




# Predictors for students' self-efficacy in online collaborative groupwork

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## Abstract

This study examines factors related to student self-efficacy beliefs in on-line groupwork. Participants in this study were 204 graduate students taking an online graduate-level course from a public university in the Southeast United States of America. Two-level hierarchical linear models were used to examine predictors of the students' self-efficacy. Three student-level variables were found to be related to groupwork self-efficacy: individual's willingness to handle groupwork challenge, trust relationship, and leadership influence. At the group level, the group's willingness to handle groupwork challenge was positively related to individual student's groupwork self-efficacy. Discussions of the findings suggest that leadership is important for groupwork. Instructors of online courses are recommended to design high-quality group projects that are purposeful, meaningful, challenging, and engaging. Communications between group members are also recommended to build trust. Implications of the findings to online learning and instruction as well as directions for future research are presented.

**Keywords** On-line groupwork · Self-efficacy · Technology and media use · Willingness to handle challenges · Leadership · Trust relationship

## Predictors for student self-efficacy in online groupwork

Online learning has become increasingly popular, and researchers have been paying more attention to issues in the context of online collaborative learning because groupwork is a challenging task (Hsu and Ching 2013; López-Bonilla and López-Bonilla 2013). Challenges for students for successful online groupwork include communication, scheduling, individual accountability, and increased dependence on peers (Liu et al. 2010). Due to these challenges, it is important for instructors in online courses to help students meet these challenges. Previous studies showed a positive relationship between self-efficacy beliefs and the success of learning outcomes (Pajares 1996; Pajares and Graham 1999). Therefore, students' self-efficacy to work online with their group members is important for their success in online collaborative learning environments. However, students' self-efficacy in

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online groupwork is noticeably absent from much contemporary research on online collaborative learning, even though some researchers have called for more attention to this issue many years ago (Brindley et al. 2009; Thompson and McGregor 2009). This study is to fill this gap by examining factors related to student online groupwork self-efficacy so that instructors can pay attention to these factors while guiding their students in the use of groupwork to facilitate online learning.

As Bandura (1997) discussed, self-efficacy is the belief “in one’s capabilities to organize and execute the courses of action required to produce given attainments” based upon self-evaluation of their competence (p. 3). Efficacious students are more likely to take on challenging tasks and are more persistent with problem-solving, whereas less efficacious students are more likely to avoid difficult tasks (Stevens et al. 2004). There is a critical need to understand the factors that predict, or are related to, students’ self-efficacy while doing online groupwork. This line of research is important, as self-efficacy has a powerful influence on engagement, persistence, performance, and achievement, in different contexts, and for different learners and learning tasks (Schunk 1989), including online learning environments (De Dreu and Weingart 2003). This line of research is particularly relevant, as students tend to have a less favorable attitude toward online groupwork compared to face-to-face groupwork (Tutty and Klein 2008).

For understanding student self-efficacy in online groupwork, there are two relevant lines of research to consider: (a) theory and research on self-efficacy, and (b) empirical findings from online groupwork research that allude to a number of factors that may influence student groupwork self-efficacy.

## Theory and research on self-efficacy

Self-efficacy can influence a person’s behavior either positively or negatively, based on one’s perception of his/her abilities as related to a particular task. It influences the choices that a person makes, the effort that he/she puts forth, and his/her persistence when facing obstacles and failure (Ackerman and Wolman 2007). As described by Bandura (1997), people with a strong sense of self-efficacy have the following characteristics:

- view challenging problems as tasks to be mastered
- develop deeper interest in the activities in which they participate
- form a stronger sense of commitment to their interests and activities
- recover quickly from setbacks and disappointments

Numerous studies have linked student academic achievement with self-efficacy beliefs (Komarraju and Nadler 2013; Pajares and Graham 1999; Wang et al. 2012; Zimmerman and Kitsantas 2005). The significant relationship between self-efficacy beliefs and increase in English language proficiency was also found for English language learners in China, Singapore, Korea, Botswana, and Norway (Diseth 2011; Liem et al. 2008; Magogwe and Oliver 2007; Wang et al. 2013; Zuo and Wang 2016). While the literature is rich about the assessment of students’ self-efficacy beliefs in learning in relation to academic achievement in general (Pajares 1996), it provides insufficient insight or guidance about how to promote positive self-efficacy beliefs among students in the online groupwork. There is a need to develop a better understanding about the factors that could influence students’ self-efficacy beliefs in online groupwork.

## Online groupwork self-efficacy and collective self-efficacy

### Collaborative learning in online environment

Collaborative learning occurred when new knowledge is created through interaction between members that interact by sharing experiences and knowledge (Fermoso et al. 2015). In the context of e-learning environment where the goal is to use technology to support collaboration (Stahl et al. 2014), collaborative learning activities could be implemented in the e-learning system by a diversity of tools such as discussion boards, instant messaging, workshop, e-journal, e-mail, chat, video or audio communication tools (Ting 2012; Tuparova and Tuparov 2010). The development of technology has reformed how learners interact with each other and teachers. The emergence of related research has been focused on e-learning environment providing possibilities for students to interact with others in various forms (So and Brush 2008). From a constructivist perspective, peer collaboration and groupwork are critical components in e-learning environment (Vygotsky 1978).

### Member accountability and commitment in e-learning environment

Collaboration requires engagement within peers through social interaction (Amhag and Jakobsson 2009). Successful collaborative activities in e-learning environment are built on the trust for their group members based on member accountability and commitment, offering possibility for members in the group to develop understanding through collaborative constructs and become active learners. Extensive literature shows that trust is the underlying key determinant for positive peer relationship and team development. Zhang and Ge (2006) proposed a conceptual framework to guide research and practice pertaining collaboration in e-learning environment based on the understanding of the complexity of the dynamics of online collaborative groupwork represented in several aspects, such as peer relationship, group development and communication. Trust between group members addresses the affective component of collaboration in e-learning environment which may have important influences on team and task performances (Du et al. 2012).

### Communication choice and behavior in e-learning environment

Information and knowledge sharing is central to collaborative groupwork in e-learning environment. Kuljis and Lees (2003) indicated that collaborative e-learning systems concentrate on environments for information exchange and social interaction. Group members' media choices and behaviors impacts their opportunities to make full use of e-learning environment, either cause or facilitate to solve difficulties occurred between the teacher and the students and among the students (Kuljis and Lees 2003). Indeed, there is growing interest in the research field of communication of learners with multiple resources in e-learning environment (Garrison 2011). For example, Du et al. (2012) considered communication media in an e-learning environment inseparable from online collaborative groupwork.

### Self-efficacy and collaborative groupwork

Collaboration in an online course involves many activities, including threaded discussions, chat room sessions, paired activities, and small group activities. Through collaboration, students may become more involved in the learning process, and this will lead

to better comprehension (Stanford-Bowers 2008). Furthermore, collaboration may also promote interpersonal skills and personal connections, which could enhance student self-efficacy as they are aligned with the sources that would shape one's self-efficacy (Bandura 1986).

In theory, groupwork should be conducive to improving student self-efficacy, because a groupwork environment has some elements that are aligned with Bandura's four sources (i.e., mastery experience, vicarious experience, social persuasion, and physiological states) for shaping one's self-efficacy. For example, in a groupwork environment, students could have more opportunities to learn vicariously by observing their fellow group members. In a small group, students could have more opportunities for social persuasion as they interact with each other. Additionally, a small group environment could be less intimidating, which could lead to favorable *physiological states* for building up self-efficacy.

As suggested by De Dreu and Weingart (2003) on self-efficacy, a student's lack of self-efficacy in an online learning environment may become a barrier to the student's effectiveness in online learning. Self-efficacy can be the distinction between enjoying a successful experience in online groupwork or suffering from failure of the task at hand. The more efficacious a student feels, the more likely he/she will be successful in online groupwork.

Relevant to the current study is the discussion and research on self-efficacy in the context of groupwork or collaboration, or collective efficacy. Little and Madigan (1997) observed that when group members shared a sense of collective efficacy, this has a mediating and facilitating effect on the group effectiveness. As a result, perceived collective efficacy was a good predictor of group effectiveness. Lent et al. (2006) examined collective efficacy for students working in teams, and examined how such collective self-efficacy was related to team cohesion and personal self-efficacy. Their findings indicated that collective efficacy was a stronger predictor of team performance than members' individual self-efficacy. Similarly, Goddard et al. (2004) observed a strong correlation between a teacher's sense of personal efficacy and their perceived collective efficacy within their group of colleagues, and showed that teachers' choices were influenced by their collective efficacy beliefs. Overall, the concept of collective efficacy appears to be useful in explaining individual cognition in group situations, but the extent to which this concept is pertinent to explaining group motivation in online collaborative and shared learning settings still needs to be established.

