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Do teamwork experience and self-regulated learning determine the performance of students in an online educational technology course?

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Abstract
This study uses the quantitative research approach to examine the connection between students' teamwork experience, self-regulated learning, technology self-efficacy, and performance in an online educational technology course. Sixty-three (63) students participated in this study. The study data were collected through an online questionnaire that included background information, course satisfaction, motivation strategies for learning, and online technology self-efficacy, to study the variables' interactions using quantitative research. To realize this study's aims, multivariate regression and correlation approaches were employed to analyze the online students' data. The multivariate regression analysis results show a relationship between self-regulated learning, the online course level, and the number of online courses that the students have completed. Right self-regulated learning strategies in online courses motivate students to strive for a good teamwork experience, leading to increased interest in online learning. In addition, the results also show that there is a relationship between satisfaction and the level of the online course. Achieving good grades makes the student more satisfied and improves the level of technology use. Finally, this study established a relationship between the students' motivation and the online course level. Therefore, teachers and course designers should implement learning objects that promote students' engagement and motivation in online learning environments.

Keywords Teamwork experience · Self-regulated learning · Technology self-efficacy · Course performance · Online learning environment · Educational technology

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1 Online learning experience

The internet and smart technologies have become an integral part of the daily lives of higher education students. This development has aided the explosive growth in online distance learning. Distance education is categorized as a mode of education in which the learners, teachers, and institutions are physically separated from each other and encompass technology to facilitate the needed interaction (Gunawardena & McIsaac, 2004). Online learning is a form of delivery technique in distance education that uses the computer and internet to convey learning, information, and knowledge to students separated by distance, space, and time (Dempsey & Van Eck, 2002; Khan, 1998). Teamwork, flexibility, and convenience of online learning are critical factors for students in this millennium. A student can study at their own pace anytime and anywhere with smart technologies and internet connection. It has been revealed that students in online and traditional settings perceived different motivation, course satisfaction, and learning in these environments (Mullen & Tallent-Runnels, 2006). Besides, learning characteristics such as flexibility, accessibility, virtual communication, student motivation dynamics, etc., are different in online learning (Chen & Jang, 2010). Educators are, therefore, seeking ways to enhance the online learning experience.

Enrollment in online courses in higher education has increased significantly in the past decade across the globe (Armstrong, 2011; Wang et al., 2013). The prospect and significance of online learning are evident from the high enrollment of students. Therefore, understanding the learners' needs and tailoring instruction to enhance the learning experience are the foremost steps to implementing appropriate instruction for the learners in an online course.

In a survey conducted among students enrolled in European higher education, among the 1765 respondents, most distance education students are adult learners aged between 25 to 44 years old (Schneller & Holmberg, 2014). According to Kuong (2009), these categories of students are "more likely to be self-directed, self-motivated, goal and relevancy oriented and less dependent on instructors" (p. 20-21). Similarly, Knowles (1980) acknowledged that adult learners are autonomous and self-directed, having a problem-centered orientation to learning, possess rich life experiences and knowledge, and are primarily motivated to learn due to intrinsic factors. On the contrary, Kuong (2015) opined that physical and cognitive changes and slow reaction to learning are some common factors that affect adult learners. However, the ability to take control of the pace of learning and the application of vast personal experience to problem-solving will help online learners to remain persistent in achieving sustained performance and remarkable learning experience.

An in-depth understanding of students' teamwork experience in online courses contributes to a firm foundation for an enhanced online learning experience. Moreover, as enrolments in online learning linger, the performance and student learning experiences develop into a dire concern that should be tackled. This study aims to unravel the relationship among students' teamwork experience, self-regulated learning, technology self-efficacy, and performance in an online educational technology course.

2 Academic performance

Academic performance can help assess distance education's fundamental value (Wang et al., 2013). According to Paechter et al. (2010), course outcome is concerned with cognitive and emotional variables. Regarding the cognitive variables, academic performance is the most important, whereas course satisfaction is the essential influential variable (Paechter et al., 2010; Wang et al., 2013). Academic performance requires diverse competencies such as problem-solving skills, practical and theoretical knowledge, social skills (e.g., teamwork learning), and experiential knowledge (Wang et al., 2013). However, an emotional variable is associated with the satisfaction that a student obtained in a course. This satisfaction influences the student's decision to persist until the end of a course (Levy, 2007). Lee and Choi (2013) showed significant facilitating effects of student satisfaction and learning experience on retention in an online course.

Similarly, Rostaminezhad et al. (2013) indicated that persistent students had significantly higher self-regulation than the dropout students in an online course. Consequently, students' satisfaction can be reasonably associated with persistence, positive learning experience, and self-regulation in online courses. More satisfied students are likely to achieve better academic performance in online courses. Hence, an online course's success depends mainly on the satisfaction derived through students' learning experience and their success in learning the course content (Wang et al., 2013).

3 Teamwork and collaboration as a facilitator

Teamwork and collaboration elements can influence team members to support the team's goals, which offers an opportunity to take full advantage of individuals' contributions to the team's success. Johnson et al. (2002) assert that this type of collaboration aims to develop team-based or group work activities that will foster team members to communicate, cooperate, and team-up to perform tasks regardless of time and space. Collaboration in online learning has been shown to promote learning, social interaction, communication, problem-solving skills, critical thinking, creativity, motivation, and personal satisfaction in the educative process through engagement in knowledge construction with peers (Tsai, 2013; Tseng & Yeh, 2013). Previous research indicated that students favored working collaboratively in online education (Biasutti, 2011; Tsai, 2013). A positive relationship has been established between collaborative learning and online course satisfaction (So & Brush, 2008). Students who perceive high levels of collaborative learning are more likely to be more satisfied with online courses than those who perceive low levels.

