

Features of Successful Group Work in Online and Physical Courses

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Abstract

The present study used a unique design in which multiple factors were combined in a multiphase study to find if there are any significant interactions among six factors known to be effective in successful group work. The results indicated that the effectiveness of group work depends on how the effectiveness is measured, how the group is formed, and what type of task is assigned to learners. An interaction of six major factors including mode of instruction (face-to-face vs online), type of task (convergent vs divergent), anonymity of participants, homogeneity of students in terms of their skill level, utilization of peer assessment, and group size, was found to play a significant role in the effectiveness of group work.

Keywords: Group work, group discussion, collaborative learning, active learning.

Many teachers are using group work or group discussion as a teaching strategy in their courses. There is wide agreement among reviewers of the collaborative learning literature that collaborative methods have a positive effect on student achievement in almost any discipline (Bennett, 2015; Katz & Rezaei, 1999; Rezaei, 2014). Group work is beneficial both for students and instructors. For students, group work motivates them, provides a peer instruction opportunity by looking at the problem from multiple perspectives and helps them to become more creative. For teachers, group work is an opportunity to give students more complex and more authentic assignments. A major research question for these instructors is how can a group work activity be more effective and what type of group activity leads to a better outcome. The problem is many teachers design their group work assignment simply based on what they assume will work better rather than using an evidence based decision making. Earlier studies have evaluated the effectiveness of group work mainly through self-report evaluations (Bennett, 2015). Some educators have evaluated the final product of the group work, while others have focused on the quality of collaboration process. As explained in the following literature review, researchers in this field who have compared different types of group work, have focused on only one factor at a time. Some have compared different group sizes and others have compared online with face-to-face group works. Besides, in most of those studies, only a single dependent variable (student satisfaction, amount of collaboration, or students' grade) has been evaluated.

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Furthermore, the results of research on the effectiveness of group work is not always positive and indeed some researchers have argued that group works in class is not useful at all (Qamar, Ahmad, & Niaz, 2015; Brown & McIlroy, 2011). There is a need to do a more comprehensive research in which several factors are investigated together (simultaneously) to find the interaction effects among these factors. The goal of this study is to identify factors that influence the success of group work in terms of student learning outcome as well as their interest and engagement in class activities and to find out why some researchers have not found group works to be quite successful.

Literature Review

Throughout the history of education, the most common teaching strategy used in classrooms has been lectures (Lammers & Murphy 2002). However, this strategy usually lacks many of the components of active learning, such as critical thinking, self-pacing, and the encouragement of dialogue and group discussion (Fredrick & Hummel 2004). Recently, higher education institutions are paying more attention to the development of students' communicative abilities and critical thinking. Collaborative learning is a key teaching strategy in use for developing these skills. Collaborative learning or group work is an instructional approach in which students work together in small or large groups to accomplish a common learning goal or a well-defined learning task. Collaborative learning procedures have also been shown to enhance student satisfaction with the learning and classroom experience (Grant-Vallone, 2011). Numerous research studies have demonstrated that small-group learning creates situations in which schoolwork is perceived not as a task or chore but as an opportunity to interact on issues of personal importance (Heejin & Windeatt 2016). Johnson, Johnson, and Smith (2006) performed a meta-analysis of 168 studies comparing cooperative learning to competitive learning and individualistic learning in college students. They found that cooperative learning produced greater academic achievement than both competitive learning and individualistic learning across the studies.

The importance of collaborative learning is rooted in its potential for meaningful learning and social interaction. Various theorists, from Vygotsky (1986), to the situated learning theorists such as Lave and Wenger (1991), to the current social constructive theorists (Jong, Lai, Hsia & Lin, 2013), have stressed the importance of social interaction in learning. These theorists propose that learning occurs in a social or inter-psychological context prior to its becoming internalized or individualized within an intra-psychological category (Vygotsky, 1986).