## **Self-efficacy, trust, leadership, and communication in online groupwork**

### **Trust**

Online interpersonal interaction can be an important aspect of online groupwork. Newton (1997) argued that social trust could be divided into either "individuals" (personality trait of individuals related to other personality traits such as optimism, belief in cooperation, and confidence in the belief that individuals can resolve their differences) or "the whole" (a social trait: participation of an individual in a culture of trust or social system, in which attitudes or behaviors related to trust spread throughout the social community). Regardless of the distinction between "individuals" and "the whole," social trust is likely to influence online groupwork for building a bridge for interpersonal interaction. Indeed, trust is viewed as the foundation for effective interactions among the members of a collaborative team (Salas et al. 2005).

## Leadership

Another social issue in online groupwork is leadership. Effective leaders have been characterized as highly committed, determined, resilient, goal-focused, resourceful, and effective problem-solvers (Locke 1991). These effective leaders can directly influence group members' self-efficacy. One of the most reported findings in the leadership literature is the relationship between a leader's self-confidence and successful leadership (Kirkpatrick and Locke 1991). Bressler and Bressler (2007) contended that a highly confident person in a leadership role would stimulate other people's self-efficacy. With these considerations, the role of leadership should be considered in research on self-efficacy in online groupwork environment.

## Communication

One relevant variable related to research on online groupwork is communication media and technology use. As online collaboration and interactivity proceeds, learners face new challenges due to the lack of face-to-face communications. The fading or blurring of physical, temporal and psychological boundaries poses new challenges for online groupwork. Appropriate utilization of communication media may help group members better overcome some of the difficulties, thus enhancing group members' self-efficacy. In a review of social presence theory and studies on Information and Communication Technologies (ICT)-mediated communication, Brooks and Ammons (2003) concluded that immediacy enhances social presence, which in turn enhances interactions. For online collaborative learning, online teams are encouraged to promote the use of media that enhances group members' sense of social presence in order to increase group members' self-efficacy with the assistance from the instructor or an external moderator (Havard et al. 2008).

## Willingness to handle challenge

Mulvey and Klein (1998) argued that relevant research suggested noteworthy relationships between task challenges and the commitment and performance of group members for achieving the common goals. In the context of students' groupwork, students' willingness to tackle challenging tasks and their self-efficacy are likely to reinforce each other: The more willing they are to handle challenging tasks, the higher their self-efficacy rises, and the vice versa.

## Interests

As students are engaged in tasks and activities of online groupwork, it is likely that individual group members will pursue certain aspects of the tasks that interest the individual members the most; in this process, each individual student will learn something new, which will improve self-confidence and ability (Nummenmaa and Nummenmaa 2008). As the group members complete a task successfully, individual students in the group will develop a sense of accomplishment. This, in turn, will reinforce a student's self-confidence, and will result in the development and improvement of self-efficacy (Dixson 2010).

To examine how the above-mentioned individual and group level variables are related to student self-efficacy in the context of online groupwork, this study will answer the following three research questions:

1. Is online groupwork self-efficacy related to student background information such as age, gender, enrollment status, and past experience with online courses?
2. Do individual characteristics such as online groupwork interest, technology and media use, and willingness to handle challenge predict online groupwork self-efficacy?
3. How does online groupwork self-efficacy vary by perceptions of leadership and trust in group members?

## Methods

### Participants

The participants were graduate students from one public university in the Southeast United States of America. These students were from the same graduate-level course taught in six semesters (from Fall 2009 to Spring 2012) by the same instructor with exactly the same syllabus and the same textbook. Across the semesters, the course content and course dynamics were kept consistent and no obvious differences were observed about student demographic characteristics (e.g., gender, age, and race/ethnicity). The possibility of contamination effects was not a concern because this course is completely on-line and later students had no way to communicate with earlier students. The participants in this study were 204 graduate students with 39.7% male and 60.3% female. Ethnic compositions were 53.0% Caucasian, 43.0% African American, 2.5% Asian American, and 1.5% from other racial and ethnic backgrounds. In addition, full-time and part-time students were 73.5% and 26.4% respectively. As for the distribution of age, 63.9% were 30 years old or younger and 36.1% were over 30 years old.

### Online course and online group activities

The course was a completely online graduate-level course delivered through *Blackboard*.<sup>1</sup> All the advising activities were conducted through emails, online communication media, or telephone. This course was designed to be student-centered, interactive, and collaborative. Most assignments required collaborative efforts among students using available asynchronous or synchronous communication tools on *Blackboard*. For the purpose of collaborative learning, the 204 students were from 61 learning groups, with the number of students in a group ranging from 2 to 4, and the average being approximately 3.34. Across the semesters, there was high degree of consistency in all major aspects of instruction and learning: the same instructor used the same instructional materials, learning activities, group projects, and assessment instruments. Students used emails, discussion boards, and chat rooms to communicate and interact with the instructor and other group members.

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<sup>1</sup> *Blackboard* is an online proprietary virtual learning environment system that is licensed to colleges and other institutions and used in many campuses for e-learning.

The course focused on the design and development of multimedia applications through working with various authoring and multimedia tools in a project-based learning environment. The course topics included the relationship between human learning and multimedia instructional design, instructional design theories and principles, strategies for multimedia instructional design and development, application of instructional design strategies and models, and evaluation of relevant instructional software.

Online communication media were set up in several areas on the *Discussion Boards*, including a group discussion area, a whole-class discussion area, and a student/instructor discussion area. In addition, the instructor interacted with group members or the entire class in a chat room at a predetermined time.

Students were assigned to groups by the instructor. For the final group project, group members were required to work together to develop a full instructional design portfolio project, which involved the selection of a real instructional problem and the presentation of an entire evaluative design and solution for the instructional problem selected. Because of the complexity, interactivity, and collaboration involved in completing this project, students were asked to attend multiple discussion activities with group members by synchronous or asynchronous communication tools (related to general discussions, debate discussions, panel discussions, and symposium discussions). Considering the inherent challenges of online collaborative learning such as group work effectiveness, each group was asked to select a leader at the beginning of the semester. The leader's role is to ensure group members' participation in discussions and group projects. A survey to assess online groupwork interest, technology and media use, willingness to handle challenges, leadership, trust relationships, and self-efficacy was administered at the end of each semester. The response rate was 98% with only a few missing due to absence at classes.

## Measures

### Online groupwork interest

This scale of five items assesses the level of online groupwork interest as perceived by students. Informed by the literature on interest and intrinsic motivation (Xu 2008; Deci et al. 1991; Isaac et al. 1999; Wigfield 1994; Wigfield and Eccles 2000), it measures the extent to which students look forward to online groupwork, and the extent to which they like or dislike such assignments ( $\alpha=0.94$ ).

### Technology and media use

This scale includes three items and assesses communication media that students use for online discussions, including chats and bulletins ( $\alpha=0.78$ ; Du and Xu 2010; Thompson and Ku 2006).

### Willingness to handle online groupwork challenge

This scale includes four items and assesses the difficulties of groupwork as perceived by students, as well as their initiatives to deal with these difficulties ( $\alpha=0.79$ ; Du and Xu 2010; Kop 2011).

## Leadership

This scale has three items about group leader's work and responsibility when he or she leads the group project as perceived by students ( $\alpha=0.73$ ; Du et al. 2007).

## Trust relationship

This scale has four items on how group members support and learn from each other for their group project in an online learning environment ( $\alpha=0.79$ ; Kirtman 2009; Smith 2008).

## Online groupwork self-efficacy

This scale includes five items to assess the level of online groupwork self-efficacy as perceived by students. It measures the extent to which students feel confident and competent ( $\alpha=0.84$ ) in an online groupwork environment.

In addition to these scales, students were asked about whether they were full-time students (*no*=0, *yes*=1) and the number of previous online courses they had taken (0, 1, 2, 3, 4 or more). Information about the reliability and choices for responses to items for each scale are presented in Table 1.

