characteristics for students' intention to use and actual use of an online peer feedback tool. On the one hand, the learner characteristics under examination were derived from UTAUT (effort expectancy, performance expectancy, facilitating conditions); on the other hand, they were taken from achievement goal theory (learning approach, appearance approach, appearance avoidance, work avoidance, and relational goals). Furthermore, we looked at the extent to which students' actual use of an online peer feedback tool would predict their final exam scores. We examined this among computer science students who had the opportunity to use an online peer feedback tool to solve mathematical proof problems throughout the course of a whole semester. The results of path modeling of the longitudinal, questionnaire- and log-based data from our field study confirmed key hypotheses and underscore the relevance of social motivations for online peer feedback processes, which so far has received only little attention in previous research, offering significant implications for future research as well as practical applications.

Our first research question, building on and extending previous research on UTAUT, focused on whether performance expectancy (H1), effort expectancy (H2), and facilitating conditions (H3), would serve as predictors of computer science students' intention to use an online peer feedback tool. Furthermore, we examined actual use (H4) and final exam score (H5) as additional outcome variables which have been largely neglected in previous research (e.g., Dwivedi et al., 2011; Nistor, 2014). The results largely support these assumptions (H1, H3, H4, and H5), except for the prediction of intention to use by effort expectancy (H2). This indicates that performance expectancy and facilitating conditions can be central factors influencing the intention to use online peer feedback tools, although the moderate reliability of facilitating conditions should be considered here. For online peer feedback tools, these results highlight the importance of students' performance expectancy, i.e., their perception of whether using the tool is associated with benefits for their academic achievement. Moreover, intention to use seems to be a significant predictor of the actual use of the tool, which also increases the importance of the influencing factors. This finding implies that targeting students' perceptions regarding peer feedback tools could be a practical strategy to encourage students to actually use them. This aspect is further elaborated in the following section.

With regard to the missing effect of effort expectancy on intention to

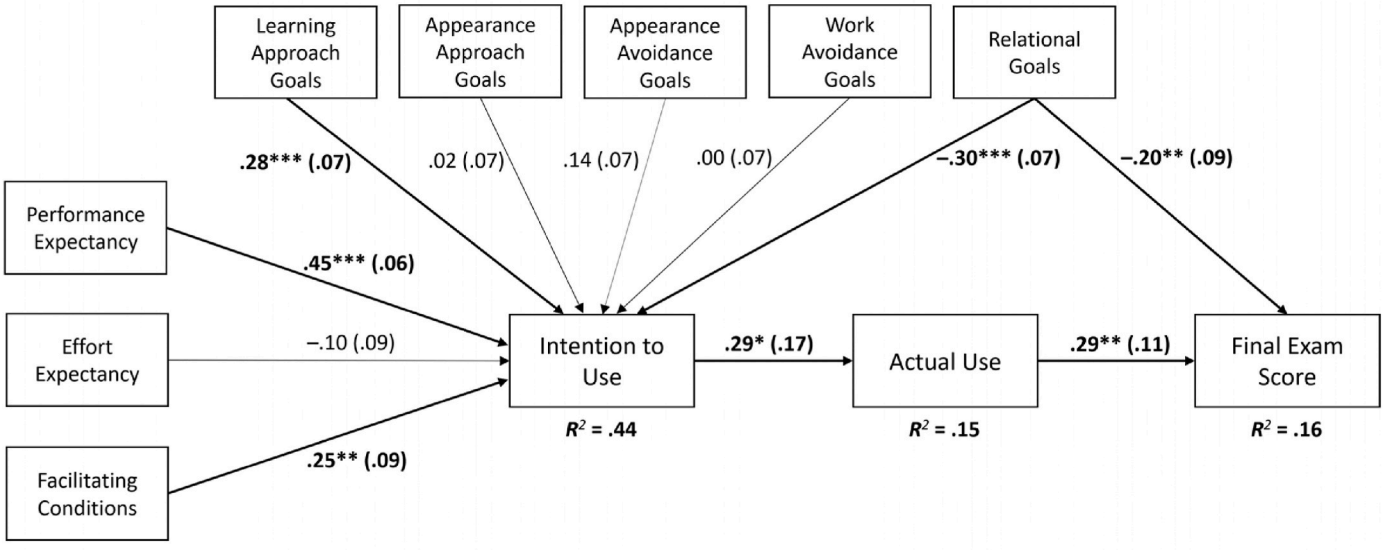

Fig. 4. Results of path modeling the relationships between achievement goals, technology acceptance, use of the online peer feedback tool, and final exam score. *Note.* Standardized coefficients are presented, with standard errors in parentheses. Statistically significant associations are bold. *$p < .10$, **$p < .05$, ***$p < .001$.