Recently, some authors have questioned whether educators are using group work just because it is popular or there is hard evidence to prove its effectiveness (Brown & McIlroy, 2011). Indeed, there are some negative reports and most of the negative reports are coming from the areas of physical or medical sciences where students work together on a well-defined project and have specific goals to reach. For example, Qamar et al. (2015) reported that “medical students’ discussion intervention” showed poor results in terms of their mean scores in their final professional exam, and their pass rate, and in terms of their perceptions of the course. These authors also reported the results of other studies,

which have revealed students' negative perspective regarding the worth of "problem oriented interactive sessions". In a study about course group work in China, students reported: uncertainty on the accuracy of the knowledge acquired, time wasted during the session, inadequate focus in teaching, and heavy workload on the students (Huang, 2005). In a more recent study, Brown and McIlroy (2011) reviewed several articles on students' perspectives about group work and concluded that rather than learning to value group collaboration, usually, students learned to hate it. The question is why these students were not happy about their group works and what the instructor could have done to change the situation. As Chapman (2005) stressed, merely setting up a group activity is insufficient; "working and discussing with others per se will not necessarily result in higher learning" (p. 289). Asking a group of students to decide if they preferred individual or group work, Brown and McIlroy (2011) found that 68.9% preferred to do individual projects, 26.4% preferred group assignments and 4.6% had no preference. They reported that students' comments mirrored those issues raised in the literature review regarding time management, personal control, and concern over the quality of the outcome (Cartney & Rouse, 2006). Similarly, Flosason, McGee, and Diener-Ludwig (2015) did not find any clear advantages of group discussion in terms of learning outcomes, although students and instructors alike reported enjoying the classroom. In another case, Lake (2001) reported that in active learning sections (group discussions) students perceived that they had learned less than students in the lecture section, and students' perceptions of the course and the instructor's effectiveness were lower; they also had lower perceptions of course and instructor quality.

The negative results in not limited to studies that focused on students' satisfaction. Several other studies did not find improvement in scores on multiple-choice or essay examinations between courses taught through lectures with those taught through combined active learning and lecture (Lake, 2001). Summers and Volet (2010) found that groups spent only a minority of their meeting time engaging with content; groups largely neglected precisely those types of discussions that were their best opportunity to reap learning benefits from the group work. The researchers concluded that it should not be assumed that group assignments will necessarily give rise to substantial engagement in productive content-related discussions.

In summary, while there are many studies which support group work and group discussion and most of them have reported positive results, the above examples indicate that group work is not always successful and that designing a collaborative environment is not always easy. A closer look at the literature shows that educators have used various group sizes and various ways in assigning students to groups and various types of assignments for group work. In the following section, some of the variables known to impact group work successfully are investigated.

Main Factors in Group Work

Since the above literature review shows group work is not always successful, there is a need to know what type of group work leads to better results and a more positive attitude towards teamwork. Earlier studies evaluated the effectiveness of group work mainly

through self-report evaluations (e.g., Bennett, 2015). Some educators have evaluated the final outcome of the group work, while others have focused on the quality of collaboration process. The author's search to identify features of group activities reflected in the literature, resulted in finding the following six main factors.

Physical vs Virtual Group Work

Usually, in virtual group meetings (online discussions), people tend to communicate differently using text as compared to voice used in physical classroom. Therefore, students may communicate more directly and more bravely when writing instead of talking (Eisele, 2013). Since online discussion is time-independent and allows for "many-to-many" interactive communication, it facilitates group work. Therefore, some researchers suggest that online communication can be as effective or more effective than face-to-face collaboration. However, Smith, Sorensen, Gump, Heindel, Caris, and Martinez (2011) noted that students frequently signed up for an online course believing that work in the course will be done individually; therefore, those students may resist team-based approaches to distance learning. These authors report that students in online courses were more negative about group work, than students in face-to-face sections. In a different study, Friedman, Karniel, and Dinur (2009) did not find a significant difference in the social dynamics between online and face-to-face groups.

Overall, research on the relative superiority of online versus face-to-face communication, and their roles in facilitating group work, is not quite conclusive (Smith et al., 2011). It could be concluded to some extent that most of the earlier studies are in favor of face-to-face group work in comparison with online collaboration; however, online group work has its own advantages and can sometimes be as effective. We need to know how can we make both online and face to face group work more effective and how can we motivate students to participate more actively. For example, does it matter if students can participate in a group discussion anonymously?