## Statistical analyses

Educational data often have multilevel structures. In the case of the present study, individual students were nested under groups; as a result, individual characteristics are confounded with those at the group level. This clustering effect presents several major statistical issues (aggregation bias, under-estimation of standard errors, and heterogeneity of regression). These issues cannot be appropriately handled under traditional regression analysis or analysis of variance. Multilevel modeling allows for the inclusion of variables at different levels (student level and group level), and takes into account the non-independence of observations by addressing the variability associated with each level of nesting (decomposing any observed relationship between variables into separate within-group and between-group components).

In the present study, multilevel analyses were conducted using the HLM 7 program. All continuous variables were standardized ( $M=0.00$ ,  $SD=1.00$ ) to enhance the interpretability of the resulting regression coefficients from the multilevel analyses. Thus, the regression weights for all variables (except the dummy-coded variables such as gender, age, and full-time student status) are comparable with the standardized weights in multiple-regression procedures (Xu 2008; Trautwein et al. 2006).

Three models were used in the analyses. The first was an unconditional two-level model (known as the "null model") for partitioning the variance in the outcome variable (self-efficacy) into two components: between-group variance and within-group variance, based on which intra-class correlation (*ICC*) was estimated. This model, using common notations in multi-level analysis, such as those in Raudenbush and Bryk (2002), takes the following form.

## Null model

$$\text{Level 1 : } Y_{ij} = \beta_{0j} + r_{ij}$$



**Table 1** Alpha reliability of multi-item scales

Scale	Items	$\alpha$ (CI)
Online groupwork interest	I look forward to online groupwork <sup>a</sup>	0.94 (0.93, 0.95)
	Online groupwork is fun <sup>a</sup>	
	I enjoy online group work <sup>a</sup>	
	How do you like online groupwork in general? <sup>b</sup>	
	Overall, do you think online groupwork is _____? <sup>c</sup>	
Technology and media <sup>d</sup>	Participating in online group work helps you learn multiple media and technology	0.78 (0.72, 0.82)
	Participating in online group work helps you in synchronous discussion in Chat room	
	Participating in online group work helps you in asynchronous discussion through Discussion Board	
	Participating in online group work helps you to get a group meeting right away	
Willingness to handle challenge <sup>e</sup>	Tell my group members to get a group meeting right away	0.79 (0.74, 0.84)
	Tell my group members to discuss task right away	
	Tell myself not to be worried	
Leadership <sup>d</sup>	Cheer myself up by working hard with my group	0.73 (0.66, 0.79)
	Participating in online group work helps you develop a sense of responsibility	
	Participating in online group work brings you group leader approval	
	Participating in online group work helps you support the group leader	
Trust relationship <sup>d</sup>	Participating in online group work helps you how to get along with other members	0.79 (0.74, 0.83)
	Participating in online group work brings you approval from group members	
	Participating in online group work gives you opportunities to work with group members	
	Participating online group work gives you opportunities to learn from group members	
Scale	Items	$\alpha$ (CI)

Table 1 (continued)

Scales	Items	$\alpha$ (CI)
Groupwork self-efficacy <sup>a</sup>	Praise my group members for good effort. Praise my group members for good work Reassure my group members that we are able to do a group project when the group members feel it is too hard Cheer myself up by telling myself that I can do it Cheer my group members up by telling ourselves that we can do it	0.84 (0.80, 0.87)

The 95% confidence intervals for coefficient alpha were calculated using a method employing the central F distribution (see Fan and Thompson 2001)

<sup>a</sup>Responses were 1 (*strongly disagree*), 2 (*disagree*), 3 (*neither agree nor agree*), 4 (*agree*), and 5 (*strongly agree*)

<sup>b</sup>Responses were 1 (*don't like it at all*), 2 (*don't like it some*), 3 (*neither like it nor dislike it*), 4 (*like it some*), and 5 (*like it very much*)

<sup>c</sup>Responses were 1 (*very boring*), 2 (*boring*), 3 (*neither boring nor interesting*), 4 (*interesting*), and 5 (*very interesting*)

<sup>d</sup>Responses were 1 (*strongly disagree*), 2 (*disagree*), 3 (*agree*), and 4 (*strongly agree*)

<sup>e</sup>Responses were 1 (*never*), 2 (*rarely*), 3 (*sometimes*), 4 (*often*), and 5 (*routinely*)

$$\text{Level 2 : } \beta_{0j} = \gamma_{00} + \mu_{0j}$$

where  $Y_{ij}$  is the self-efficacy measurement for student  $i$  nested under group  $j$ ,  $\beta_{0j}$  (intercept) represents group  $j$  average of self-efficacy, while  $r_{ij}$  represents individual residual.  $\gamma_{00}$  represents the overall average of self-efficacy, and  $\mu_{0j}$  represents the residual across the groups.

In the next model, nine student-level variables (i.e., Level 1) were used to predict the outcome of self-efficacy  $Y_{ij}$ , but no predictors at the group level (i.e., Level 2) were included in the Level 2 model. This model is Model 1, as shown below:

### Model 1

$$\text{Level 1 : } Y_{ij} = \beta_{0j} + \beta_1(X_1^S) + \beta_2(X_2^S) + \dots + \beta_9(X_9^S) + r_{ij}$$

$$\text{Level 2 : } \beta_{0j} = \gamma_{00} + \mu_{0j}$$

where  $X_1^S$  to  $X_9^S$  represent nine student-level (indicated by the superscript  $S$ ) covariates/predictors (i.e., gender, age, full-time student status, the number of previous online courses taken, online groupwork interest, technology and media use, handling online groupwork challenge, leadership, and trust relationship) relevant to the outcome of self-efficacy  $Y_{ij}$ . As explained before,  $r_{ij}$  is the individual residual, and  $\beta_{0j}$  is the model intercept (i.e., conditional group average of self-efficacy). In Model 1 above, no group level predictors were included in the Level 2 model.

Model 1 was a random-intercept model, and only the intercept was assumed to vary across groups to reflect possible between-group differences in self-efficacy. Because we did not have a priori hypotheses concerning group-classroom differences in relation to the predictive power of the predictor variables, we did not use the random-slope model in this study; as a result, the slopes of the model ( $\beta_1$ – $\beta_9$ ) were considered fixed, rather than random.

Built upon Model 1, Model 2 included two group-level variables (willingness to handle challenge and online groupwork interest) at level 2, as described below. In educational research, the aggregation of student-level variables to form an indicator of the group, classroom, or school environment is a standard procedure for obtaining general information about the learning environment (Xu 2008; Ryan et al. 1998; Raudenbush and Bryk 2002; Trautwein et al. 2006). For the two group-level variables, willingness to handle challenge within a group was aggregated to the group level to form an index of the students' shared willingness for handling challenges at the group level. Similarly, online groupwork interest within a group was aggregated to the group level to form an index of the students' shared interest toward online groupwork.

### Model 2

$$\text{Level 1 : } Y_{ij} = \beta_{0j} + \beta_1(X_1^S) + \beta_2(X_2^S) + \dots + \beta_9(X_9^S) + r_{ij}$$

$$\text{Level 2 : } \beta_{0j} = \gamma_{00} + \gamma_{01}(Z_1^G) + \gamma_{02}(Z_2^G) + \mu_{0j}$$

In this model, the variables in the Level 1 model remain the same as in Model 1, but two group-level variables (i.e., willingness to handle challenge and online groupwork interest) are included in the Level 2 model, as represented by  $Z_1^G$  and  $Z_2^G$  (group level indicated by superscript  $G$ ). In this model, the effects of group level predictors on the intercept ( $\beta_{0j}$ ) of the Level 1 model are captured by the coefficients  $\gamma_{01}$  and  $\gamma_{02}$ . The effects ( $\gamma_{01}$  and  $\gamma_{02}$ ) on

the Level 1 model's intercept will, in turn, translate into the effects on individual student's self-efficacy  $Y_{ij}$ .

Full maximum likelihood estimation was used in multi-level modeling analyses. To disentangle individual level and group level effects (Raudenbush and Bryk 2002), online groupwork interest and handling groupwork challenge were centered at the group mean. The other predictor variables were introduced as un-centered variables.

## Results

### **Research question one: is online groupwork self-efficacy related to student background information such as age, gender, enrollment status, and past experience with online courses?**

Table 2 presents the descriptive statistics of the variables. It also includes correlations among independent variables and online groupwork self-efficacy. Online groupwork self-efficacy was found to correlate significantly with all of the independent variables, except full-time student status.