use, meta-analyses and more recent studies also indicate that effort expectancy or the analogous perceived ease of use in technology acceptance models sometimes have no significant effect on intention to use (Ayanwale & Ndlovu, 2024; Ayaz & Yanartaş, 2020; Blut, Chong, Tsiga, & Venkatesh, 2021; Dwivedi et al., 2011; Jung, Kwon, & Kim, 2020; Ly & Hor, 2023). For example, Venkatesh et al. (2003) show that the relationship between performance expectancy and effort expectancy on intention can vary by gender, age and experience. However, there is also evidence of no influence of gender, age or experience (e.g., Horodyski, 2023). According to Venkatesh and colleagues' (2003) study, in case of performance expectancy, a stronger relationship with intention to use can be observed particularly among male and younger users. In contrast, the relationship between effort expectancy and intention to use is particularly strong among female, older and less experienced users. Given that our sample consists of rather young adults and predominantly male students, this might serve as an explanation for the dominant effect of performance expectancy on intention to use as well as the missing effect of effort expectancy on intention to use (Blut et al., 2021; Venkatesh et al., 2003). Even though there is no observed ceiling effect related to effort expectancy, it seems likely that computer science students represent a peculiar population, that, perhaps because of its probably high computer-related self-efficacy, might assess the effort of using a tool as rather surmountable, regardless of its apparent complexity. In line with this, research indicates that when tools are perceived as easy to use, the perceived usefulness (i.e., performance expectancy) becomes more crucial for the decision to use the tool than its perceived ease of use (i.e., effort expectancy; Deng, Doll, Hendrickson, & Scazzero, 2005; Scott & Walczak, 2009).

The significant prediction of performance by actual use (H5) provides powerful evidence for beneficial effects of online peer feedback tool use on learning outcomes in a real educational context. This finding aligns well with existing research (e.g., Alqassab, 2017; Double et al., 2020) but also specifically pertains to the context of mathematical argumentation processes of computer science students. Therefore, in sum, these results underscore the significance of using online peer feedback tools for student learning outcomes, demonstrating their benefit within higher education disciplines and subjects, such as computer science or the development of mathematical proofs, respectively.

Our second research question concerned the associations of different achievement goals on the intention to use online peer feedback tools. Based on previous research, we hypothesized that learning approach goals are positively associated with intention to use (H6), that appearance approach goals are positively associated with intention to use (H7), that appearance avoidance goals are negatively associated with intention to use (H8), that work avoidance goals are negatively associated with intention to use (H9), and that relational goals are negatively associated with intention to use (H10). Results support the assumptions that learning approach goals are positively associated with the intention to use (H6) and relational goals are negatively associated with intention to use (H10). This indicates that students with stronger learning approach goals display a higher intention to use the peer feedback tool. Thus, students probably regard the use of online peer feedback tools as a learning opportunity, which corroborates existing research (e.g., Cushing, Abbott, Lothian, Hall, & Westwood, 2011). Furthermore, the negative association with relational goals might suggest that students may have concerns about potential adverse effects of using the peer feedback tool on their social relationships. These findings are consistent with previous research regarding students' concerns in peer feedback processes, such as the perception of criticism as socially uncomfortable (e.g., Topping, 2003), emphasizing the significance of viewing online peer feedback processes as a context for social interaction. With respect to research on achievement goals, the results provide further evidence for potentially unfavorable effects of relational goals on learning processes (Daumiller, Fritz, et al., 2023) and support the possibly contradictory position of learning approach and relational goals (Urdan & Maehr, 1995), perhaps, or even more so, within the context of collaborative learning (see also Greisel, Melzner, Dresel, & Kollar, 2023). The additional direct negative effect of relational goals on students' final exam performance speaks to this issue as well, potentially indicating additional behavioral patterns associated with relational goals that are unrelated to the use of online peer feedback tools but are nonetheless detrimental for students' exam performance (e.g., social activities with other students that are not related to learning content). In educational contexts, thus, this suggests the importance of students' individual goals and how these might either support (e.g. with regard to learning approach goals) or conflict with (e.g., in terms of relational goals) the use of peer feedback tools. Therefore, educators might consider these when implementing or promoting the use of peer feedback tools. Potential approaches for this will be explained in the next chapter.

Regarding the remaining achievement goals, i.e., appearance approach goals (H7), appearance avoidance goals (H8) and work avoidance goals (H9), the results do not support our hypotheses, as they were all unrelated to students' intention to use and actual use of the online peer feedback tool. In addition, there were no associations between these goals and final exam performance. This might be explained in several ways. One explanation for the missing effect of appearance approach goals might be that students with this primary goal, on the one hand, may not want to help other students in order to achieve the best performance themselves (i.e., to prevent others from surpassing them). On the other hand, they may want to demonstrate their competencies to their peers. As a result, these two effects might cancel each other out (Daumiller et al., 2019). Ultimately, it may also be essential to assess the effects of appearance-based approach or avoidance goals, specifically taking the presence of a teacher or instructor versus a peer into account. These effects may differ in online peer feedback processes due to the potentially predominant exposure of performance to peers. Thus, it may be necessary to differentiate between the impact of appearance goals in relation to the interaction with teachers versus peers.

8. Limitations and conclusions

Of course, this study suffers from several limitations. First, it is important to note that, since we assessed all participants enrolled in specific lecture within computer science, we investigated a rather small and specific group of students. This is also why we were only able to calculate a manifest path model instead of performing structural equation modeling since we used established scales. While this approach allows for the collection of data that represents a typically composed population for the study programs in this discipline, it may lead to biases (e.g., gender or selection bias), distortions of the relations, increase the likelihood of a type II error and limit the generalizability of the effects to other populations. In connection with this, it is important to note that there are rather high dropout rates in computer science (Pappas, Giannakos, & Jaccheri, 2016), and students in the second semester may also represent a subgroup that has already been pre-selected due to its success and therefore display, for example, rather low work avoidance goals. Moreover, it is possible that the bonus points students received for using the tool may have influenced both the intention to use and actual use of the tool and therefore represent a factor that may additionally have impacted students' technology acceptance. Future studies should therefore use larger samples, possibly also with students from different study programs or a manipulation of the incentives, and in addition, also calculate a structural equation model to include latent variables and address these issues.