Anonymous vs. Non-Anonymous Groups

Another major difference between virtual and physical discussion is the possibility of maintaining anonymity online. When students learn collaboratively, they generally learn better if they complement one another in knowledge. However, when group members meet face-to-face, they may be influenced by interpersonal relationships and peer pressure, which can cause group members to interact in less academic ways (Jong et al., 2013). Jong et al.'s study concluded that anonymous group discussions tend to generate better results. They argued that when students know one another reasonably well and meet face-to-face, those with a lower learning achievement may tend to rely on those with a higher learning achievement. This can in turn greatly reduce the effects of collaborative learning. Some researchers have suggested that in an anonymous group discussion, students feel safer to evaluate each other's' contribution to group discussions (Wen, Tsai, & Chang, 2006). As stated by Jong, Lai, Hsia and Lin (2013), when group members are familiar with one another and meet face-to-face, it is only natural that those who are typically low achievers decide to let those who are typically high achievers give "the right

answer.” This effect becomes even more significant when students with a lower learning achievement also have little motivation to learn.

Anonymity can also promote an objective evaluation of inputs by the recipient since it helps individuals to cognitively separate the message from the messenger. Finally, anonymity may help group members to be open and honest without any direct fear of reprisals, and they can be critical of any views. In summary, while anonymity has a great potential for a productive group discussion, there is not much research to support its effectiveness. A major question remains to be answered is if there is a way to minimize the limitations and increase the advantages. For example, if the members are anonymous but the teacher puts homogenous students together, does it change the outcome of group work?

Divergent vs Convergent Discussions

Group tasks have been categorized in several ways. Some researchers have identified three kinds of peer group discussions: disputational, commutative, and exploratory (Tin, 2003). Tin reported that out of the three types of discussion, the exploratory discussion has the highest educational value. As argued by Authors (1999), when peer discussion fails to be exploratory, it may be due to a cumulative effect in which ideas are accepted unchallenged and without justification. Therefore, the vital role of the teacher in this context is to design a collaborative environment that encourages the exploratory peer discussion.

Other researchers have categorized group tasks into well-structured and ill-structured tasks (Jonassen, 1997). Others such as Paulus (2005) have used the terms synthesis and application to categorize group work tasks. The synthesis task requires students to discuss ideas and theories, while the application task asks the group to apply the learning theory to solve a particular learning problem. Jonassen (1997) concluded that when the task is synthesis, groups collaborate significantly more.

According to Jonassen (1997), instructional designs for well-structured problems are rooted in information processing theory while instructional designs for ill-structured problems necessarily borrows assumptions and methods from constructivism and situated cognition. Solving ill-structured problems is largely an iterative and cyclical process. By arguing and counter-arguing learners refine their problem representations and agree on the best course of action.

Finally, researchers such as Tin (2003) categorized group works into convergent and divergent tasks. She also explored what causes students to engage in exploratory talk. She suggested that in convergent (commutative) tasks exploratory talk may not be triggered unless the expert knowledge required to solve the problem is already at the students’ potential or developmental level. She argued that in closed convergent tasks, only one outcome is expected or is true; and the participants need to converge towards a single goal. In open divergent tasks, more than one outcome is possible, and the participants may often end up maintaining their own opinion, even after listening to those of the other partic-

ipants. Following this Vygotskian view of interaction for learning, many educational studies have been conducted, investigating and identifying the features of talk desirable for learning. No matter what one names them or how one categorizes group work tasks, there is enough evidence that these tasks require different types of instructional design. In summary, divergent tasks have a greater potential for a higher level of students' discussion; however, convergent tasks lead to a more evenly distributed amount of work among group members. A question that remains to answer is what group size (small, medium, large) is the best fit for either divergent or convergent task.