Moreover, teamwork and collaboration can increase the academic performance of the student in an online course. *However, to the best of our knowledge, there has been no quantitative research that simultaneously examined the relationship between online learning experience, teamwork experience, and academic performance.* Online learning platforms provided practical support to both teachers and

students to develop a teamwork approach, mainly through group workspace and shared learning environments such as forums, and discussion boards, where teams can chat, develop ideas, and collaborate to solve problems (Johnson et al., 2008). Therefore, it is vital for instructors in an online course to understand students' expectations for collaborative learning.

4 Self-regulated learning and academic performance in online settings

Learning in online settings is different from learning within traditional settings. "Students in online learning settings do not physically present themselves in a classroom and do not have the opportunity to interact face-to-face with their instructors and classmates." (Wang et al., 2013, pp.304). Students in an online course would need more persistence, focus, and discipline to succeed. In addition, online learners must take responsibility for their own educational undertakings to achieve the much-needed success. The relevance of self-regulation in improving academic performance in online settings cannot be overemphasized. Zimmerman (1989) asserts that self-regulated learning denotes the use of specified learning strategies, and personality attributes such as metacognition, motivation and behavioral orientations, to achieve desired learning goals. Self-regulated students initiate and direct their own learning rather than relying on educational actors such as teachers, parents or peers. Besides, research has shown that students who have mastered self-regulation of their learning outperform those who are less capable to self-regulate their learning (Broadbent & Poon, 2015; Zimmerman & Schunk, 2001; Mwandosya et al., 2019). Existing studies have tried to establish the relationship among relevant online learning variables for example, between students' characteristics and self-regulated learning (Wang et al., 2013), between self-regulated learning and academic performance (Rashid & Asghar, 2016; Zimmerman & Schunk, 2001). However, studies among online learning facilitating variables such as teamwork, motivation, and collaboration on the one side, and self-regulated learning and academic performance on the other side are uncommon. Therefore, this study will build on existing research to reveal the relationship among teamwork experience, self-regulated learning, technology self-efficacy, and academic performance. Existing studies were, for example, confined to the study of the perceptions of students in online courses and achievement (Barnard et al., 2008). Besides, Rashid and Asghar (2016) applied a path model to test the use of technology, self-directed learning, student engagement, and academic performance. The study indicated that technology use positively affects self-directed learning and student engagement; besides, academic performance is indirectly affected by technology via self-directed learning (Rashid & Asghar, 2016).

5 Online technology self-efficacy and academic performance

The notion of self-efficacy denotes the convictions about one's ability to execute a particular task at the expected level (Puzziferro, 2008; Bandura, 1997). A person's conviction to accomplish a designated task provides the drive and zeal to engage in the

task. Self-efficacy "acts as a motivational influence and affect individual action, performance, and behavior" (Puzziferro, 2008, p.73) and mediate between an individual's behavior to attempt an assignment and persisting to completion of the assignment. Self-efficacy influences learners' motivation, persistence and learning, and academic achievement (Wang et al., 2013). The study of self-efficacy is particularly relevant to online learning, as extra effort and motivation are required by online learners to persist to the end of the course. Besides, proficiency in online technologies is necessary to improve student's positive self-efficacy towards online learning. Examples of online technology proficiency include opening a web browser, bookmarking a website, conducting an internet search using one or more keywords, signing on and off an asynchronous conferencing system, using emails, participating in discussion boards, and download and upload of files. Persistence in an online course has been attributed to learners' strong computer skills and less computer anxiety (Osborn, 2001). Similarly, Bates and Khasawneh (2004) opined that the learners who panic in using computer technologies tend to experience frustration, confusion, apprehension, withdrawal, and exclusion.

Nevertheless, previous studies have conveyed inconsistent results about the relationship between online technology self-efficacy and academic performance. Malaney (2004) reported that students' grades were hurt because they spent too much time on the internet and had difficulty controlling the amount of time they spent online. Other studies such as Karpinski and Duberstein (2009), DeTure (2004), and Puzziferro (2008) have shown there is no correlation between technology self-efficacy and academic performance in online courses. Hunley et al. (2005) reported no significant association between using a computer and academic performance among adult students. Moreover, the grade point averages (GPA) were not closely associated with particular online undertakings, such as browsing the web for information, sending and receiving email, etc.

Furthermore, a positive relationship between technology self-efficacy and academic performance has been established (Pasek et al., 2009; Wang & Newlin, 2002). Notwithstanding the varied research outcomes, substantial interest is apparent in the drive to unravel the link between technology self-efficacy and academic performance among online courses universities. Therefore, this study adopted the multivariate regression analysis to investigate the relationship among online learning experience, collaboration and teamwork experience, self-regulated learning, technology self-efficacy, and academic performance. Besides, according to earlier research results, this study was schemed to explore the postulated model presented in Fig. 1.

This study will consider the following research hypothesis:

- Students' levels of the current online course, the number of online courses, the previous online course's grade, teamwork experience, self-regulated learning, and technology self-efficacy predict performance (grade and course satisfaction) in online learning courses.
- Teamwork experience, technology self-efficacy, learning strategies, motivation are facilitators for course satisfaction, the current studies' level, the previous online course's grade, and course performance.