Moreover, in terms of the examined constructs, the present study only considered a limited number of variables regarding both the UTAUT construct and students' achievement goals. Additionally, these involve self-reported scales, which may be prone to errors (e.g., Noroozi, Alqassab, Taghizadeh Kerman, Banihashem, & Panadero, 2024). However, the addition of further constructs examined in connection with the UTAUT (for example, user characteristics, such as gender) or

differentiation of the items (e.g., with regard to the development of a written assignment vs. the provision of feedback) might explain further (missing) effects. Besides, there might also be further interesting connections that may affect other constructs of UTAUT as well as other goals: for example, the voluntariness of use on the one hand and normative goals on the other (Dunning, 2017). For instance, it seems conceivable that the influence of voluntariness diminishes in the case of pronounced prosocial behavior. Overall, the exploration of broader facets of learner characteristics might help to develop an integrative model of technology acceptance towards online peer feedback tools, offering an even more comprehensive understanding of students' behavior.

In addition to this, it is essential to highlight that we were not able to perform a content analysis of the feedback or revisions. As previous research indicates, content analyses in peer feedback processes can provide valuable insights, particularly through the use of learning analytics. For example, Moon and colleagues (2024a, 2024b) conducted studies in which they employed methods such as epistemic network analysis and sequence pattern mining, enabling them to identify different types of discussions as well as temporal dynamics in collaborative learning situations. In this context, regarding the relationship between learners' goals and peer feedback processes, another study, also based on epistemic network analysis, suggests that the induction of learning goals within peer feedback processes is associated with different learning activities and greater knowledge acquisition of students compared to when no goals are induced (Özbek, Wekerle, & Kollar, 2024). Therefore, exploring the impact of students' (varying) goals on specific content, particularly with regard to mathematical proofs (e.g., Alqassab, 2017), might be a compelling avenue for future research (see also Kerman et al., 2024).

Also, our partly cross-sectional design makes it difficult to arrive at causal conclusions. Although it seems theoretically plausible that achievement goals predict intention to use, this cannot be ensured in the current study, due to its correlational character. For this reason, future studies should experimentally manipulate and assess achievement goals and intention to use at different timepoints and/or determine the development of technology acceptance through multiple data collections.

Nevertheless, the present study offers important implications for research on online peer feedback tools and their practical implementation in higher education. The results show that students' attitudes towards online peer feedback tools can be modeled well with the UTAUT and point to the importance of performance expectancy and facilitating conditions as predictors of intention to use and thus, in turn, actual use and academic achievement for students. In order to increase the use of peer feedback tools by students, these perceptions can therefore be approached. For example, teachers could explain the benefits of the use of peer feedback tools for students' achievement (Özbek, 2024). In this way, learners' performance expectancy could be increased by demonstrating how the tool's usage can contribute to their achievement. Similarly, a supportive infrastructure and the availability of contact persons should lead to a more active use by students and subsequently to higher achievement. This perception might be enhanced by developing resources that are currently lacking in educational contexts to support students with technical issues (e.g., through support services), or by bringing existing resources (such as in-tool assistance) more prominently to students' attention. Consequently, these results might offer valuable insights into how to promote students' acceptance and use of online peer feedback tools in higher education and highlight the need to consider both technical and motivational prerequisites for their successful integration (Ly & Doeur, 2024). At the same time, the study also complements previous research on the positive effects of digitally supported peer feedback on academic achievement by the prediction of exam performance by actual use in a real educational context. Thus, the results of our study can be used as evidence that using online peer feedback tools may be a powerful method to support student learning and emphasize that the potential of peer feedback tools should be leveraged by educators.

Regarding the associations of achievement goals and UTAUT, the results also demonstrate the relevance of students' learning approach and relational goals for their acceptance and use of online peer feedback tools as further explanatory factors for intention to use. Accordingly, students' individual goals seem to play a crucial role in whether they (intend to) use online peer feedback tools. In case of learning approach goals, this also points to the importance of framing the use of the tool as a learning opportunity, which might be motivating for students with strong learning approach goals to use online peer feedback tools. Therefore, with regard to the example mentioned earlier, where students are made aware of the positive impact of tool usage on their achievement, this approach might therefore not only enhance their performance expectancy, but also demonstrate how peer feedback tools can serve as a means to achieve their learning approach goals.

With regard to students' relational goals and their negative association with intention to use, the study points to a perhaps serious challenge regarding the use of online peer feedback tools. That is, any concerns students may have about their social relationships when using online peer feedback tools on the one hand and the striving to learn on the other. Thus, the results once again reinforce rather ambiguous effects of relational goals on learning processes (Daumiller, Fritz, et al., 2023; Urdan & Maehr, 1995) and emphasize the need for further research on relational goals with regard to different educational contexts. Moreover, to overcome these concerns of students, for instance, educators should frame peer feedback as a friendly learning opportunity and provide guidance on how to give constructive feedback in order to alleviate the fear of damaging social relationships through peer feedback. Given that social motivations appear to play a crucial role in the utilization of online peer feedback tools, it also seems to be an intriguing research gap, to explore how the integration of AI in peer feedback processes (e.g., Bauer et al., 2023) relates to learners' goals and might also address such issues. It is conceivable that the integration of AI, which either replaces or supports peers within the peer feedback process, might diminish the effect of students' relational goals, as it may reduce or eliminate genuine social interactions. With regard to the integration of AI in peer feedback processes, existing research presents a mixed picture, suggesting that tools like ChatGPT could, on the one hand, play a complementary role alongside peer feedback (Banihashem, Kerman, Noroozi, Moon, & Drachsler, 2024), potentially enhancing the overall feedback process in the future. On the other hand, there is also evidence indicating potential adverse effects of AI on feedback quality (e.g., because students overly rely on AI; Hansen, Prilop, & Nielsen, 2024). For this reason, it might be valuable to investigate how learners' individual goals interact with the use of AI and influence its impact on the feedback process. Thus, the study offers important implications for technology acceptance of online peer feedback tools and the role of achievement goals in educational research and practice.