Large vs Small Groups

Although different streams of research have addressed the effects of group size (Mueller, 2012; Wheelan, 2009), the authors have not justified their group size choices theoretically (Cummings, Kiesler, Bosaghzadeh, & Balakrishnan, 2013). According to Steiner (1972), having more members provides more resources available to meet task demands. Larger groups sometimes perform better than smaller groups as a result of having more people. Nonetheless, the potential productivity gained from having more people working on parts of the task can be offset by process losses associated with the need to motivate members to participate and coordinate their work.

In larger groups, each member contributes less, on average, than in smaller groups (Liden, Wayne, Jaworski, & Bennett, 2004). One reason for this decline in marginal productivity is social loafing; some members of larger groups perform less than their share of the work (Brown & McIlroy, 2011). Also, larger groups have more difficulty than smaller groups reaching a common definition of the group's goals, managing the flow of work, sustaining members' attention and cooperation, minimizing turnover, and encouraging knowledge sharing over time (Cummings et al., 2013). In summary, there is no consensus on the optimum group size. The big question is if group size has an interaction with homogeneity/heterogeneity of the group members.

Homogeneity vs Heterogeneity of Groups

Homogenous ability grouping is usually used by teachers who want to form more cohesive groups and those who want to avoid free riding in group work. However, Nelson (2008) reports that there is a curvilinear relationship between group cohesion and group functionality. He found that groups with high levels of cohesion function just as poorly as a group with low levels of cohesion. When students of the same ability are placed together, they usually are able to work at about the same pace. Additionally, an ERIC Digest report by Carol Nelson (1994) stated that ability grouping for a particular educational purpose benefits students. In a homogenous ability grouping, the teacher would know how much help is needed for each group and this gives the teacher the ability to adapt instructional content to the level of the group. However, it should be noted that in a homogenous grouping, students in lower groups receive lower quality instruction, work at a slower pace, and can detect a teacher's decreased expectations of performance and quality of instruction. Heltemes (2009) argued that this is harmful to a low-ability student's academic achievement, motivation to learn, and self-esteem.

In a heterogeneous classroom, providing individual attention is difficult since group members are not all at the same level. On the other hand, in a heterogeneous group, high-ability students may get a chance to restructure and elaborate on material as they help other students to understand the task (learning by teaching). Moreover, unlike homogenous groups in which once a student is placed in a group they may get “stuck” in the group, in heterogeneous groups it is not hard to move students (Heltemes, 2009). In a comprehensive research, she placed seventh grade science classes into 16 randomized heterogeneous and homogenous ability groups and tested after each session. Her main findings indicate that high ability students may succeed in either ability grouping style. Medium ability students showed better group performance in homogenous ability groups but tested better as a result of heterogeneous grouping. Low ability students experienced much greater academic achievement because of heterogeneous ability groups. Teachers who let students choose their groupmates, should note that these groups tend to be more homogeneous, in comparison with situations where teachers randomly assign students to groups. There is a need to know how homogeneity of group interacts with other variables such as group size and task type in order to get the best outcome.

Peer Assessment vs Instructor Assessment

Peer assessment happens when the instructor allows students to evaluate each other’s contributions to group work. This benefits students in two ways: assessing peers’ work helps students to evaluate their own work and those being assessed may accept peer assessments more readily than instructor assessments made without seeing the entire process of collaboration (Jong et al., 2013). Although an assessment of overall performance is important, as noted by Baker (2008, p. 183) “when the instructor focuses simply on the end result of a group project, much information is lost about specific task and relationship behaviors that affect group success.” For example, the instructor may not consider the extent to which each group member took initiative, researched the issues, contributed ideas, met group deadlines, contributed to problem solving, and helped resolve group conflict. It is suggested that peer assessment not only helps students to think in a positive way about the evaluation of their work but also helps them to learn better (Rezaei, 2014).

Some instructors put a heavy weight on peer assessment in their grading, while others consider only the final product resulting from the group, and not the individual contributions, (Tinoca, Oliveira, & Pereira, 2007). An important issue is the validity and reliability of peer assessment. Several research studies in the literature have supported the validity of peer assessment (Erez, Lepine, & Elms, 2002; Baker, 2008; Druskat & Wolff, 1999). For example, Baker (2008) compared three peer evaluation methods including two rating scales and single score methods. She concluded that all three instruments demonstrated acceptable levels of reliability and were found to be correlated with individual performance measures. When peers assess each other’s work, they use their own language and communicate in their own way. Compared to the language and approach used by the instructor, peer assessment may help the student being assessed to understand the advantages and shortcomings of his/her work more effectively.