This study's exogenous variables are the level of education, grade in a previous online course, and the number of already completed online courses. Simultaneously,

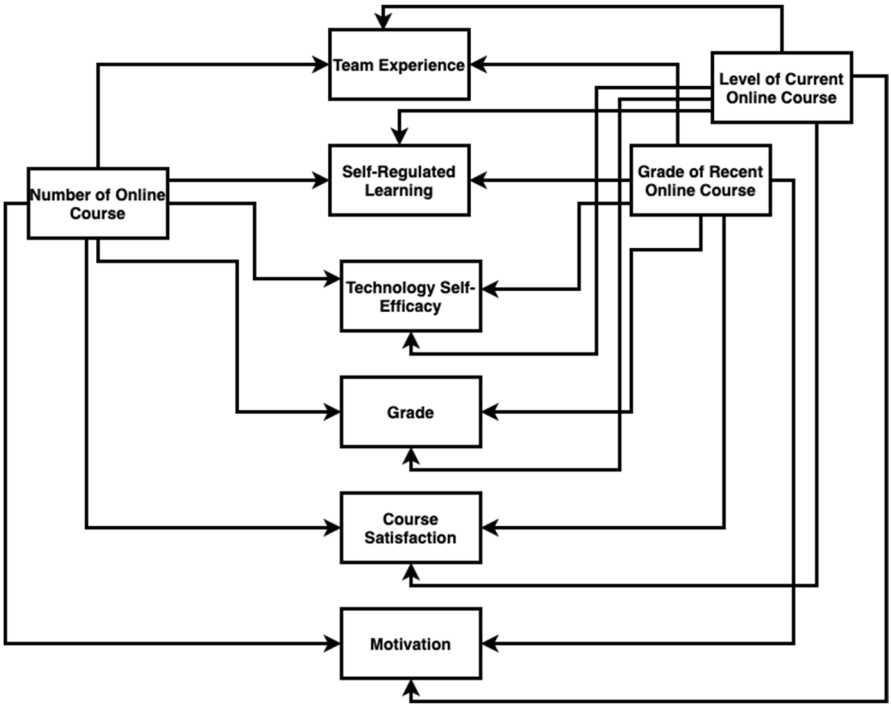

Fig. 1 Postulated model showing the relationship among the variables

the endogenous variables are teamwork collaboration, learning strategies, motivation, course satisfaction, grade in the current course, and technology self-efficacy.

6 Research design

6.1 Participants

Sixty-three students ($N=63$) participated in this study. The selected participants enrolled in an online course in a Finnish University. The educational technology research group offers students from diverse academic majors who consider the course relevant to their future career options. The participants were informed that participating in the study is voluntary, and assurances were offered regarding their responses' confidentiality.

6.2 Course setting

The course involved in this study is entitled, Technologies in Education. The course is four months long, five ECTS (European Credit Transfer and

Accumulation System), and offered biannually. The course deals with advanced learning technologies, for example, the use of technology in education. The course's main aim is to provide knowledge about some of the advanced technologies related to learning and increase awareness of the possibilities, roles, opportunities, and challenges of technological advances and innovations in learning and education. The learning objectives followed Bloom's taxonomy that classifies educational learning objectives into levels of complexity and specificity (cognitive, affective, sensory). The followings are the learning objectives set in this course. At the end of the course, the students are expected to 1) be familiar

Table 1 Course modules and learning activities within the State-of-the-Art Technologies in Education

Study module	Description of learning activities in the modules
1. Introduction to contemporary learning technologies	Learning activity 1: Introduction to the course Learning activity 2: Introduction to Advanced Learning Technologies - explore and study themes and concepts Learning activity 3: Discuss presentations related to advanced learning technologies
2. Learning technologies in action	Learning activity 4: Advanced learning technologies in action – create a plan on how to use advanced learning technology in a concrete educational setting, in teams of 3-5 students for collaboration, discussion, and learning from peers. Teams will use online platforms for teamwork. An important consideration for the team's online collaboration platform is that the team can use any solution/platform/tool/environment. The team will communicate and share documents via the selected technology. Besides, the course instructor should be able to have access to the team's working space. A plan for collaboration should be included in the team's mid-way report. Teams should identify a specific area of study or a learning situation, e.g., the learning context, where the technology will support the learners' learning processes. A learning context can be, for instance, a computing course at the university level or a chemistry class in a high school, or a painting course in a vocational training school. The central aspect is that the learning context is defined as precisely as possible: what is the subject matter, which level of education (higher education, secondary education, primary education), what is the course or study unit, what is the subject under study, who are the learners, what are the learning goals. It is not enough to give a general introduction to the technology, but the team needs to think about how it can be applied in real-life settings.
3. Summary and reflection	Learning activity 5: Summary & Reflection: The purpose of the study module is to look back by exploring the presentations shared in Study module 1, authoring summaries of teamwork presentations given in study module 2, writing a personal reflection about the group work, and finally summarizing the whole course. The module has one learning activity, which includes four distinct components.

with some of the recent technological advances in education, 2) understand the role of novel technology in education, 3) plan a lesson or part of a lesson using a selected technological innovation. The course contents are divided into three modules and five learning activities, as presented in Table 1. Two teachers were involved in teaching the modules. The course was set up on the Moodle platform of the Finnish University. Moodle, being a free and open-source learning management system, support the creation, organization, and offering of online courses for teachers and students to achieve learning goals.

6.3 Measures

Learners in the online course completed the questionnaire two weeks after the course. The questionnaire contained four sections based on items from the demographic measures, course satisfaction questionnaire (Frey et al., 2003), modified motivation strategies for learning questionnaire (Pintrich et al., 1993; Artino & McCoach, 2008), and online technology self-efficacy scale (Miltiadou & Yu, 2000). These instruments have been used in previous studies (Wang et al., 2013; Puzziferro, 2008).