CRediT authorship contribution statement

Tuğçe Özbek: Writing – review & editing, Writing – original draft, Visualization, Software, Resources, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Martin Daumiller:** Writing – review & editing, Validation, Software, Formal analysis. **Aida Roshany-Tabrizi:** Writing – review & editing, Software, Resources, Data curation. **Tobias Mömke:** Writing – review & editing, Resources, Data curation. **Ingo Kollar:** Writing – review & editing, Validation, Supervision, Resources, Project administration, Methodology, Data curation, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence

the work reported in this paper.

Acknowledgment

This work was supported by the "Stiftung Innovation in der Hochschullehre" (project "Facilitating Competence Development through Authentic, Digital, and Feedback-Based Teaching-Learning Scenarios") under grant FBM2020.

Data availability

Data will be made available on request.

References

Al-kfairy, M., Ahmed, S., & Khalil, A. (2024). Factors impacting users' willingness to adopt and utilize the metaverse in education: A systematic review. *Computers in Human Behavior Reports, 100459*. https://doi.org/10.1016/j.chbr.2024.100459

Alqassab, M. (2017). Peer feedback provision and mathematical proofs: Role of domain knowledge, beliefs, perceptions, epistemic emotions, and peer feedback content. *[Doctoral dissertation, LMU]*.

Ames, C. (1992). Classrooms: Goals, structures, and student motivation. *Journal of Educational Psychology, 84*(3), 261–271. https://doi.org/10.1037/0022-0663.84.3.261

Ashworth, P., Bannister, P., Thorne, P., & Unit, S. on the Q. R. M. C.. (1997). Guilty in whose eyes? University students' perceptions of cheating and plagiarism in academic work and assessment. *Studies in Higher Education, 22*(2), 187–203. https://doi.org/10.1080/03075079712331381034

Ayanwale, M. A., & Ndlovu, M. (2024). Investigating factors of students' behavioral intentions to adopt chatbot technologies in higher education: Perspective from expanded diffusion theory of innovation. *Computers in Human Behavior Reports, 14*, Article 100396. https://doi.org/10.1016/j.chbr.2024.100396

Ayaz, A., & Yanartaş, M. (2020). An analysis on the unified theory of acceptance and use of technology theory (UTAUT): Acceptance of electronic document management system (EDMS). *Computers in Human Behavior Reports, 2*, Article 100032. https://doi.org/10.1016/j.chbr.2020.100032

Azarnoosh, M. (2013). Peer assessment in an EFL context: Attitudes and friendship bias. *Language Testing in Asia, 3*, 1–10. https://doi.org/10.1186/2229-0443-3-11

Baker, K. M. (2016). Peer review as a strategy for improving students' writing process. *Active Learning in Higher Education, 17*(3), 179–192. https://doi.org/10.1177/1469787416654794

Banihashem, S. K., Kerman, N. T., Noroozi, O., Moon, J., & Drachsler, H. (2024). Feedback sources in essay writing: Peer-generated or AI-generated feedback? *International Journal of Educational Technology in Higher Education, 21*(1), 23. https://doi.org/10.1186/s41239-024-00455-4

Baruah, B., Ward, T., & Jackson, N. (2017). Is reflective writing an effective peer assessment tool for students in higher education?. *Conference presentation at the 16th international conference on information technology based higher education and training (ITHET), ohrid, Macedonia*. https://doi.org/10.1109/ITHET.2017.8067802

Bauer, E., Greisel, M., Kuznetsov, I., Berndt, M., Kollar, I., Dresel, M., … Fischer, F. (2023). Using natural language processing to support peer-feedback in the age of artificial intelligence: A cross-disciplinary framework and a research agenda. *British Journal of Educational Technology, 54*(5), 1222–1245. https://doi.org/10.1111/bjet.13336

Bernacki, M. L., Byrnes, J. P., & Cromley, J. G. (2012). The effects of achievement goals and self-regulated learning behaviors on reading comprehension in technology-enhanced learning environments. *Contemporary Educational Psychology, 37*(2), 148–161. https://doi.org/10.1016/j.cedpsych.2011.12.001

Blut, M., Chong, A., Tsiga, Z., & Venkatesh, V. (2021). Meta-analysis of the unified theory of acceptance and use of technology (UTAUT): Challenging its validity and charting A research agenda in the red ocean. *Journal of the Association for Information Systems, 23*(1), 13–95. https://doi.org/10.17705/1jais.00719

Butler, R. (2012). Striving to connect: Extending an achievement goal approach to teacher motivation to include relational goals for teaching. *Journal of Educational Psychology, 104*(3), 726–742. https://doi.org/10.1037/a0028613

Butler, R., & Shibaz, L. (2014). Striving to connect and striving to learn: Influences of relational and mastery goals for teaching on teacher behaviors and student interest and help seeking. *International Journal of Educational Research, 65*, 41–53. https://doi.org/10.1016/j.ijer.2013.09.006