The Pearson correlation coefficients in Table 2 suggested that male students reported lower self-efficacy beliefs in online groupwork relative to female students but no difference between full-time and part-time students. Statistically significant positive relationships were also found between online groupwork self-efficacy and student age and number of previous online courses taken.

### **Research question two. Do individual characteristics such as online groupwork interest, technology and media use, and willingness to handle challenge predict online groupwork self-efficacy?**

HLM was used to answer Research Question Two. The unconditional model (i.e., null model) indicated that 91.9% of the variance in groupwork self-efficacy occurred at the student level and 8.1% of the variance occurred at the group level (i.e., *ICC* of .08), which means that most of the differences in groupwork self-efficacy exists at the individual level and that the between-group differences were small compared to within-group differences. As discussed in the multi-level literature (Kreft and de Leeuw 1998; von Secker 2002), for our nested data with *ICC* of 0.08, it would be desirable to conduct multilevel analyses. Model 1 explained 52.1% of the variance in groupwork self-efficacy at the student level and 78.7% of the variance at the group level (see Table 3).

Model 2 accounted for an additional 5.8% of the variance in groupwork self-efficacy at the student level and an additional 21.1% of the variance at the group level. Overall, the final model (Model 2) explained 57.9% of the variance in groupwork self-efficacy at the student level and 99.8% of the variance at the group level, which means that Model 2 explained nearly all of the between-group differences in online groupwork self-efficacy. As indicated in Table 3, neither online groupwork interest nor technology and media use was statistically significantly related to online groupwork self-efficacy. However, students' willingness to handle challenge is positively related to online groupwork self-efficacy ( $b=0.46$ ,  $p<0.01$ ). Handling groupwork challenge, at the group level, was also positively related to individual student's online groupwork self-efficacy. Therefore, among the individual

**Table 2** Descriptive statistics and Pearson correlations

Variables	M	SD	1	2	3	4	5	6	7	8	9	10	11
1. Gender (female=0, male=1)	0.40		-										
2. Full-time student (no=0, yes=1)	0.74		0.37 <sup>†</sup>	-									
3. Age (30 and below=0, above 30=1)	0.36		-0.38 <sup>†</sup>	-0.56 <sup>†</sup>	-								
4. Number of previous online courses	2.42	1.53	-0.32 <sup>†</sup>	-0.22 <sup>†</sup>	0.25 <sup>†</sup>	-							
5. Online groupwork interest	3.07	0.97	-0.12	-0.15*	0.06	0.17*	-						
6. Technology and media use	2.94	0.60	-0.07	-0.11	0.06	0.18*	0.45 <sup>†</sup>	-					
7. Willingness to handle challenge	3.49	0.78	-0.09	-0.08	0.19 <sup>†</sup>	0.14	0.35 <sup>†</sup>	0.42 <sup>†</sup>	-				
8. Leadership	2.95	0.57	-0.05	-0.07	0.13	0.21 <sup>†</sup>	0.36 <sup>†</sup>	0.65 <sup>†</sup>	0.45 <sup>†</sup>	-			
9. Trust relationship	2.94	0.53	-0.17*	-0.15*	0.22 <sup>†</sup>	0.21 <sup>†</sup>	0.36 <sup>†</sup>	0.65 <sup>†</sup>	0.43 <sup>†</sup>	0.80 <sup>†</sup>	-		
10. Online groupwork interest (group)	3.10	0.61	-0.08	-0.17*	0.06	0.28 <sup>†</sup>	0.62 <sup>†</sup>	0.27 <sup>†</sup>	0.24 <sup>†</sup>	0.17*	0.14 <sup>†</sup>	-	
11. Handling challenge (group)	3.48	0.54	-0.03	-0.16*	0.18*	0.16*	0.24 <sup>†</sup>	0.33 <sup>†</sup>	0.64 <sup>†</sup>	0.32 <sup>†</sup>	0.35 <sup>†</sup>	0.38 <sup>†</sup>	-
12. Online groupwork self-efficacy	3.61	0.76	-0.14*	-0.04	0.14*	0.24 <sup>†</sup>	0.35 <sup>†</sup>	0.53 <sup>†</sup>	0.67 <sup>†</sup>	0.62 <sup>†</sup>	0.62 <sup>†</sup>	0.22 <sup>†</sup>	0.45 <sup>†</sup>

*N* varies from 200 to 204. \* $p < 0.05$ , <sup>†</sup> $p < 0.01$ . The mean of gender refers to the percentage of male students in the sample, and the mean of full-time student refers to the percentage of full-time student in the sample. The mean of age refers to the percentage of students above 30 years old

**Table 3** Predicting online groupwork self-efficacy: results from hierarchical linear modeling

Model predictor	Model 1		Model 2	
	<i>b</i>	<i>SE</i>	<i>b</i>	<i>SE</i>
Student level				
Gender (female = 0, male = 1)	-0.06	0.12	-0.11	0.13
Full-time student (no = 0, yes = 1)	0.11	0.11	0.17	0.10
Age (30 and below = 0, above 30 = 1)	0.03	0.11	0.03	0.10
Number of previous online courses	0.10	0.06	0.08	0.06
Online groupwork interest	-0.07	0.08	-0.02	0.07
Technology and media use	0.10	0.07	0.04	0.07
Willingness to handle challenge	0.43 <sup>†</sup>	0.08	0.46 <sup>†</sup>	0.09
Leadership	0.19*	0.08	0.17*	0.08
Trust relationship	0.31 <sup>†</sup>	0.09	0.26 <sup>†</sup>	0.08
Group level				
Online groupwork interest			0.04	0.07
Willingness to handle challenge			0.46 <sup>†</sup>	0.08
<i>R</i> <sup>2</sup> individual level	0.521		0.579	
<i>R</i> <sup>2</sup> group level	0.787		0.998	
Deviance statistics	409.94		376.99	
Number of estimated parameters	12		14	

*N* = 200 from 61 groups. *b* = unstandardized regression coefficient. *SE* = standard error of *b*. *R*<sup>2</sup> = amount of explained variance

\**p* < 0.05, <sup>†</sup>*p* < 0.01

characteristics examined in this study, only willingness to handle challenge predicts online groupwork self-efficacy.

### Research question three. How does online groupwork self-efficacy vary by perceptions of leadership and trust in group members?

HLM results suggest that both perceptions of leadership and trust relationship influence student online self-efficacy. The more students trust and support each other within the group, the more efficacious they are doing online groupwork (*b* = 0.26, *p* < 0.01). Similarly, the more positive perceptions of the leadership in the group, the more efficacious they are doing online groupwork (*b* = 0.17, *p* < 0.05). This means that students who trust the relationship within their group members and who perceive their group leader as responsible are more likely to have higher levels of online groupwork self-efficacy.

## Discussion

Results from the multilevel analyses revealed that most of the variance in student self-efficacy in collaborative groupwork was at the student level. Results further revealed that groupwork self-efficacy was positively related to several variables at the student level (willingness to handle challenge, leadership, and trust relationship), and one

variable at the group level (group's willingness to handle groupwork challenge). Discussions are warranted about the meanings and implications of the results and findings.

### **Willingness to handle challenge**

The finding that groupwork self-efficacy is related to student's willingness to handle challenge can be examined in light of Bandura's social cognitive theory that self-efficacy was influenced by mastery experiences. Prior studies have found that individuals with higher levels of self-efficacy believe that they are able to take up challenges and put more effort into a task to achieve it (Gibbons and Weingart 2001). In this study, we found that both individuals' self-efficacy and groups' willingness to handle groupwork challenge were related to individuals' willingness to take up challenges. Students' self-efficacy beliefs in groupwork are shaped by mastery experiences. In the context of this study, mastery experience refers to personal interpretations of student performances on groupwork tasks. Students become more efficacious when they feel that they are able to handle problems or challenges in groupwork. Furthermore, when facing a challenge, it can be comforting to confront the challenge within a group, rather than only individually, as the group may collaboratively confront a challenge and try to bring solutions to the challenge (Kirtman 2009; Kop 2011). Self-efficacy is positively influenced by working together to overcome the challenge, and this self-efficacy from accomplishing a difficult group-oriented task may extend to other potential groupwork. Therefore, the degree of self-efficacy will be positively affected by the expansion of achievements made by groupwork. In the meantime, participants' potentials for dealing with other similar challenges will also improve. In another study, Rossetto et al. (2014) found that emotional challenge and self-efficacy were highly predictive of willingness to provide support. Students are able to provide support to overcome challenges in groupwork, which could be a reason why self-efficacy was related to willingness to take up challenges.