6.4 Demographic measures

The demographic aspect collected information such as student's age, sex, level of current studies (bachelor, master, doctoral), number of online courses taken, the grade for the previous online course, and grade of the current online course. The grade for the previous and current online courses were coded as A = 5, B = 4, C = 3, D = 2 and F = 1.

6.5 Course satisfaction questionnaire (CSQ)

The CSQ (Frey et al., 2003) consisted of 21 different items and was used to measure the students' overall satisfaction with the online course. The instrument consisted of items covering areas associated with the interaction between students and instructor, interaction among students, organization of the course content, the relevancy of course content, the teaching methods for delivering the content, and the feedback mechanisms adopted in the course (see Appendix Tables 6 for the CSQ items). Responses are scored on a seven-point Likert scale, ranging from 1 (completely dissatisfied) to 7 (completely satisfied). A high score in the response determines a higher level of satisfaction concerning the online course. Tests on the psychometric characteristics of the CSQ from previous studies indicate reliability coefficient or internal consistency, Cronbach's alpha = .97 (Frey et al., 2003; Wang et al., 2013). In this current study, the Cronbach alpha was estimated at .96.

6.6 Modified motivation strategies for learning questionnaire (modified MSLQ)

The MSLQ has gained wide use for measuring self-regulated learning (Pintrich et al., 1993; Zimmerman, 2008; Dinsmore et al., 2008). The MSLQ was designed to address aspects of self-regulated learning, which includes motivation, metacognition, and behavior. It has two parts comprising of motivation and learning strategies. The motivation part was grounded on the general social-cognitive model of motivation, including self-reported components such as value, expectancy, self-efficacy, and affect (Jackson, 2018). However, the learning strategies aspect was prepared to measure the overall cognitive strategies of student's learning and processing of information (Jackson, 2018; Wang et al., 2013). This study will adopt the modified MSLQ by Artino and McCoach (2008). It is more applicable to measure self-regulated learning in an online learning environment (see Appendix Table 7 for the modified MSLQ items). The motivation part of the modified MSLQ comprises 19 items that address task value, self-efficacy, and test anxiety. In contrast, the learning strategies part comprises 31 items that address elaboration, critical thinking, metacognitive self-regulation, and time/study environmental management. Responses are scored on a seven-point Likert scale, ranging from 1 (not at all true of me) to 7 (very true of me). The higher the score, the higher the indication of motivation and use of suitable online learning strategies. The following Cronbach's alpha has been reported by Artino and McCoach (2008), task value = .90, self-efficacy = .93, test anxiety = .80, elaboration = .75, critical thinking = .80, metacognitive self-regulation = .79, and time/study environmental management = .76. For this particular study, the following Cronbach's alphas were recorded: task value = .92, self-efficacy = .92, test anxiety = .93, elaboration = .94, critical thinking = .86, metacognitive self-regulation = .91, and time/study environmental management = .82.

6.7 Online technologies self-efficacy scale (OTSES)

The OTSES (Miltiadou & Yu, 2000) was developed to measure the online students' self-efficacy with communication technologies. OTSES consisted of 30 items in which responses are scored on a four-point Likert scale representing a different level of confidence, ranging from 1 (not confident at all) to 4 (very confident). The higher score represents the higher level of self-efficacy (see Appendix Table 8 for the OTSES items). In the study by Miltiadou and Yu (2000), the Cronbach's Coefficient Alpha for the whole instrument was .95. In this current study, the Cronbach alpha was estimated at .83.

6.8 Procedure

This study used an online survey hosted on Google forms. Participants received the survey invitation in the course platform's announcement feature and through the email address linked to the student's Moodle profile. The invitation was sent two weeks after the course so that the participants would have received their grades. The

invitation message contained a link to enter the online survey platform. All students enrolled in the course were at least 18 years old and invited to participate in the survey. The data were collected anonymously, and no information that will identify the respondents was collected in the survey.

7 Methods

7.1 Multivariate regression analysis

Multivariate regression analysis shows the relationship between one or more dependent and independent variables, i.e., a multivariate regression model is not interested in predicting only one dependent variable but several dependent random variables,$Y_1, Y_2, \ldots, Y_p$.

$$Y_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_p X_p + e$$

where, β_0 is the intercept.

$\beta_1, \beta_2, \ldots, \beta_p$	are the regression coefficients
$X_1, X_2, \ldots, X_p$	are the independent variables
$Y_1, Y_2, \ldots, Y_p$	are the dependent variables and
e	is the error term.

The analysis was carried out using STATA 12 software (StataCorp, 2011).

8 Results

This section presents the analysis carried out to investigate the relationships among the variables in each of the objectives set out in this study. The variables used in the analysis include dependent variables [team experience, self-regulated learning (SRL), technology self-efficacy (TS), motivation, grade, and satisfaction] and Independent variable [level of the online course (LOC), number of the online course (NOC), the grade of the recent online course (GRC)].

Hypothesis 1 Students' levels of the current online course, number of online courses, grade of the previous online course, teamwork experience, self-regulated learning, and technology self-efficacy predict performance (grade and course satisfaction) in online learning course.

The model summary of the multivariate regression analysis shows the percentage of the independent variables [level of the online course (LOC), number of the online course (NOC), the grade of the recent online course (GRC)] explained by the dependent variables [team experience, self-regulated learning (SRL), technology self-efficacy (TS), grade and satisfaction] (see Table 2).