Although some instructors may question the appropriateness of allowing students to influence the grades of their peers, as reported by Baker (2008), many researchers have justified the use of peer ratings for administrative purposes because peers are frequently in the best position to observe relevant behaviors and ratings can be aggregated across peers to increase accuracy. Wager and Carroll's (2012) findings also suggest that students prefer a confidential questionnaire to conduct peer evaluations and perceive it to be the fairest approach, although also reducing concerns for evaluating shared workload. While peer assessment has the potential to help students learn better, it can also cause anxiety because students may fear that judging one another could lead to hard feelings (Jong et al., 2013). Students may also avoid commenting on those with greater academic performance. To tackle this problem, there are methods that allow peers to assess one another without revealing their own identities (Wen et al., 2006). In summary, there are strong theoretical justifications for peer evaluation; however, there are not enough research evidence to support its effectiveness on student learning.

Hypothesis and Research Questions

Researchers in this field who have compared different types of group work. Some have compared different group sizes and others have compared online and face-to-face group works. Earlier studies have considered one factor at a time or have considered only one measure of success, therefore, the results of these studies are mixed and it is hard to conclude which type of group work leads to better results. For example, in most of those studies only a single dependent variable (student satisfaction, amount of collaboration, or students' grade) has been evaluated. The goal of this study is to do a more comprehensive research in which several factors are investigated together (simultaneously) to find the interaction effects among those factors. It is hypothesized that there is a significant interaction among these factors and perhaps that is why the results of earlier studies on the aforementioned single factors are not quite conclusive.

Methodology

Four hundred and forty-seven students participated in this study. All participants were graduate students attending a public university in southern California who had taken at least one course with the researcher between 2013 and 2016. In each course, at least one type of group work or group discussion activity was used. Of these assignments, eight were conducted online (virtual environment) and the remainder (17 assignments) were done in a physical classroom. Some of these assignments were a simple collaboration on a quiz and some involved larger projects requiring students to do a research and to write an essay collaboratively. Some of the assignments required finding specific answers (convergent assignments), and others required exchanging ideas and summarizing the results of a group discussion (divergent assignments). Most assignments were graded by the instructor, however, some assignments were evaluated both by the instructor and the peer group, and just a few assignments were evaluated by peer group only. The evaluation of learning outcome or group performance involved either a rubric or some grading criteria assessing the quality and accuracy of the final product of the group work. Another dependent variable was the level and quality of collaboration (contribution to group

work) as measured by a given rubric (Appendix A). The third dependent variable was the level of students' satisfaction with their group work experience. Student's satisfaction was measured by a simple questionnaire given to students at the end of the assignment (Appendix B). Some groups had a chance to select their group members. These groups are considered homogenous since typically students of the same ability level tend to get together, of course with some exceptions. Other groups had to work in heterogeneous ability groups set up by the instructor. Finally, groups were different in terms of group size. Three group sizes were used for the purpose of data analysis in this study; small groups (pairs of students), medium groups (3-5 students), and large groups (more than 6 students).

Results

A summary of descriptive analysis of data is presented in Table 1. The six independent variables (mode of instruction, type of task, anonymity of participants, homogeneity of students in terms of their skill level, utilization of peer assessment, and group size) are listed in the first column and the averages of students' scores on the three dependent variables (performance /outcome, satisfaction, collaboration) are presented in the last three columns. For convenience, all scores are converted to a 1-100 scale. Three independent variables (outcome, satisfaction, collaboration) are included in Table 1. The outcome/performance was measured by student score in a test/quiz or final projects. Student satisfaction and level of students' collaboration were measured using the rubrics provided in Appendix A, and B. The first independent variable is the mode of instruction. For two-level independent variable t-test, and for more than two level variables analysis of variance was used to test the significance of any differences. The significance levels of p values for t-tests and analyses of variances are marked by asterisks in Table 1 and 2 indicating the difference is significant at $P < .05$. A quick review of this table shows that the learning outcome score and students' satisfaction with group activity were higher in face-to-face courses rather than the online courses. However, the level or the amount of collaboration was higher in online courses.