### **Perceptions of leadership**

The findings showed that students' self-efficacy was positively associated with perceptions of leadership in online groupwork. Kirtman (2009) argued that strong leadership support helps develop groupwork self-efficacy. When group members feel supported by their leader, high morale and conscientious work is the payoff. Strong leaders provide a role model for working with others and for task completion. Good leaders are able to delegate responsibility and they communicate well (Moore 2002; Neuhauser 2002). These two qualities promote self-efficacy within groupwork, and self-efficacious leaders inspire self-efficacy in their peers.

Prussia et al. (1998) examined a specific aspect of leadership, self-leadership which is self-imposed leadership. They found that self-leadership strategies had a significant effect on self-efficacy evaluations and that self-efficacy affected performance. Self-leadership describes how self-leaders think and how they behave according to cognitive, motivational, and behavioral strategies (Yun et al. 2006). This can be applied to online groupwork where the teams following the self-leadership model, rather than externally assigned leadership model, might demonstrate an increase in self-efficacy and performance.

## Trust relationship

Trust refers to an implicit set of beliefs that the other party will behave in a dependent manner (Gefen et al. 2003). The finding that online groupwork self-efficacy was positively associated with trust relationships is in line with the existing literature (Aubert and Kelsey 2003), and consistent with findings in the context of online discussion forums (Du and Xu 2010). Thus, it is not surprising that a trusting relationship helps enhance group members' self-efficacy, as they feel more secure, confident, competent in the steps they are taking as well as in the interdependence and fairness of the overall relationship dynamics of the group.

The two factors of trust relationship and perception of leadership are likely to work together as part of the vicarious experiences (Bandura 1986). In a situation where one has little or no experience, one's self-efficacy beliefs may be influenced by one's perceptions of the outcomes others have achieved when performing similar tasks. The trust relationship factor exhibits characteristics of vicarious experiences: Students who build a trust relationship and work closely with the group members were potentially using vicarious experiences as a source of self-efficacy beliefs. Likewise, students who were influenced by their leaders may also use the vicarious experience of witnessing another's ability to complete a task to shape their beliefs. In both cases, students are forming their beliefs based on the outcomes of others' actions.

Trust has been recognized as an important factor affecting knowledge sharing (Ridings et al. 2002). Pavlou and Fygenon (2006) found there is a causal relationship between trust and self-efficacy and that trust could raise the degree of self-efficacy for donating cognition. This can apply to online groupwork where trust plays an important role to raise the degree of self-efficacy to share knowledge.

## Online groupwork interest

It would be expected that the variable of groupwork interest be related to online groupwork efficacy. Our results; however, showed that this was not the case. This finding could be a statistical artifact in the context of multiple predictors in a regression model due to multicollinearity (i.e., correlations among the predictors in the model; Pedhazur 1997). More specifically, as shown in Table 2, online groupwork interest is positively related to groupwork efficacy, but its coefficient in the regression model (Table 3) was slightly negative, which was opposite to its original correlation coefficient. A quick check for multicollinearity condition suggested moderate multicollinearity of "online groupwork interest" with both "leadership" and "trust relationship" (variance inflation factor, or VIF, larger than 2). In planning for future research involving these and similar variables, such possible multicollinearity condition among these variables should be taken into consideration in the modeling process.

## Technology and media use

How would we interpret the finding that technology and media use was not associated with groupwork self-efficacy? Again, like the variable of online groupwork interest discussed above, this might be the result caused by multi-collinearity. As shown in Table 2, technology and media use are considerably correlated with the outcome variable of online groupwork self-efficacy. However, as other variables (willingness to handle challenge,



leadership, trust relationship) have even stronger relationships with the outcome, when used together with these other variables in the same model, technology and media use has a statistically non-significant coefficient for predicting the outcome of online groupwork self-efficacy. Maybe, with the development of information and communication technology that makes online learning much less dependent on one's familiarity with technology, technical issues have become less of an issue affecting learners' collaboration (An et al. 2008; Liu et al. 2010).

Puzziferro (2008) found that online technology self-efficacy scores were not correlated with community college student performance. DeTure (2004) noted that cognitive style scores and online technologies self-efficacy scores were poor predictors of student success in online distance education courses. While these studies are not directly related to group work self-efficacy, they suggest that online technology self-efficacy does not seem to be a good predictor of success.

## Gender

Gender was used in this study mainly to serve as a covariate, a variable to control for differences due to gender. The finding that female students had higher online groupwork self-efficacy when other variables were not controlled (Table 2) but gender was not significantly related to groupwork self-efficacy when other variables (such as age and prior experience) were controlled in the HLM (Table 3) supports our use of this variable but is not consistent with the self-efficacy literature that females tend to have less confidence in their abilities (Kukulu et al. 2013). Durndell and Haag (2002) in their study of computer self-efficacy, anxiety, and attitudes towards the internet reported a significant gender variation on all the measures: on average females reporting a smaller time of use of the Internet, less positive attitudes towards the internet, greater computer anxiety and lower computer self-efficacy than males. In general, earlier studies have found when it comes to gender and technology, females have lower self-efficacy than males (Bimber 2000; Denis and Ollivier 2002). Recently, however, this gap in online abilities has decreased in the literature.

Online group work is not only the use of technology but also social interaction. When it comes to social interaction, females exhibit more social behaviors and write significantly more messages than males in same-gender groups (Barrett and Lally 1999). However, this was not the case in mixed-gender groups (Bostock and Lizhi 2005). Self-efficacy is context-specific (Bandura 1997). One possible explanation is that gender difference in self-efficacy may be moderated by the learning environment (i.e., online versus face-to-face). This is, to some extent, supported by recent findings that gender was not related to students' experiences in e-learning (Paechter and Maier 2010). The finding about the lack of gender difference in this study warrants future research on online groupwork self-efficacy and potential gender differences.

## Age

Age was also used in this study as a covariate to control for differences due to age. The finding that online groupwork self-efficacy was not related to age (students of over 30 vs. those under 30) when other variables were controlled in HLM (Table 3) supports our use of this variable and is in line with the literature on the use of certain self-regulatory strategies after junior high school (Zimmerman and Martinez-Pons 1990). This is also in line with the finding based on a sample of undergraduate and graduate students that age did not

relate to the problem of poor motivation in online group collaboration (Liu et al. 2010). Another possibility for this statistically insignificant relationship is that age was coded dichotomously. Had it been treated as a continuous variable, the results could be different.

### **Previous online courses**

Previous online courses was also used as a covariate to control for differences due to previously online courses taken. Groupwork self-efficacy was not related to the number of previous online courses taken (Table 3), which supports our treatment of this variable. Traditionally, technical limitations, which could be influenced by previous online course taken, are viewed as a major reason that prevents online learners from communicating and learning together (Havard et al. 2008; Bunn 2001; Liu et al. 2010).

### **Implications for practice**

Several implications and recommendations about online learning design and teaching practice were developed through the research findings. This study has implications for (1) online instructors who are looking for various group strategies to implement in their online courses (2) instructional designers who assist in the design and development of online courses where they provide recommendations on designing group activities. This study also adds to the research literature and assists other researchers in building on group collaboration for online learning. Results revealed that groupwork self-efficacy was positively related to willingness to handle challenge, leadership, and trust relationship at the student level and group's willingness to handle groupwork challenge at the group level.