Table 2 Model summary of the dependent variable

Equation	Root Mean Square error	R-squared	P
Experience	0.89	0.06	0.29
SRL	1.00	0.10	0.10
TS	0.35	0.04	0.48
Grade	0.94	0.08	0.17
Satisfaction	0.98	0.14	0.03

Table 2 shows that team experience, self-regulated learning, technology self-efficacy, and grade are not significant ($p > 0.05$), while satisfaction is significant ($p < 0.05$). The R-sq. shows that the three independent variables explain 6%, 10%, 4%, 8%, and 14% of the dependent variables' variance (team experience, self-regulated learning, technology self-efficacy, grade, and satisfaction).

Table 3 presents the test of equality, which is used to measure the relationship between the dependent variables: team experience, self-regulated learning, technology self-efficacy, grade and satisfaction, independent variables: level of the online course, number of online courses, grade of the recent online course.

Figure 2 shows the relationship between the dependent variables and the independent variable to confirm hypothesis 1.

Table 3 presents the models and their linear relationship using the hypothesis:

H_0: there is no linear relationship between the dependent and independent variables vs. H_1: there is a linear relationship between the variables

Decision rule: reject H_0, if $p < 0.05$.

Effect of self-regulated learning on the online course level, number of the online course, and the recent online course grade. The regression equation is presented as:

$$\text{Self-regulated learning} = 3.2562 + 0.4789\text{LOC} + 0.2111\text{NOC} + 0.0450\text{GRC}$$

Table 3 Regression coefficients

Variables	Coefficient	Standard Error	t	P > |t|
SRL				
LOC	0.48	0.21	2.32	0.02
NOC	0.21	0.10	2.11	0.04
GRC	0.05	0.14	0.32	0.75
Constant	3.26	0.82	3.95	0.00
Grade				
LOC	0.42	0.19	2.14	0.04
NOC	0.05	0.09	0.49	0.63
GRC	0.03	0.13	0.18	0.86
Constant	0.93	1.13	0.82	0.42
Satisfaction				
LOC	0.57	0.21	2.74	0.01
NOC	0.16	0.10	1.63	0.11
GRC	0.12	0.14	0.82	0.42
Constant	3.42	0.83	4.14	0.00

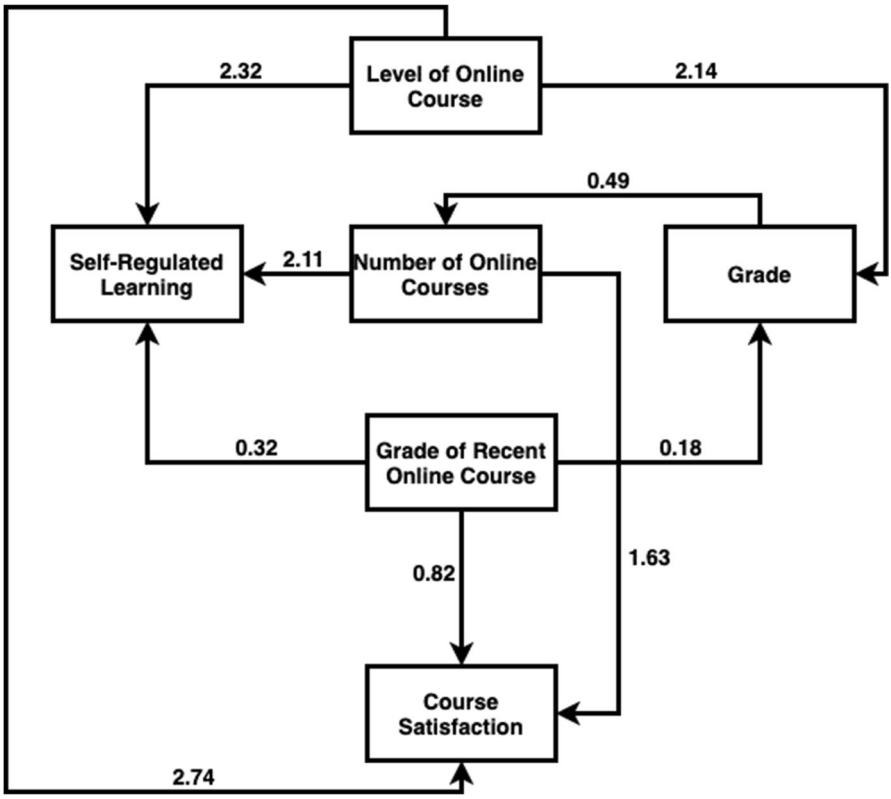

Fig. 2 The model based on hypothesis 1

1) Decision: since p (0.024) < 0.05, reject H_0
2) Decision: since p (0.039) < 0.05, reject H_0
3) Decision: since p (0.752) > 0.05, accept H_0

Conclusion: There is a linear relationship between self-regulated learning and (level of the online course, number of the online course) with $t = 2.32$ and 2.11 respectively, i.e., it is statistically significant while there is no linear relationship between self-regulated learning and grade of the recent online course with $t = 0.32$, i.e., it is not statistically significant.

Effect of grade on the online course level, number of the online course, and the grade of a recent online course. The regression equation is presented as:

$$\text{Grade} = 0.9299 + 0.4163\text{LOC} + 0.0464\text{NOC} + 0.0245\text{GRC}$$

1) Decision: since p (0.036) < 0.05, reject H_0
2) Decision: since p (0.625) > 0.05, accept H_0
3) Decision: since p (0.855) > 0.05, accept H_0

Conclusion: There is a linear relationship between self-regulated learning and online course level with $t = 2.14$, i.e., statistically significant. Simultaneously, there is no linear relationship between self-regulated learning and (number of online courses and grade of the recent online course) $t = 0.49$ and 0.18, respectively, i.e., it is not statistically significant.