The second independent variable presented in this table is the type of assignment. Comparing convergent and divergent tasks also showed that learning outcome score and students' satisfaction with group activity were higher in convergent tasks rather than the divergent tasks. No significant difference was observed between convergent and divergent tasks in terms of students' level of collaboration.

Anonymity is the third variable in this table. The table shows that the outcome quality of students' group work was higher, and students collaborated more when they worked in groups anonymously. However, they were more satisfied and collaborated more in non-anonymous groups. Similarly, the table shows that students performed better and were more satisfied when they worked in homogeneous groups but the level of collaboration was higher when the groups were heterogeneous.

A univariate analysis of variance on the fifth independent variable showed that the outcome was highest when students' performance was evaluated by the instructor, and the

Table 1. Mean scores for different types of group work.

Variables	Categories	Outcome / performance	Satisfaction	Collaboration
1- Mode	Virtual	78	74	79*
	Physical	81*	93*	74
2- Assignment Type	Convergent	82*	90*	75
	Divergent	77	79	76
3- Anonymity	Anonymous	82*	71	84*
	Non Anonymous	73	77*	73
4- Homogeneity	Homogeneous	84*	90*	72
	Heterogeneous	78	83	78
5- Assessment	Instructor	86*	89*	75
	Peer	63	79	70
	Both	76	84	81*
6- Group Size	Small	82*	89*	74
	Medium	80	84	80*
	Large	77	86	70

* Means the number is significantly higher than other numbers.

performance was rated lowest when student performance was evaluated only by their peer group. The performance quality (learning outcome) was somewhere in between when it was evaluated both by the instructor and the peer group. A similar pattern was observed with satisfaction as the dependent variable. However, as shown in Table 1, the level of collaboration was highest when student performance was evaluated both by the instructor and the peer group.

Finally, the last independent variable in Table 1 is the group size. The results showed that larger groups performed lower and their level of satisfaction and their level of collaboration was also lower than small groups. The level of collaboration was highest for the medium size groups

In order to investigate possible interactions among these six factors, several factorial analysis of variance were performed. Six major interactions were found to be significant. The results of the factorial design analyses are presented in Table 2. The first significant interaction was found between the mode of group work (virtual, physical) and the type of

Table 2- Results of significant interactions found in factorial analysis of variance.

Interaction	Categories		Outcome / performance	Satisfaction	Collaboration
1- Mode & Type	Virtual	Convergent	71	71	79
		Divergent	80*	75*	79
	Physical	Convergent	84*	93	75*
		Divergent	68	92	70
2- Mode and Homogeneity	Virtual	Homogeneous	58	65	68
		Heterogeneous	80*	75*	80*
	Physical	Homogeneous	87*	93	73
		Heterogeneous	75	92	76
3- Mode and Group Size	Virtual	Small	58	65	68
		Large	78*	81*	75*
	Physical	Small	86*	93	75*
		Large	75	92	63
4- Type & Homogeneity	Convergent	Homogeneous	87*	93*	73
		Heterogeneous	76	86	79
	Divergent	Homogeneous	58	65	68
		Heterogeneous	79*	81*	78
5- Type & Group Size	Convergent	Small	86*	93	75*
		Large	84	94	59
	Divergent	Small	58	65	68
		Large	74*	83*	74*

* Means the number is significantly higher than other numbers.

the task (convergent vs divergent). Virtual courses led to better outcomes and more students' satisfaction when the assignment was divergent. However, in face-to-face group works, convergent tasks lead to better learning outcome and more collaboration among students.

The second significant interaction was found between the mode of group work (online vs face-to-face) and the homogeneity of group members. It was observed that in virtual environments heterogeneous groups performed better, were more satisfied, and collaborated more in comparison with homogeneous groups. However, in physical environments, homogeneous groups performed better than heterogeneous groups.