### **Willingness to handle challenges**

As willingness to handle challenge in online groupwork at both the group and the student levels were positively associated with online groupwork self-efficacy, instructors of online courses need to construct online group learning tasks that are more purposeful, meaningful, challenging, and engaging (Jin 2005). There is the need to design high-quality group projects, with particular emphasis on complexity, formats, and types of collaborative activities that are appropriately challenging for students to handle and succeed as a group (e.g., matching the content of group activities to students' experiences and encouraging them to learn from each other). The instructors may also need to find ways to encourage and to increase students' willingness to handle challenges in online groupwork assignments. One approach for doing so is to consider the type and the complexity of a task, and develop appropriate guidance and strategies accordingly. Providing guidelines to students can be helpful to engage students in various types of tasks of different complexity. For example, guidelines for online discussion should prompt students to ask questions, provide explanations, make clarifications, negotiate meanings, share experiences, make inferences, and make justifications. Guidelines for problem-solving tasks should guide students to engage in cognitive and metacognitive processes of problem solving, such as representing the problem, developing solutions, constructing arguments, and monitoring and evaluating. Guidelines for decision-making tasks should direct students' interactions in areas of negotiating meanings, reaching consensus, and providing justifications. Students can also be challenged through the use of higher order questioning techniques in the online group

discussion environment to encourage critical thinking skills. Online discussion boards can be used both for community building and consensus building. These are challenging tasks in the online environment, but with the support of their group, students are willing to become part of the vibrant learning community rather than being an independent learner with no peer interaction. Consensus building is challenging where online students are expected to work together to come to agreement on creating a product together or coming to agreement on a topic.

## Leadership

The finding that perceptions of leadership was positively related to online groupwork self-efficacy suggests that a leader in groupwork plays an important role in enhancing and sustaining group members' self-efficacy. With respect to online groupwork practices, it would be beneficial that the instructor of an online course would create opportunities that will allow group members to serve as leaders in different projects of the class, thus to enhance the sense of a student being part of a group and to cultivate leader's responsibility. This is similar to guided mastery experiences (Bandura 1997). It involves creating leadership role opportunities for students and providing them with the instruction and coaching needed to help them succeed. Such successful role experiences will in general lead to a heightened quality of leadership. One implication of perceptions of leadership that can be used in online group activities is to identify facilitators for each discussion forum where they serve as leaders. The leaders are given a voice and can use their messages to bring out ideas and encourage participation from their peers. They would be driving the discussion and take responsibility to log on and post messages regularly. The discussion leaders can also be asked to summarize the discussion. The self-leadership model can also be used where discussion facilitators self-sign up to facilitate a forum of their choice where they demonstrate leadership.

## Trust relationship

Finally, as a positive factor, trust relationship in online groupwork may enhance students' self-efficacy. For this reason, it is highly recommended for virtual teams to arrange one or more initial face-to-face meetings (Mittleman et al. 2000). If face-to-face meetings are not possible, initial contacts can be made through the use of rich media, which are capable of conveying both verbal and nonverbal communication cues, as well as social presence. Audio-visual introductions where students not only read text but also see and hear each other help overcome any initial inhibitions they might have. Jones et al. (2008) found that students benefited from the introduction video as it helped form a relationship with the instructor and other students from the beginning of the course. Mittleman et al. (2000) suggested using an informal break for online team meetings, when all parties can share casual talks and social jokes with the assistance of ICT. Another useful strategy, as suggested by Dykman and Davis (2008), is to promote some small social talks and encourage members to greet each other in a positive tone. LaPointe et al. (2004) found that audio and visual components in synchronous systems help build communities of practice and bridge cultural differences. Using synchronous tools such as Webex and Skype for an introductory team meeting with the audio and visual components help build trust in online group work. This has implications for online instructors to establish trust among the learners and create a sense of connection by providing numerous opportunities for learners to increase their

familiarity with group members and build more trusting relationships to form a community of learners.

## Limitations and future research directions

This study has some limitations. One limitation is related to a single data source: student responses to a survey at the conclusion of a specific online course that included activities described in the items. This course does not represent all similar courses because the content of the course as well as the instructor's characteristics are also related to the student learning outcomes (Clotfelter et al. 2007; Darling-Hammond 2000; Hahnel and Jackson 2012; Harris and Sass 2007). Future researchers should consider stratified sampling in order to gain access to a representative sample of students taking varieties of online courses. The specific context of the course as well as the timing of the administration of the survey should be taken into consideration when generalizing the results from this study to courses in other content areas or taught by different instructors. Furthermore, the researchers were only able to obtain information from self-reported data; no other data were available to the researchers. The researchers were unable to observe the students' behaviors in searching for information while participating in online discussions. Due to the text-based nature of online exchanges in this study, some other relevant learning behaviors in online groups were not observed. Supplementary data would be beneficial for this research (Kirtman 2009; Torrisi-Steele and Davis 2000). In order to gain a better understanding of these and other factors that have been identified as sources of students' efficacy beliefs, interviews facilitated by survey data could be conducted. The qualitative inquiry, as an attempt to develop a more in-depth understanding about online collaborative learning, could lead to improved insight into how efficacy beliefs are formed. This knowledge could allow the creation of more optimal learning environments for promoting students' self-efficacy beliefs, and thereby to increase their confidence, success, and retention.

In addition, some measures used in this study could benefit from more psychometric research work and refinement. In the research literature, different measures for similar constructs (self-efficacy) may have been used in different contexts and at different times. Future research could be considered to synthesize and integrate some existing measures of similar constructs to create psychometrically stronger measures for wider use of the research community.

Future researchers could also consider a longitudinal design to investigate the change of students' self-efficacy in online groupwork while participating in online classes over a period of time. Specifically, the four sources that shape one's self-efficacy beliefs (i.e., mater experience, vicarious experience, social persuasion, and physiological states) should be examined to understand the development of one's self-efficacy beliefs. Another consideration in future studies is to consider the construct complexity of self-efficacy. The meaning of efficacy may change when the focus shifts from individual competence to group competence. Therefore, collective efficacy has been suggested as a meaningful group-level parallel to the concept of individual level self-efficacy. This change may occur in two steps (Chan 1998). First, individuals shift their reference from the individual to the group level when they evaluate team-efficacy. Second, the agreement among all team members elevates the construct itself to the group level. Thus, collective efficacy reflects the shared beliefs of the group members in their group's capabilities to reach the desired level of attainments on a specific task (Gibson 2003).

A next logical step for researchers in this area is to examine task interdependence of online groupwork as a structural factor that affects the emergence of collective efficacy as a group level construct, as opposed to original self-efficacy at the individual level. Collective efficacy, however, is not simply the sum of the individual perceptions of self-efficacy. Instead, it focuses on the team members' shared perceptions of their team's efficacy, or collective efficacy (Bandura 2000; Bar-Tal 1989). Therefore, a valid instrument should be developed to measure collective efficacy. In this context, researchers could pursue research on different issues, such as the effects of self- and collective efficacy on team performance, what people choose to do as a group, how much effort individuals contribute to the group's objectives, and their persistence when group efforts fail to produce expected results (Bandura 1997).

## Compliance with ethical standards

**Conflict of interest** The authors declare that they have no conflict of interest.

## References

- Ackerman, P. L., & Wolman, S. D. (2007). Determinants and validity of self-estimates of abilities and self-concept measures. *Journal of Psychology: Applied*, *13*, 57–78.
- Amhag, L., & Jakobsson, A. (2009). Collaborative learning as a collective competence when students use the potential of meaning in asynchronous dialogues. *Computers & Education*, *52*(3), 656–667.
- An, H., Kim, S., & Kim, B. (2008). Teacher perspectives on online collaborative learning: Factors perceived as facilitating and impeding successful online group work. *Contemporary Issues in Technology and Teacher Education*, *8*, 65–83.
- Aubert, B., & Kelsey, B. (2003). Further understanding of trust and performance in virtual teams. *Small Group Research*, *34*(5), 575–618.
- Bandura, A. (1986). *A Social Cognitive Theory, Social Foundations of Thought and Action*. Englewood Cliffs: Prentice-Hall.
- Bandura, A. (1997). *Self-efficacy: The exercise of control*. New York, NY: W.H. Freeman & Company.
- Bandura, A. (2000). Exercise of human agency through collective efficacy. *Current Directions in Psychological Science*, *9*, 75–78.
- Barrett, E., & Lally, V. (1999). Gender differences in an on-line learning environment. *Journal of Computer Assisted Learning*, *15*, 48–60.
- Bar-Tal, D. (1989). *Group beliefs: A conception for analyzing group structure, processes, and behavior*. New York, NY: Springer.
- Bimber, B. (2000). The gender gap on the internet. *Social Science Quarterly*, *81*, 868–876.
- Bostock, S., & Lizhi, W. (2005). Gender in student online discussions. *Innovations in Education and Teaching International*, *42*(1), 73–85.
- Bressler, L., & Bressler, M. (2007). The relationship of self-esteem and self-efficacy among distance learning students in accounting information systems on-line classes. *International Journal of Innovation and Learning*, *4*, 274–289.
- Brindley, J., Walti, C., & Blaschke, L. (2009). Creating effective collaborative learning groups in an online environment. *International Review of Research in Open and Distance Learning*, *10*(3), 1–18.
- Brooks, C. M., & Ammons, J. L. (2003). Free riding in group projects and the effects of timing, frequency, and specificity of criteria in peer assessments. *Journal of Education for Business*, *78*, 268–272.
- Bunn, M. D. (2001). Timeless and timely issues in distance education planning. *American Journal of Distance Education*, *15*(1), 55–68.
- Chan, D. (1998). Functional relations among constructs in the same content domain at different levels of analysis: A typology of composition models. *Journal of Applied Psychology*, *83*, 234–246.
- Clotfelter, C. T., Ladd, H. F., & Vigdor, J. L. (2007). Teacher credentials and student achievement: Longitudinal analysis with student fixed effects. *Economics of Education Review*, *26*, 673–682.
- Darling-Hammond, L. (2000). Teacher quality and student achievement: A Review of state policy evidence. *Education Policy Analysis Archives*, *8*(1), 1–42.