Effect of course satisfaction on the online course level, number of online courses, and the recent online course grade. The regression equation is presented as:

Course satisfaction $= 3.4212 + 0.5673\text{LOC} + 0.1639\text{NOC} + 0.1169\text{GRC}$

1) Decision: since p $(0.008) < 0.05$, reject H_0
2) Decision: since p $(0.109) > 0.05$, accept H_0
3) Decision: since p $(0.415) > 0.05$, accept H_0

Conclusion: There is a linear relationship between satisfaction and level of online course $t = 2.74$, i.e., it is statistically significant while there is no linear relationship between satisfaction, number of online course and grade of recent online course $t = 1.63$ and 0.82 respectively, i.e., it is not statistically significant.

Hypothesis 2 Teamwork experience, technology self-efficacy, learning strategies, motivation are facilitators for course satisfaction, current studies, the grade of the previous online course, and course performance.

Table 4 presents the percentage of the independent variables: level of the online course (LOC) and grade of the recent online course (GRC) explained by the dependent variables: team experience, self-regulated learning (SRL), technology self-efficacy (TS), motivation, grade, and satisfaction.

Interpretation: Table 4 shows that team experience, self-regulated learning, technology self-efficacy, motivation, grade, and satisfaction are not significant ($p > 0.05$). The R-sq. shows that the three independent variables explain 5%, 3%, 2%, 6%, 7%, and 6% of the dependent variables' variance (team experience, self-regulated learning, technology self-efficacy, motivation, grade, and satisfaction).

Table 5 presents the test of equality, which is used to measure the relationship between the dependent variables [team experience, self-regulated learning (SRL),

Table 4 Model summary of dependent variable

Equation	Root Mean Square error	R-squared	P
Experience	0.88	0.0513	0.2062
SRL	1.03	0.0321	0.3759
TS	0.35	0.0211	0.5274
Motivation	0.90	0.0615	0.1489
Grade	0.94	0.0776	0.0887
Satisfaction	1.01	0.0586	0.1634

Table 5 Regression coefficients

Variables	Coefficient	Standard Error	t	P > |t|
Grade				
LOC	0.37	0.16	2.23	0.03
GRC	0.04	0.13	0.34	0.73
Constant	1.29	0.82	1.50	0.14

technology self-efficacy (TS), motivation, grade, and satisfaction] and the independent variables [level of the online course (LOC) and grade of the recent online course (GRC)].

Figure 3 presents the model diagram showing the relationship between the online course level, the recent online course's grade, and course grade.

Table 5 presents the models and their linear relationship using the hypothesis:

H_0: there is no linear relationship between the variables vs. H_1: there is a linear relationship between the variables

Decision rule: reject H_0, if $p < 0.05$.

Effect of grade on level of online course and grade of the recent online course. The regression equation is presented as:

$$\text{Grade} = 1.2896 + 0.3660\text{LOC} + 0.0437\text{GRC}$$

1) Decision: since p (0.030) < 0.05, reject H_0
2) Decision: since p (0.732) > 0.05, accept H_0

Conclusion: There is a linear relationship between motivation and level of online course $t = 2.23$, i.e., it is statistically significant, while there is no linear relationship between motivation and grade of recent online course $t = 0.34$, i.e., it is not statistically significant.

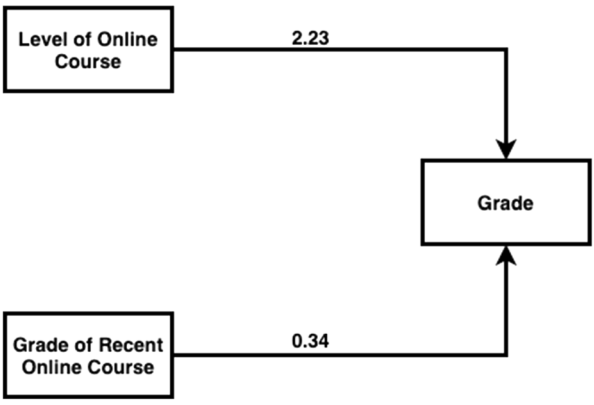

Fig. 3 The model based on hypothesis 2

9 Discussion

Earlier, this study set two clear objectives to accomplish and contribute to online learning literature. This research employed multivariate regression and correlation to analyze data collected from the online students in an educational technology course in a Finnish University to achieve these set goals. To clarify each objectives' importance, this study aligns the suitable data analysis technique with the objectives in a systematic order. Multivariate regression analysis was employed to expand knowledge on objectives one, while Pearson correlation was used to expound on the second objective. To find answers to the question that indicates whether students' levels of the current online course, number of the online course, the grade of the previous online course, teamwork experience, self-regulated learning, and technology self-efficacy can predict performance, that is, grade and course satisfaction in an online learning course and whether students degrees of teamwork experience, self-regulated learning strategies courses technology self-efficacy varies according to the level of current studies, number of the online course and grade of the previous online course and why teamwork experience, technology self-efficacy, learning strategies, motivation are facilitators of course satisfaction, level of current studies, the grade of the previous online course and course performance, this study examined the relationship of six dependent variables and three independent variables. To respond to research question one, this study revealed the online course level and the number of online courses as predictors of self-regulated learning. Still, the number of online courses is a positive predictor, which indicates that the higher the number of online courses the online students attempt, the higher the self-regulated learning or vice versa.