Mode of group work (virtual vs physical) and group size also showed a significant interaction. In virtual environment, larger groups performed better, were more satisfied, and collaborated more in comparison with small groups. However, in physical environments, smaller groups performed better and collaborated more than large groups.

Another significant interaction was found between the type of task (convergent vs divergent) and homogeneity of groups. On convergent tasks, homogeneous groups performed better and were more satisfied than heterogeneous groups. However, on divergent tasks, the heterogamous groups performed higher and were more satisfied than homogenous groups. No significant interaction was observed between these two variables in terms of students' level of collaboration.

Finally, there was a significant interaction between the task type and group size. As shown in the last rows of Table 2, on convergent tasks, small groups performed higher and collaborated more than large groups. However, on divergent tasks, large groups performed better, were more satisfied, and collaborated more than did small groups.

Discussion and Conclusions

Six major factors including mode of instruction (face-to-face vs online), type of task (convergent vs divergent), anonymity of participants, homogeneity of students in terms of their skill level, peer assessment, and finally, group size were found to play significant roles in the effectiveness of group discussion. The most important conclusion of this study is the results revealed through the factorial analyses of variance. Several important interactions were found to be significant through this analysis. These findings have not been found or reported in earlier studies, particularly, in terms of considering all three measures of group work success together.

The findings of this study are valuable for teachers who want to start using group work in their courses. For many instructors who want to use group work in their courses there is no evidenced based research to help them how to form groups or teams in their classes and usually wonder what works and what doesn't work. The overall results of this study indicate that the effectiveness of group work or group project depends on how the effectiveness is measured and how the group work is designed. Depending on how the effectiveness was measured, the results were quite different. Faculty can assign more complex, and more authentic tasks to groups of students than they could to individuals. Additionally, group assignments can be useful when the task is divergent in nature and requires multiple perspectives. A major advantage of group work for instructors is that they can save time through group work assignments by reducing the number of final products instructors have to grade and hence having more time on giving constructive and detailed feedback to students.

Instructors should assign only group work tasks that fulfill the course objectives and assign tasks that lend themselves well to collaboration. Instructors should also be aware that group project assignments can add more work for themselves and may introduce its own grading complexities.

For example, the results showed while face-to-face group work lead to a better learning outcome (final product) and it lead also to higher student satisfaction, online group work lead to more collaboration. This finding contrasts to earlier studies reporting face-to-face courses to be more productive in terms of collaboration among students. However, if we

consider the interaction with other factors, this contrast could be easily explained. As shown in Table 2, students perform better in face to face course only if the task is convergent. Another reason might be due to the fact the author required students to document their contribution to the group work in the online courses. This policy might have encouraged (forced) students to participate in all stages of group work. Conversely, this finding supports earlier studies claiming that students prefer face-to-face group work over online group work (Smith et al., 2011). Apparently, the logistical difficulties of working in groups are harder to resolve in online courses.

The second finding was that students performed better in convergent tasks in comparison with their performance in divergent tasks. However, if we consider the interaction with other factors, we'll notice that this is true only if the course is fact-to-face. In virtual courses, students perform better in divergent tasks rather than convergent tasks. In face to face courses, students know each other. Therefore, if they work on a convergent task such as a science project, they can assign tasks to students who are the best in those tasks and as a result, the final project is going to be of high quality. On the other hand, in divergent tasks such as group discussions in social issues, the more the students know each other, the less there is a chance that they disagree on a social issue, and there is no real discussion or real exchange of ideas among homogenous groups. This is exactly the opposite in online courses. As mentioned earlier, in an online environment, students are much braver to challenge each other's ideas and to defend their own viewpoints. Thus, in such environment there is a higher chance for a more meaningful and a more productive discussion and a higher quality final outcome. As another example, in face-to face courses, the author observed that when students were allowed to work on a quiz or on a problem-solving activity (a convergent task), they perform better than when they had to work in a research project (a divergent task). This is quite consistent with another finding in this study indicating homogenous groups performing better on convergent tasks and heterogenous groups performing better on divergent tasks.