- De Dreu, C. K. W., & Weingart, L. (2003). Task- and relationship conflict, team performance, and team member satisfaction: a meta-analysis. *Journal of Applied Psychology*, *86*, 1191–1201.
- Deci, E. L., Vallerand, R. J., Pelletier, L. G., & Ryan, R. M. (1991). Motivation and education: The self-determination perspective. *Educational Psychologist*, *26*, 325–346.
- Denis, A., & Ollivier, M. (2002). How wired are canadian women? The intersection of gender, class and language with the use of new information technologies. In A. Martinez & M. Stuart (Eds.), *Out of the ivory tower: Taking feminist research to the community* (pp. 251–269). Toronto, CA: Sumach Press.
- DeTure, M. (2004). Cognitive style and self-efficacy: Predicting student success in online distance education. *American Journal of Distance Education*, *18*(1), 21–38.
- Diseth, A. (2011). Self-efficacy, goal orientation and learning strategies as mediators between preceding and subsequent academic achievement. *Learning and Individual Differences*, *21*, 191–195.
- Dixson, M. D. (2010). Creating effective student engagement in online courses: What do students find engaging? *Journal of the Scholarship of Teaching and Learning*, *10*(2), 1–13.
- Du, J. X., Durrington, V. A., & Mathews, J. G. (2007). Collaborative discussion: Myth or valuable learning tool. *Journal of Online Learning and Teaching (JOLT)*, *3*(2), 94–104.
- Du, J., Ge, X., & Zhang, K. (2012). Graduate students' experiences of online collaborative learning in Web-based learning environments. *International Journal of Information Communication and Technology Education*, *8*(4), 62–74.
- Du, J., & Xu, J. (2010). The quality of online discussion reported by graduate Students. *Quarterly Review of Distance Education*, *11*(1), 13–24.
- Durndell, A., & Haag, Z. (2002). Computer self-efficacy, computer anxiety, attitudes towards the Internet and reported experience with the Internet, by gender, in an East European sample. *Computers in Human Behavior*, *18*, 521–535.
- Dykman, C. A., & Davis, C. K. (2008). Online education forum-Part three: A quality online education experience. *Journal of Information Systems Education*, *19*, 281–289.
- Fan, X., & Thompson, B. (2001). Confidence intervals for effect sizes: Confidence intervals about score reliability coefficients, please: An EPM guidelines editorial. *Educational and Psychological Measurement*, *61*(4), 517–531.
- Fermoso, A. M., Mateos, M., Beato, M. E., & Berjón, R. (2015). Open linked data and mobile devices as e-tourism tools. A practical approach to collaborative e-learning. *Computers in Human Behavior*, *51*, 618–626.
- Garrison, D. R. (2011). *E-learning in the 21st century: A framework for research and practice*. London: Routledge.
- Gefen, D., Karahanna, E., & Straub, D. W. (2003). Trust and TAM in online shopping: An integrated model. *MIS quarterly*, *27*(1), 51–90.
- Gibbons, D. E., & Weingart, L. R. (2001). Can I do it? Will I try? Personal efficacy, assigned goals, and performance norms as motivators of individual performance. *Journal of Applied Social Psychology*, *31*, 624–648.
- Gibson, C. B. (2003). The efficacy advantage: Factors related to the formation of group efficacy. *Journal of Applied Social Psychology*, *33*, 2153–2186.
- Goddard, R. D., Hoy, W. K., & Hoy, A. W. (2004). Collective efficacy beliefs: Theoretical developments, empirical evidence, and future directions. *Educational Researcher*, *33*, 3–13.
- Hahnel, C., & Jackson, O. (2012). *Learning denied: The case for equitable access to effective teaching in California's largest school district*. Oakland, CA: The Education Trust-West.
- Harris, D., & Sass, T. (2007). Teacher training, teacher quality and student achievement. *Journal of Public Economics*, *95*(7–8), 798–812.
- Havard, B., Du, J., & Xu, J. (2008). Online collaborative learning and communication media. *Journal of Interactive Learning Research*, *19*(1), 37–50.
- Hsu, Y.-C., & Ching, Y.-H. (2013). Mobile computer-supported collaborative learning: A review of experimental research. *British Journal of Educational Technology*, *44*, E111–E114.
- Isaac, J. D., Sansone, C., & Smith, J. L. (1999). Other people as a source of interest in an activity. *Journal of Experimental Social Psychology*, *35*, 239–265.
- Jin, S. H. (2005). Analyzing student–student and student–instructor interaction through multiple communication tools in web-based learning. *International Journal of Instructional Media*, *32*(1), 59–67.
- Jones, P., Naugle, K., & Kolloff, M. (2008). Teacher presence: Using introductory videos in hybrid and online courses. Learning Solutions. Retrieved from learningsolutionsmag.com.
- Kirkpatrick, S. A., & Locke, E. A. (1991). Leadership: Do traits matter? *Academy of Management Perspectives*, *5*(2), 48–60.
- Kirtman, L. (2009). Online versus In-class courses: An examination of differences in learning outcomes. *Issues in Teacher Education*, *18*(2), 103–116.