Chung, Y., Bong, M., & Kim, S. I. (2020). Performing under challenge: The differing effects of ability and normative performance goals. *Journal of Educational Psychology, 112*(4), 823–840. https://doi.org/10.1037/edu0000393

Cushing, A., Abbott, S., Lothian, D., Hall, A., & Westwood, O. M. (2011). Peer feedback as an aid to learning–what do we want? Feedback. When do we want it? Now. *Medical Teacher, 33*(2), e105–e112. https://doi.org/10.3109/0142159X.2011.542522

Daumiller, M. (2023). Achievement goals: The past, present, and possible future of achievement goal research in the context of learning and teaching. In G. Hagenauer, R. Lazarides, & H. Jarvenoja (Eds.), *Motivation and emotion in learning and teaching across educational contexts: Theoretical and methodological perspectives and empirical insights* (pp. 35–53). New York, NY: Routledge. https://doi.org/10.4324/9781003303473-4. PsyArXiv: xn2Vol. 5.

Daumiller, M., Dickhäuser, O., & Dresel, M. (2019). University instructors' achievement goals for teaching. *Journal of Educational Psychology, 111*(1), 131–148. https://doi.org/10.1037/edu0000271

Daumiller, M., Fritz, T., González Cruz, H., C. Rudert, S., & Janke, S. (2023). Cheating as a prosocial act? Helping others with academic cheating is related to social goals and cooperative norms. *Assessment & Evaluation in Higher Education*, 1–14. https://doi.org/10.31234/osf.io/n2jhu

Daumiller, M., Rinas, R., & Dresel, M. (2023). Relevance of students' goals for learning engagement and knowledge gains in an online learning course. *Behavioral Sciences, 13*(2), 161. https://doi.org/10.3390/bs13020161

Davis, F. D. (1989). *Technology acceptance model: TAM. Al-suqri, MN, Al-aufi, AS: Information seeking behavior and technology adoption* (pp. 205–219).

Deng, X., Doll, W. J., Hendrickson, A. R., & Scazzero, J. A. (2005). A multi-group analysis of structural invariance: An illustration using the technology acceptance model. *Information & Management, 42*(5), 745–759. https://doi.org/10.1016/j.im.2004.08.001

Double, K. S., McGrane, J. A., & Hopfenbeck, T. N. (2020). The impact of peer assessment on academic performance: A meta-analysis of control group studies. *Educational Psychology Review, 32*(2), 481–509. https://doi.org/10.1007/s10648-019-09510-3

Dunning, D. (2017). Normative goals and the regulation of social behavior: The case of respect. *Motivation and Emotion, 41*(3), 285–293. https://doi.org/10.1007/s11031-017-9616-8

Dweck, C. S. (1986). Motivational processes affecting learning. *American Psychologist, 41*(10), 1040–1048. https://doi.org/10.1037/0003-066X.41.10.1040

Dwivedi, Y. K., Rana, N. P., Chen, H., & Williams, M. D. (2011). A meta-analysis of the unified theory of acceptance and use of technology (UTAUT). In M. Nüttgens, A. Gadatsch, K. Kautz, I. Schirmer, & N. Blinn (Eds.), *Governance and Sustainability in information systems. Managing the Transfer and Diffusion of IT: IFIP WG 8.6 international working conference, hamburg, Germany* (pp. 155–170). https://doi.org/10.1007/978-3-642-24148-2_10

Dwivedi, Y. K., Rana, N. P., Jeyaraj, A., Clement, M., & Williams, M. D. (2019). Re-examining the unified theory of acceptance and use of technology (UTAUT): Towards a revised theoretical model. *Information Systems Frontiers, 21*, 719–734. https://doi.org/10.1007/s10796-017-9774-y

Elizondo-Garcia, J., Schunn, C., & Gallardo, K. (2019). Quality of peer feedback in relation to instructional design: A comparative study in energy and sustainability MOOCs. *International Journal of Instruction, 12*(1), 1025–1040.

Elliot, A. J. (1999). Approach and avoidance motivation and achievement goals. *Educational Psychologist, 34*(3), 169–189. https://doi.org/10.1207/s15326985ep3403_3

Elliot, A. J. (2005). A conceptual history of the achievement goal construct. *Handbook of Competence and Motivation, 16*(2005), 52–72.

Elliot, A. J., & Hulleman, C. S. (2017). Achievement goals. *Handbook of Competence and Motivation: Theory and Application, 2*, 43–60.

Elliot, A. J., Murayama, K., & Pekrun, R. (2011). A 3× 2 achievement goal model. *Journal of Educational Psychology, 103*(3), 632–648. https://doi.org/10.1037/a0023952

Grant, H., & Dweck, C. (2003). Clarifying achievement goals and their impact. *Journal of Personality and Social Psychology, 85*, 541–553. https://doi.org/10.1037/0022-3514.85.3.541

Greisel, M., Melzner, N., Dresel, M., & Kollar, I. (2023). How are achievement goals associated with self-, co-, and socially shared regulation in collaborative learning? *Educational Psychology, 43*(4), 384–402. https://doi.org/10.1080/01443410.2023.2211751

Hansen, R. R., Prilop, C. N., & Nielsen, T. A. (2024). AI-prompted peer feedback: Can an AI feedback coach enhance peer feedback quality?. https://doi.org/10.31219/osf.io/mq628.