Another important interaction was found between group size and the type of the task. Earlier studies had reported that smaller groups (2-4 students) perform better than larger groups (5-8 students). As expected, smaller groups performed better on convergent tasks particularly in physical courses. Larger groups performed better on divergent tasks, particularly, in online courses.

The results of this study suggest that teachers should not rely merely on research findings that have focused only on one factor at a time. For example, while many studies have suggested that small groups usually perform better than large groups, if the task is divergent and the goal is greater collaboration, then small groups may not be the best option. On the other hand, when teaching online, and the group is large, it is better to assign divergent tasks for group work. If teaching face-to-face and the goal is a higher quality final product, one should assign convergent tasks. It is suggested that if the goal is for all students to reach at a specific level of learning or to reach a specific level of achievement, then perhaps heterogeneous grouping is the best option, however, if the goal is to have students maximize their capacity as learners, homogenous grouping may work better. The results of this study indicate that the effectiveness of heterogeneous grouping depends on

the task (convergent, divergent) and also depends on the mode of instructions (i.e., online, in class). In online environments, high achievers will not become mentally lazy, and individuals from different cultural backgrounds and those who are not native English speakers, will get a chance to rephrase their statements and participate in group work with a higher confidence. The results of this study also support earlier studies finding students to prefer face-to-face group work over online group work. However, this study's results show that students collaborate more and more equally in online group work, particularly, when the task is divergent and student's participation is evaluated both by the instructor and peer group.

Most employers require graduates to be able to demonstrate competent teamwork skills and the ability to solve problems collaboratively. While teachers use group work to reach this goal, many teachers have reported that students simply use the opportunity to socialize rather than to collaborate. The results of this study would help teachers to set up their group work assignment in a way that maximizes the quality of final product or increases the level of collaboration or enhances students' satisfaction with the group experience. Overall, as concluded in a report by the Carl Wieman Science Education Initiative (2010), although group work is sometimes hailed as an educational panacea, the realities are considerably more complex. Many studies of group work have been done and have shown a wide variety of results. In general, research in the area of group work has been oversimplified in many earlier studies. The results of this study reveal the complexity of the topic and suggests that educators need to consider at least six factors while they design group work assignments. This study is not a true experimental research and the conclusions should be considered cautiously. However, the findings clearly indicate that the success of group work depends on more than one simple factor such as group size or group homogeneity.

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Appendix A. Rubrics to Measure the Level of Students' Collaboration

Online Group Discussion

1. Your input, measured by the number of words you post on discussion board.
2. The “frequency distribution” of your comments over time. Don’t post all or most of your comments at the same time.
3. Your knowledge, measured by the number of your references to the given list of readings and videos and other sources including any statistics you use to support your argument.
4. Your initiation, measured by the number of times you start a message that prompts others to reply or object (you get at least two replies).
5. The quality of your posting. Posting messages that contains a clearly stated conclusion or thesis supported by premises, reason, evidence, or your personal experience.
6. The number of your responses to other students’ posting.
7. The quality of the final reflection, and your conclusions.

Class Group Discussion

1. Taking the leading role or facilitating group discussion.
2. Teacher’s class observation of the level of participation of the student.
3. Peer group final ratings of individual students’ contribution to group discussion.
4. The amount and timeliness of student's participation in group discussion (not coming late or leaving early).
5. Rate the level of accuracy of this student's answers as evaluated by peer group.

Appendix B- Student Satisfaction with Group Work

1. Did you meet at a time that all convenient to all members?
2. We you able to spend enough time on solving the problem?
3. Were you given the opportunity to contribute?
4. Were all group members able to contribute something?
5. Did you work well as a group?
6. Did group members managed differences well to avoid conflict?
7. Were group members guarded or cautious in discussions?
8. Were group members reluctant to ask for or give help?
9. Was the group discussion dominated by a few members?
10. Were the final decisions made by only a few members?
11. Did you feel that rules set up by the instructor hindered your creativity and critical thinking in any ways?
12. Do you think your abilities, knowledge and experience were well utilized?