The level of the online course is the highest predictor of self-regulated learning. Additionally, the level of online courses positively predicts the online student's grade. It means the online course level will have a positive impact on the online student's grade. When the online course level increases, the online students' grades may appreciate. The level of online courses also predicts online learning satisfaction. As the level of online courses increases, online student satisfaction increases. There is an establishment of variation in the relationship of students' degrees of teamwork experience, self-regulated learning strategies, technology self-efficacy according to the level of current studies, the number of online courses, and grade of the previous online course as the results show positive, and insignificant relationship.

The grade is found as the facilitator of the level of the online course. This study confirmed that effective self-regulated learning strategies lead to higher performance levels and course satisfaction in online learning settings, indicating the more elevated the self-regulated learning strategies, the higher the online students' performance and course satisfaction. The integration of students' teamwork experience and self-regulated learning as an antecedent of online student performance demands thorough investigation. In comparison to the recent studies that focus on the usefulness of semantic search engine for academic resources on engineering teamwork (García-Peñalvo et al. (2020), using project management application to improve

students' teamwork experience (Young Illies & Stachowski, 2020) and application of immersive virtual reality to augmenting learning of design teamwork (Sonalkar et al., 2020; Oyelere et al., 2020; Bouali et al., 2019). This current study established a linear relationship between self-regulated learning, online course level, and the number of online courses. This result clarifies the impact of self-regulated learning on online courses. The evidence of a linear relationship between satisfaction, level of online courses, and the number of online courses taken was established. The students undertaking online courses have the fulfillment of their expectations. Besides, the online students' motivation shows a linear relationship with the online course level while there is also a linear relationship between self-regulation learning and satisfaction. This study showed the factors responsible for students' online courses' performance and advancement as motivation, self-regulated learning, and satisfaction. It emphasized the crucial role of self-regulated learning as antecedents of online learning performance and satisfaction. It also clarified an ambiguity in the relationship of these variables and established their conceptualization in the context of online computer courses.

9.1 Study limitation and future study

Trying to measure the factors determining the effectiveness of academic e-learning is not an easy task. Group work and self-regulation are conditioned by many intermediate variables, such as the subject matter of the course, students' interest in a given topic, the quality of the course - the content made available on the platform, the use of various didactic forms, the type of e-learning platform used, the level of digital competence of students and previous experiences with e-learning in the studied group. Not all of these variables were included in the research model. Therefore, it is worth extending further research with the indicated intermediate variables.

This research has one element which significantly limits the possibility of generalizing the collected results. This is the size of the research sample. There is, therefore, a need to renew the research procedure among more students. However, considering the country's specificity in which the study was carried out, it should be stressed that these studies covering groups of no more than several dozen people are distinct sample groups for a given field of study in a given year. However, concerning other countries where academic e-learning courses are delivered in more numerous groups, this sample can only be considered an adequate representative for pilot studies.

A limitation that also requires further analysis is the coefficient (R-squared), which explains only several percent of the independent variable. This means that further research involves adding the intermediary variables listed in the previous paragraphs to the model, which may clarify the research model presented in Fig. 1. Among the variables that may be particularly useful in developing the research model and increasing the prediction level are student orientation towards collaboration and motivation. However, this new model requires a battery of psychological tests and psychologists' inclusion dealing with educational processes in the cooperation.

An exciting direction of research showing the effectiveness of the proposed model seems to be comparative analyses, where the same group of students will participate in various courses. It will then be possible to assess to what extent cooperation in the group depends on the course's subject matter. There is a possibility that the hidden intermediary variable is not only the individual predispositions of the students but above all the elements relating directly to the characteristics of a given e-learning course, i.e., the type of content, the types of activation methods, the length of the course, the field of study.

10 Conclusion

This study focused on online students' performance and to accomplish the study's objectives, the research utilized multivariate regression analysis to examine students' teamwork experience, self-regulated learning, technology self-efficacy, and performance in an online educational technology course. This exposition is timely and attempts to integrate two crucial aspects of learning as determinants of online students' performance. Teamwork has been discussed in the current literature about student expectations during group projects. The study shows how students' prior experience with collaborative software development aligns with their expectations (Iacob & Faily, 2019). Besides, Konak et al. (2019) study concerns about online students' future teamwork attitudes and whether the online environment positively influences the student's teamwork skills. The study comparatively found out that students' attitudes towards teamwork online as a learning platform is less to the students with physical contact; nevertheless, the online students excel in self-efficacy teamwork. Self-regulated learning is related to teamwork as guidance of metacognition. It helps students to be conscious and understand their thought processes. According to Cárdenas-Robledo and Peña-Ayala (2019), self-regulation learning is a booster to students' conscious learning, especially technology-enhanced learning. Self-regulation in learning is an essential skill for teamwork. Reimann (2019) also concludes that self-regulated learning is a path to methodology and theory advancement. Musso et al. (2019) established the connection between cognitive processes and self-regulated learning and its effect on mathematics performance, and this is applicable at the strategic level. This study differentiates itself from the existing research by combining teamwork and self-learning regulations to predict the online students' academic performance. The integration of these key learning concepts facilitates the increasing understanding and retention of excellent students' performance. This study will help the education managers pay attention to integrating teamwork experience and self-regulation learning as a motivating factor for online courses success. It will also help the education managers to unite online students and teachers to accomplish their set goals for performance from time-to-time.