Hao, Q., Barnes, B., Wright, E., & Branch, R. M. (2017). The influence of achievement goals on online help seeking of computer science students. *British Journal of Educational Technology, 48*(6), 1273–1283. https://doi.org/10.1111/bjet.12499

Harackiewicz, J. M., Barron, K. E., Carter, S. M., Lehto, A. T., & Elliot, A. J. (1997). Predictors and consequences of achievement goals in the college classroom: Maintaining interest and making the grade. *Journal of Personality and Social Psychology, 73*(6), 1284–1295. https://doi.org/10.1037/0022-3514.73.6.1284

Harks, B., Rakoczy, K., Hattie, J., Besser, M., & Klieme, E. (2014). The effects of feedback on achievement, interest and self-evaluation: The role of feedback's perceived usefulness. *Educational Psychology, 34*(3), 269–290. https://doi.org/10.1080/01443410.2013.785384

Holzer, J., Bürger, S., Lüftenegger, M., & Schober, B. (2022). Revealing associations between students' school-related well-being, achievement goals, and academic achievement. *Learning and Individual Differences, 95*, Article 102140. https://doi.org/10.1016/j.lindif.2022.102140

Horodyski, P. (2023). Recruiter's perception of artificial intelligence (AI)-based tools in recruitment. *Computers in Human Behavior Reports, 10*, Article 100298. https://doi.org/10.1016/j.chbr.2023.100298

Huang, C. (2012). Discriminant and criterion-related validity of achievement goals in predicting academic achievement: A meta-analysis. *Journal of Educational Psychology, 104*(1), 48–73. https://doi.org/10.1037/a0026223

Huisman, B., Saab, N., van den Broek, P., & van Driel, J. (2019). The impact of formative peer feedback on higher education students' academic writing: A meta-analysis. *Assessment & Evaluation in Higher Education, 44*(6), 863–880. https://doi.org/10.1080/02602938.2018.1545896

Huisman, B., Saab, N., Van Driel, J., & Van Den Broek, P. (2018). Peer feedback on academic writing: Undergraduate students' peer feedback role, peer feedback perceptions and essay performance. *Assessment & Evaluation in Higher Education, 43*(6), 955–968. https://doi.org/10.1080/02602938.2018.1424318

Hulleman, C. S., Schrager, S. M., Bodmann, S. M., & Harackiewicz, J. M. (2010). A meta-analytic review of achievement goal measures: Different labels for the same constructs or different constructs with similar labels? *Psychological Bulletin, 136*(3), 422–449. https://doi.org/10.1037/a0018947

Jongsma, M. V., Scholten, D. J., van Muijlwijk-Koezen, J. E., & Meeter, M. (2023). Online versus offline peer feedback in higher education: A meta-analysis. *Journal of Educational Computing Research, 61*(2), 329–354. https://doi.org/10.1177/07356331221114181

Jung, J. H., Kwon, E., & Kim, D. H. (2020). Mobile payment service usage: US consumers' motivations and intentions. *Computers in Human Behavior Reports, 1*, Article 100008. https://doi.org/10.1016/j.chbr.2020.100008

Kaufman, J. H., & Schunn, C. D. (2011). Students' perceptions about peer assessment for writing: Their origin and impact on revision work. *Instructional Science, 39*, 387–406. https://doi.org/10.1007/s11251-010-9133-6

Kerman, N. T., Banihashem, S. K., Karami, M., Er, E., Van Ginkel, S., & Noroozi, O. (2024). Online peer feedback in higher education: A synthesis of the literature. *Education and Information Technologies, 29*(1), 763–813. https://doi.org/10.1007/s10639-023-12273-8

Kerman, N. T., Banihashem, S. K., & Noroozi, O. (2023). The relationship among students' attitude towards peer feedback, peer feedback performance, and uptake. In O. Noroozi, & B. De Wever (Eds.), *The power of peer learning: Fostering students' learning processes and outcomes* (pp. 347–371). Springer. https://doi.org/10.1007/978-3-031-29411-2_16.

Kerman, N. T., Banihashem, S. K., Noroozi, O., & Biemans, H. J. (2022). The effects of students perceived usefulness and trustworthiness of peer feedback on learning satisfaction in online learning environments. *Conference presentation at the HEAd 2022-8th international Conference on higher education advances, valència Spain*. https://doi.org/10.4995/HEAd22.2022.14445

King, R. B., & McInerney, D. M. (2014). The work avoidance goal construct: Examining its structure, antecedents, and consequences. *Contemporary Educational Psychology, 39*(1), 42–58. https://doi.org/10.1016/j.cedpsych.2013.12.002

King, R. B., & Watkins, D. A. (2012). "Socializing" achievement goal theory: The need for social goals. *Psychological Studies, 57*, 112–116. https://doi.org/10.1007/s12646-011-0140-8

Korn, R. M., Elliot, A. J., & Daumiller, M. (2019). Back to the roots: The 2× 2 standpoints and standards achievement goal model. *Learning and Individual Differences, 72*, 92–102. https://doi.org/10.1016/j.lindif.2019.04.009

Kuo, F.-C., Chen, J.-M., Chu, H.-C., Yang, K.-H., & Chen, Y.-H. (2017). A peer-assessment mobile kung fu education approach to improving students' affective performances. *International Journal of Distance Education Technologies, 15*(1), 1–14. https://doi.org/10.4018/IJDET.2017010101

Lin, G.-Y. (2018). Anonymous versus identified peer assessment via a Facebook-based learning application: Effects on quality of peer feedback, perceived learning, perceived fairness, and attitude toward the system. *Computers & Education, 116*, 81–92. https://doi.org/10.1016/j.compedu.2017.08.010