- Komarraju, M., & Nadler, D. (2013). Self-efficacy and academic achievement: Why do implicit beliefs, goals, and effort regulation matter? *Learning and Individual Differences*, 25, 67–72.
- Kop, R. (2011). The challenges to connectivist learning on open online networks: Learning experiences during a massive open online course. *International Review of Research in Open and Distance Learning*, 12(3), 19–38.
- Kreft, I., & de Leeuw, J. (1998). *Introduction to multilevel modeling*. London: Sage.
- Kukulu, K., Korukcu, O., Ozdemir, Y., Bezci, A., & Calik, C. (2013). Self-confidence, gender and academic achievement of undergraduate nursing students. *Journal of Psychiatric and Mental Health Nursing*, 20, 330–335.
- Kuljis, J., & Lees, D. Y. (2003). Supporting organizational e-learning with a distributed, virtual, collaborative learning environment. *International Journal of Computers and Applications*, 25(1), 42–49.
- LaPointe, D. K., Greysen, K. R. B., & Barrett, K. A. (2004). Speak2Me: Using synchronous audio for ESL teaching in Taiwan. *The International Review of Research in Open and Distance Learning*, 5(1), 1–6.
- Lent, R. W., Schmidt, J., & Schmidt, L. (2006). Collective efficacy beliefs in student work teams: Relation to self-efficacy, cohesion, and performance. *Journal of Vocational Behavior*, 68, 73–84.
- Liem, A. D., Lau, S., & Nie, Y. (2008). The role of self-efficacy, task value, and achievement goals in predicting learning strategies, task disengagement, peer relationship, and achievement outcome. *Contemporary Educational Psychology*, 33, 486–512.
- Little, B. L., & Madigan, R. M. (1997). The relationship between collective efficacy and performance in manufacturing work. *Small Group Research*, 28, 517–534.
- Liu, S., Joy, M., & Griffiths, N. (2010). *Students' perceptions of the factors leading to unsuccessful group collaboration*. Paper presented at 2010 IEEE 10th International Conference on Advanced Learning Technologies. Sousse, Tunisia.
- Locke, E. A. (1991). *The essence of leadership: The four keys to leading successfully*. New York, NY: Lexington Books.
- López-Bonilla, J. M., & López-Bonilla, L. M. (2013). Exploring the relationship between social networks and collaborative learning. *British Journal of Educational Technology*, 44, E139–E142.
- Magogwe, J. M., & Oliver, R. (2007). The relationship between language learning strategies, proficiency, age and self-efficacy beliefs: A study of language learners in Botswana. *System*, 35, 338–352.
- Mittleman, D. D., Briggs, R. O., & Nunamaker, J. F., Jr. (2000). Best practice in facilitating virtual meetings: Some notes from initial experience. *Group Facilitation: A Research and Applications Journal*, 2, 5–14.
- Moore, M. G. (2002). Editorial, what does research say about the learners using computer-mediated communication in distance learning? *American Journal of Distance Education*, 16(2), 61–64.
- Mulvey, P. W., & Klein, H. J. (1998). The impact of perceived loafing and collective efficacy on group goal processes and group performance. *Organizational Behavior and Human Decision Processes*, 74(1), 62–87.
- Neuhauser, C. (2002). Learning style and effectiveness of online and face-to-face instruction. *American Journal of Distance Education*, 16(2), 99–113.
- Newton, K. (1997). Social capital and democracy. *American Behavioral Scientist*, 40, 575–586.
- Nummenmaa, M., & Nummenmaa, L. (2008). University students' emotions, interest and activities in a web-based learning environment. *British Journal of Educational Psychology*, 78(1), 163–178.
- Paechter, M., & Maier, B. (2010). Online of face-to-face? Students' experiences and preferences in e-learning. *Internet and Higher Education*, 13, 292–297.
- Pajares, F. (1996). Self-efficacy beliefs in academic settings. *Review of Educational Research*, 66, 543–578.
- Pajares, F., & Graham, L. (1999). Self-efficacy, motivation constructs, and mathematics performance of entering middle school students. *Contemporary Educational Psychology*, 24, 124–139.
- Pavlou, P. A., & Fygenson, M. (2006). Understanding and predicting electronic commerce adoption: An extension of the theory of planned behavior. *MIS quarterly*, 30, 115–143.
- Pedhazur, E. J. (1997). *Multiple regression in behavioral research: Explanation and prediction* (3rd ed.). New York, NY: Harcourt Brace College Publishers.
- Prussia, G. E., Anderson, J. S., & Manz, C. C. (1998). Self-leadership and performance outcomes: The mediating influence of self-efficacy. *Journal of Organizational Behavior*, 19, 523–538.
- Puzziferro, M. (2008). Online technologies self-efficacy and self-regulated learning as predictors of final grade and satisfaction in college-level online courses. *The American Journal of Distance Education*, 22(2), 72–89.
- Raudenbush, S., & Bryk, A. (2002). *Hierarchical linear models: Applications and data analysis* (2nd ed.). Thousand Oaks, CA: Sage.
- Ridings, C. M., Gefen, D., & Arinze, B. (2002). Some antecedents and effects of trust in virtual communities. *Strategic Information Systems*, 11, 271–295.

- Rossetto, K. R., Lannutti, P. J., & Smith, R. A. (2014). Investigating self-efficacy and emotional challenge as contributors to willingness to provide emotional support. *Southern Communication Journal*, 79(1), 41–58.
- Ryan, A. M., Gheen, M. H., & Midgley, C. (1998). Why do some students avoid asking for help? An examination of the interplay among students' academic efficacy, teachers' social-emotional role, and the classroom goal structure. *Journal of Educational Psychology*, 90, 528–535.
- Salas, E., Sims, D. E., & Burke, C. S. (2005). Is there a “Big Five” in teamwork? *Small Group Research*, 36, 555–599.
- Schunk, D. H. (1989). Self-efficacy and achievement behaviors. *Educational Psychology Review*, 1, 173–208.
- Smith, R. (2008). The paradox of trust in online collaborative groups. *Distance Education*, 29, 325–340.
- So, H. J., & Brush, T. A. (2008). Student perceptions of collaborative learning, social presence and satisfaction in a blended learning environment: Relationships and critical factors. *Computers & Education*, 51(1), 318–336.
- Stahl, G., Koschmann, T., & Suthers, D. D. (2014). Computer-supported collaborative learning. In R. K. Sawyer (Ed.), *Cambridge handbook of the learning sciences* (pp. 479–500). New York, NY: Cambridge University Press.
- Stanford-Bowers, D. E. (2008). Persistence in online classes: A study of perceptions among community college stakeholders. *Journal of Online Learning and Teaching*, 4, 37–50.
- Stevens, T., Olivarez, A., Jr., Lan, W. Y., & Tallent-Runnels, M. K. (2004). Role of mathematics self-efficacy and motivation in mathematics performance across ethnicity. *The Journal of Educational Research*, 97, 208–221.
- Thompson, L., & Ku, H.-Y. (2006). A case study of online collaborative learning. *The Quarterly Review of Distance Education*, 7, 361–375.
- Thompson, D., & McGregor, I. (2009). Online self- and peer assessment for groupwork. *Education Training*, 51, 434–447.
- Ting, Y.-L. (2012). Using mobile technologies to create interwoven learning interactions An intuitive design and its evaluation. *Computers & Education*, 60(1), 1–13.
- Torrisi-Steele, G., & Davis, G. (2000). ‘A website for my subject’: The experiences of some academics’ engagement with educational designers in a team based approach to developing online learning materials. *Australian Journal of Educational Technology*, 16, 283–301.
- Trautwein, U., Ludtke, O., Schnyder, I., & Niggli, A. (2006). Predicting homework effort: Support for a domain-specific, multilevel homework model. *Journal of Educational Psychology*, 98, 438–456.
- Tuparova, D., & Tuparov, G. (2010). Management of students’ participation in e-learning collaborative activities. *Procedia-Social and Behavioral Sciences*, 2(2), 4757–4762.
- Tutty, J. I., & Klein, J. D. (2008). Computer-mediated instruction: a comparison of online and face-to-face collaboration. *Educational Technology Research and Development*, 56, 101–124.
- Von Secker, C. (2002). Effects of inquiry-based teacher practices on science excellence and equity. *Journal of Educational Research*, 95, 151–160.
- Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Cambridge, MA: Harvard University Press.
- Wang, C., Hu, J., Zhang, G., Chang, Y., & Xu, Y. (2012). Chinese college students’ self-regulated learning strategies and self-efficacy beliefs in learning English as a foreign language. *Journal of Research in Education*, 22(2), 103–135.
- Wang, C., Kim, D. H., Bong, M., & Ahn, H. S. (2013). Examining measurement properties of an English self-efficacy scale for English language learners in Korea. *International Journal of Educational Research*, 59, 24–34.
- Wigfield, A. (1994). Expectancy-value theory of achievement motivation: A developmental perspective. *Educational Psychology Review*, 6, 49–78.
- Wigfield, A., & Eccles, J. S. (2000). Expectancy-value theory of achievement motivation. *Contemporary Educational Psychology*, 25, 68–81.
- Xu, J. (2008). Models of secondary school students’ interest in homework: A multilevel analysis. *American Educational Research Journal*, 45(4), 1180–1205.
- Yun, S., Cox, J., & Sims, H. P. (2006). The forgotten follower: A contingency model of leadership and follower self-leadership. *Journal of Managerial Psychology*, 21, 374–388.
- Zhang, K., & Ge, X. (2006). Dynamic contexts of online collaborative learning. In A. D. de Figueiredo & A. P. Afonso (Eds.), *Managing learning in virtual settings: The role of the context* (pp. 97–115). Hershey, PA: Idea Group.



- Zimmerman, B. J., & Kitsantas, A. (2005). Homework practices and academic achievement: The mediating role of self-efficacy and perceived responsibility belief. *Contemporary Educational Psychology, 30*, 397–417.
- Zimmerman, B. J., & Martinez-Pons, M. (1990). Student differences in self-regulated learning: Relating grade, sex, and giftedness to self-efficacy and strategy use. *Journal of Educational Psychology, 82*, 51–59.
- Zuo, H., & Wang, C. (2016). Understanding Sources of Self-Efficacy of Chinese Students Learning English in an American Institution. *Multicultural Learning and Teaching, 11*(1), 83–112.

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