Appendix

Table 6 Course satisfaction questionnaire (CSQ)

S/N	Item
1	The amount of interaction between you and your instructor
2	The quality of interaction between you and your instructor
3	The cooperation between you and your classmates
4	The manner in which the syllabus was distributed
5	The logical organization of the course content
6	The reminders given to you about assignments due
7	The manner in which guidelines were given on the completion of assignments
8	The lecture notes provided to you
9	The extra learning resources provided to you (e.g., online resources, online discussion groups)
10	The format of the different assignments
11	The learning value of the assignments
12	The options available to you to hand in assignments
13	The time it took for your instructor to provide feedback on graded assignments
14	The quality of the feedback provided on graded assignments
15	Access to your grades during the semester
16	The teaching style of your instructor
17	The assistance given by the instructor in completing the course successfully
18	The instructor in terms of his devotion to the course
19	The accommodation of your approach to learning in the way this course was taught
20	The increase in your knowledge and/or skills as a result of this course
21	The increase in your confidence in using the knowledge and/or skills as a result of this course

Table 7 Modified motivation strategies for learning questionnaire (Modified MSLQ)

S/N	Item
Motivation Self-efficacy	
1	I believe I will receive an excellent grade in this class
2	I'm certain I can understand the most difficult material presented in the readings for this course
3	I'm confident I can learn the basic concepts taught in this course
4	I'm confident I can understand the most complex material presented by the instructor in this course
5	I'm confident I can do an excellent job on the assignments in this course
6	I expect to do well in this class
7	I'm certain I can master the skills being taught in this class
8	Considering the difficulty of this course, the teacher, and my skills, I think I will do well in this class
Test anxiety	
9	When I take a test I think about how poorly I am doing compared with other students
10	When I take a test I think about items on other parts of the test I can't answer
11	When I take tests I think of the consequences of failing
12	I have an uneasy, upset feeling when I take an exam
13	I feel my heart beating fast when I take an exam
Task value	
14	I think I will be able to use what I learn in this course in other courses
15	It is important for me to learn the course material in this class
16	I am very interested in the content area of this course
17	I think the course material in this class is useful for me to learn
18	I like the subject matter of this course
19	Understanding the subject matter of this course is very important to me
Learning strategies Elaboration	
20	When I become confused about something I'm reading for this class, I go back and try to figure it out
21	When I study for this class, I pull together information from different sources, such as readings, online discussions, and my prior knowledge of the subject
22	I try to relate ideas in this subject to those in other courses whenever possible
23	When reading for this class, I try to relate the material to what I already know
24	I try to understand the material in this class by making connections between the readings and the concepts from the online activities
25	I log in to Blackboard/WebCT for this class regularly
26	When studying for this course I try to determine which concepts I don't understand well
27	I try to apply ideas from course readings in other class activities such as online discussions
Time management	
28	I usually study in a place where I can concentrate on my course work
29	I make good use of my study time for this course

Table 7 (continued)

S/N	Item
30	I find it hard to stick to a study schedule
31	I have a regular place set aside for studying
32	I make sure that I keep up with the weekly readings and assignments for this course
33	I often find that I don't spend very much time on this course because of other activities
34	I rarely find time to review my notes or readings
Metacognitive and self-regulation	
35	When reading for this course, I make up questions to help focus my reading.
36	If course readings are difficult to understand, I change the way I read the material
37	Before I study new course material thoroughly, I often skim it to see how it is organized
38	I ask myself questions to make sure I understand the material I have been studying in this class
39	I try to change the way I study in order to fit the course requirements and the instructional methods used in this class
40	I try to think through a topic and decide what I am supposed to learn from it rather than just reading it over when studying for this course
41	When I study for this course, I write brief summaries of the main ideas from the readings and online discussions
42	When I study for this class, I set goals for myself in order to direct my activities in each study
Critical thinking	
43	I often find myself questioning things I hear or read in this course to decide if I find them convincing
44	When a theory, interpretation, or conclusion is presented in the online discussions or in the readings, I try to decide if there is good supporting evidence
45	I treat the course material as a starting point and try to develop my own ideas about it
46	I try to play around with ideas of my own related to what I am learning in this course
47	Whenever I read an assertion or conclusion in this class, I think about possible alternatives.

Table 8 Online technologies self-efficacy scale (OTSES)

S/N	Item
General technology	
1	Opening a Web browser (e.g., Netscape or Explorer)
2	Reading text from a Web site
3	Clicking on a link to visit a specific Web site
4	Accessing a specific Web site by typing the address (URL)
5	Bookmarking a Web site
6	Printing a Web site
7	Conducting an Internet search using one or more keywords
8	Downloading (saving) an image from a Web site to a disk
9	Coping a block of text from a Web site and pasting it to a document in a word processor
10	Creating a simple web page with text, images, and links
Online learning platform technology	
11	Providing a nickname within a synchronous chat system (if necessary)
12	Reading messages from one or more members of the synchronous chat system
13	Answering a message or providing my own message in a synchronous chat system (one-to-many interaction)
14	Interacting privately with one member of the synchronous chat system (one-to-one interaction)
15	Logging on and off an email system
16	Sending an email message to a specific person (one-to-one interaction)
17	Sending one email message to more than one person at the same time (one-to-many interaction)
18	Replying to an email message
19	Forwarding an email message
20	Deleting messages received via email
21	Creating an address book
22	Saving a file attached to an email message to a local disk and then viewing the contents of that file
23	Attaching a file (image or text) to an email message and then sending it off
24	Signing on and off an asynchronous conferencing system
25	Posting a new message to an synchronous conferencing system (creating a new thread)
26	Reading a message posted on an asynchronous conferencing system
27	Replying to a message posted on an asynchronous conferencing system so that all members can view it
28	Replying to a message posted on an asynchronous conferencing system so that only one member can view it (reply to sender)
29	Downloading (saving) a file from an asynchronous conferencing system to a local disk
30	Uploading (sending) a file to an asynchronous conferencing system

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