Ly, B., & Doeur, B. (2024). Key factors influencing digital learning adoption among cambodian university students: An integrated theoretical approach. *Computers in Human Behavior Reports, 15*, Article 100460. https://doi.org/10.1016/j.chbr.2024.100460

Ly, B., Ly, R., & Hor, S. (2023). Zoom classrooms and adoption behavior among Cambodian students. *Computers in Human Behavior Reports, 9*, Article 100266. https://doi.org/10.1016/j.chbr.2022.100266

McGloin, R., McGillicuddy, K. T., & Christensen, J. L. (2017). The impact of goal achievement orientation on student technology usage in the classroom. *Journal of Computing in Higher Education, 29*, 240–266. https://doi.org/10.1007/s12528-017-9134-4

Moon, J., McNeill, L., Edmonds, C. T., Banihashem, S. K., & Noroozi, O. (2024a). Using learning analytics to explore peer learning patterns in asynchronous gamified environments. *International Journal of Educational Technology in Higher Education, 21*(1), 45.

Moon, J., Yeo, S., Banihashem, S. K., & Noroozi, O. (2024b). Using multimodal learning analytics as a formative assessment tool: exploring collaborative dynamics in mathematics teacher education. *Journal of Computer Assisted Learning*.

Nelson, M. M., & Schunn, C. D. (2009). The nature of feedback: How different types of peer feedback affect writing performance. *Instructional Science, 37*, 375–401. https://doi.org/10.1007/s11251-008-9053-x

Nicholls, J. G., Patashnick, M., & Nolen, S. B. (1985). Adolescents' theories of education. *Journal of Educational Psychology, 77*(6), 683–692. https://doi.org/10.1037/0022-0663.77.6.683

Nistor, N. (2014). When technology acceptance models won't work: Non-significant intention-behavior effects. *Computers in Human Behavior, 34*, 299–300. https://doi.org/10.1016/j.chb.2014.02.052

Noroozi, O., Alqassab, M., Taghizadeh Kerman, N., Banihashem, S. K., & Panadero, E. (2024). Does perception mean learning? Insights from an online peer feedback setting. *Assessment & Evaluation in Higher Education*, 1–15. https://doi.org/10.1080/02602938.2024.2345669

Noroozi, O., Banihashem, S. K., Biemans, H. J., Smits, M., Vervoort, M. T., & Verbaan, C.-L. (2023). Design, implementation, and evaluation of an online supported peer feedback module to enhance students' argumentative essay quality. *Education and Information Technologies*, 1–28. https://doi.org/10.1007/s10639-023-11683-y

Noroozi, O., & Hatami, J. (2018). The effects of online peer feedback and epistemic beliefs on students' argumentation-based learning. *Innovations in Education & Teaching International, 56*(5), 548–557. https://doi.org/10.1080/14703297.2018.1431143

Noroozi, O., & Mulder, M. (2017). Design and evaluation of a digital module with guided peer feedback for student learning biotechnology and molecular life sciences, attitudinal change, and satisfaction. *Biochemistry and Molecular Biology Education, 45*(1), 31–39. https://doi.org/10.1002/bmb.20981

Or, C. (2023). Revisiting unified theory of technology and use of technology using meta-analytic structural equation modelling. *International Journal of Technology in Education and Science, 7*(1), 83–103. https://doi.org/10.46328/ijtes.420

Özbek, T., Greisel, M., Wekerle, C., Gegenfurtner, A., & Kollar, I. (2024). How do different goals affect students' internal collaboration script configurations? Results of an epistemic network analysis study. *Frontiers in Psychology, 15*, Article 1410152. https://doi.org/10.3389/fpsyg.2024.1410152

Özbek, T., Wekerle, C., & Kollar, I. (2024). Fostering pre-service teachers' technology acceptance–does the type of engagement with tool-related information matter? *Education and Information Technologies, 29*(5), 6139–6161. https://doi.org/10.1007/s10639-023-12047-2

Pappas, I. O., Giannakos, M. N., & Jaccheri, L. (2016). Investigating factors influencing students' intention to dropout computer science studies. *Proceedings of the 2016 ACM conference on innovation and technology in computer science education*. https://doi.org/10.1145/2899415.2899455

Patchan, M. M., Schunn, C. D., & Clark, R. J. (2018). Accountability in peer assessment: Examining the effects of reviewing grades on peer ratings and peer feedback. *Studies in Higher Education, 43*(12), 2263–2278. https://doi.org/10.1080/03075079.2017.1320374

Rodríguez, M. F., Nussbaum, M., Yunis, L., Reyes, T., Alvares, D., Joublan, J., et al. (2022). Using scaffolded feedforward and peer feedback to improve problem-based learning in large classes. *Computers & Education, 182*, Article 104446. https://doi.org/10.1016/j.compedu.2022.104446

Roussel, P., Elliot, A. J., & Feltman, R. (2011). The influence of achievement goals and social goals on help-seeking from peers in an academic context. *Learning and Instruction, 21*(3), 394–402. https://doi.org/10.1016/j.learninstruc.2010.05.003

Scott, R. A., Stuart, J., & Barber, B. L. (2022). Connecting with close friends online: A qualitative analysis of young adults' perceptions of online and offline social interactions with friends. *Computers in Human Behavior Reports, 7*, Article 100217. https://doi.org/10.1016/j.chbr.2022.100217

Scott, J. E., & Walczak, S. (2009). Cognitive engagement with a multimedia ERP training tool: Assessing computer self-efficacy and technology acceptance. *Information & Management, 46*(4), 221–232. https://doi.org/10.1016/j.im.2008.10.003

Senko, C., & Dawson, B. (2017). Performance-approach goal effects depend on how they are defined: meta-analytic evidence from multiple educational outcomes. *Journal of Educational Psychology, 109*(4), 574.

Senko, C., & Harackiewicz, J. M. (2005). Achievement goals, task performance, and interest: Why perceived goal difficulty matters. *Personality and Social Psychology Bulletin, 31*(12), 1739–1753. https://doi.org/10.1177/0146167205281128

Shang, H.-F. (2022). Exploring online peer feedback and automated corrective feedback on EFL writing performance. *Interactive Learning Environments, 30*(1), 4–16. https://doi.org/10.1080/10494820.2019.1629601

Shi, M. (2019). The effects of class size and instructional technology on student learning performance. *International Journal of Management in Education, 17*(1), 130–138. https://doi.org/10.1016/j.ijme.2019.01.004

Šumak, B., Heričko, M., & Pušnik, M. (2011). A meta-analysis of e-learning technology acceptance: The role of user types and e-learning technology types. *Computers in Human Behavior, 27*(6), 2067–2077. https://doi.org/10.1016/j.chb.2011.08.005

Teo, T., Moses, P., Cheah, P. K., Huang, F., & Tey, T. C. Y. (2023). Influence of achievement goal on technology use among undergraduates in Malaysia. *Interactive Learning Environments*, 1–18. https://doi.org/10.1080/10494820.2023.2197957

Topping, K. (2003). Self and peer assessment in school and university: Reliability, validity and utility. In M. Segers, F. Dochy, & E. Cascallar (Eds.), *Optimising new modes of assessment: In search of qualities and standards* (pp. 55–87). Springer. https://doi.org/10.1007/0-306-48125-1.

Tsui, A. B., & Ng, M. (2000). Do secondary L2 writers benefit from peer comments? *Journal of Second Language Writing, 9*(2), 147–170. https://doi.org/10.1016/S1060-3743(00)00022-9

Urdan, T. C., & Maehr, M. L. (1995). Beyond a two-goal theory of motivation and achievement: A case for social goals. *Review of Educational Research, 65*(3), 213–243. https://doi.org/10.2307/1170683

Usher, M., & Barak, M. (2018). Peer assessment in a project-based engineering course: Comparing between on-campus and online learning environments. *Assessment & Evaluation in Higher Education, 43*(5), 745–759. https://doi.org/10.1080/02602938.2017.1405238

Van Yperen, N. W., Blaga, M., & Postmes, T. (2014). A meta-analysis of self-reported achievement goals and nonself-report performance across three achievement domains (work, sports, and education). *PLoS One, 9*(4), Article e93594. https://doi.org/10.1371/journal.pone.0093594

Van Yperen, N. W., Blaga, M., & Postmes, T. (2015). A meta-analysis of the impact of situationally induced achievement goals on task performance. *Human Performance, 28*(2), 165–182. https://doi.org/10.1080/08959285.2015.1006772

Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly*, 425–478. https://doi.org/10.2307/30036540

Venkatesh, V., Thong, J. Y., & Xu, X. (2016). Unified theory of acceptance and use of technology: A synthesis and the road ahead. *Journal of the Association for Information Systems, 17*(5), 328–376. https://doi.org/10.17705/1jais.00428

Wagner, I. (2016). Gender and performance in computer science. *ACM Transactions on Computing Education, 16*(3), 1–16. https://doi.org/10.1145/2920173

Wigfield, A., & Eccles, J. S. (2000). Expectancy–value theory of achievement motivation. *Contemporary Educational Psychology, 25*(1), 68–81. https://doi.org/10.1006/ceps.1999.1015

Xie, K., & Huang, K. (2014). The role of beliefs and motivation in asynchronous online learning in college-level classes. *Journal of Educational Computing Research, 50*(3), 315–341. https://doi.org/10.2190/EC.50.3

Yang, Y., & Cao, L. (2013). Differential influences of achievement approach goals and intrinsic/extrinsic motivation on help-seeking in e-learning. *Knowledge Management & E-Learning, 5*(2), 153. https://doi.org/10.34105/j.kmel.2013.05.011

Yeh, Y.-C., Kwok, O.-M., Chien, H.-Y., Sweany, N. W., Baek, E., & McIntosh, W. A. (2019). How college students' achievement goal orientations predict their expected online learning outcome: The mediation roles of self-regulated learning strategies and supportive online learning behaviors. *Online Learning, 23*(4), 23–41. https://doi.org/10.24059/olj.v23i4.2076

Yu, Q., & Schunn, C.D. (2024). Which experiences are consistently associated with other-regulation of peer feedback length? Journal of Educational Psychology. Advance online publication. https://doi.org/10.1037/edu0000913.

Zong, Z., Schunn, C. D., & Wang, Y. (2021). What aspects of online peer feedback robustly predict growth in students' task performance? *Computers in Human Behavior, 124*, Article 106924. https://doi.org/10.1016/j.chb.2021.106924

Zong, Z., Schunn, C. D., & Wang, Y. (2022). Do experiences of interactional inequality predict lower depth of future student participation in peer review? *Computers in Human Behavior, 127*, Article 107056. https://doi.org/10.1016/j.chb.2021.107056

Zou, Y., Schunn, C. D., Wang, Y., & Zhang, F. (2018). Student attitudes that predict participation in peer assessment. *Assessment & Evaluation in Higher Education, 43*(5), 800–811. https://doi.org/10.1080/02602938.2017.1409872