INVESTIGATING GROUP WORK ONLINE THROUGH THEORY OF CONNECTIVISM

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Abstract. The well-established pedagogy, group work is a key component of teaching and learning as it offers a wide range of benefits to learners across all education levels. In fact, advancements in digital technology today have simplified the incorporation of online group work in academic environments. However, the growing application of online group activities in higher education is not without any issues. While it offers endless possibilities of a more effective learning experience, challenges in incorporating online group works are inevitable. Moreover, limited empirical research has examined online group collaboration through the lens of connectivism. Hence, the current study aims to explore online group work using connectivism theory. A quantitative survey was shared online to 180 students at a public university. The survey consists of 4 sections; Section A on demographic profile, Section B on online teaching presence, Section C on cognitive presence, and Section D on social presence. The findings of the study revealed that in line with connectivism theory, autonomy, openness and connectedness and diversity show strong intercorrelations in online group work approaches. Based on the findings, this framework can be a guideline for a thoughtful instructional design. Thus, the study suggests educators design purposeful online group work experiences using the principles of teaching presence, cognitive presence and social presence that can enhance group work practices in digital environments.
Keywords: *connectivism theory, autonomy, openness, connectedness and diversity, online group work*

Introduction

The rapid growth of online and blended learning environments has transformed the ways in which students collaborate. Group work, once predominantly conducted face-to-face, has increasingly shifted to digital platforms such as Google Workspace, Microsoft Teams, and Zoom. These tools enable geographically dispersed learners to share ideas, co-create content, and interact in real time, making collaboration possible beyond the boundaries of physical classrooms (Jafar et al., 2023). Online group work offers multiple benefits, including increased flexibility (Law and Kaur, 2025), enhanced learners' social skills and exposure to diverse perspectives (Gasmi, 2022), as well as developing essential skills related to digital collaboration, which is crucial for the twenty-first-century workforce. The theory of connectivism, introduced by Siemens (2005), offers a contemporary framework for understanding learning in a networked environment. Connectivism posits that learning is a process of creating and navigating networks of information, people, and digital resources. It emphasises the importance of technology in the learning process, as more than just a mere educational tool. The prevalence of this theory is much more evident in the post-COVID teaching era, where online interaction has become the new spectrum of teaching and learning. Therefore, to ensure that students could benefit from this new norm, they need to be well equipped

with the necessary skills, especially to collaborate with their friends in any online activities to leverage the benefits that online group work has to offer (Pallof and Pratt, 2010).

Statement of Problem

Online group work has emerged as a common instructional strategy in higher education, particularly in technology-enhanced and blended learning environments. Not only that, within companies where hybrid mode is applied, virtual collaboration is also required as a crucial skill for university graduates. The online learning environment is an ideal environment to teach virtual collaboration skills in higher education to better prepare students for a virtual collaborative working environment. One way to equip students with the necessary skill to operate within the virtual learning environment is to teach virtual collaborative skills through incorporating collaborative learning activities to students. Technology advancement has afforded learners to effectively collaborate through virtual platforms that could result in successful individual and group learning and in the long run, organizational success (Mitchell, 2021).

While online group work holds the potential to facilitate deeper learning through peer interaction and shared knowledge construction (Pallof and Pratt, 2010), its effectiveness is inconsistent. Studies have documented persistent challenges, including unequal participation (Law and Kaur, 2025), lack of engagement (Jafar et al., 2023), and the underutilisation of available digital tools. These issues can reduce the quality of collaborative learning and limit students' ability to develop essential skills for the networked society. Despite the growing application of online group activities in higher education, limited empirical research has examined such collaboration through the lens of connectivism. This theory offers a relevant perspective for examining online group work, as it accounts for the ways in which learning occurs through the formation of human and technological connections. However, most research on online group collaboration has focused on practical or pedagogical aspects without explicitly applying connectivism as an analytical framework (Oyarzun et al., 2023). In the Malaysian higher education context, where online and blended learning have become increasingly common, little is known about how connectivism principles manifest in students' online group interactions. Hence, this study aims to address this gap by investigating online group work using connectivism as the guiding theoretical framework.

Objective of the study and research questions

This study is conducted to explore group work online. It seeks to examine how participants perceive working in groups emphasizing the principles of connectivism theory that have become highly relevant these days particularly when learners not only learn online but also collaborate virtually to gain knowledge. Considering the role of technology, human connection and knowledge contruction, this study is specifically done to answer the following questions: (1) How do learners perceive openness during online group work? (2) How do learners perceive connectedness and diversity during online group work? (3) How do learners perceive autonomy during online group work? (4) Is there a relationship between all factors in online group work?

Literature review

Theory of connectivism

George Siemens introduced this theory in a foundational online article published on December 12, 2004 (Corbett and Spinello, 2020). This theory explains that learning occurs through networks, especially when people connect with each other as well as digital tools to gain and share knowledge. Fakir et al. (2024) in their study mentioned that knowledge is distributed across networks and learning happens when individuals form connections with information sources, other people, as well as technological tools. According to Siemens (2005), there are 8 principles under this theory. The first principle states that learning and knowledge rest in a diversity of opinions, which means that knowledge, is spread across the network and influenced by various opinions. The second principle notes that learning is a process of connecting specialized nodes or information sources. It means that learning occurs when we are able to link different sources of knowledge, such as books, websites, experts or communities. The next key principle mentions that learning may reside in non-human appliances which mean that knowledge can be kept and stored in tools like computers and smartphones. The fourth principle highlights the importance of finding and learning new information rather than simply depending on what is already known. The fifth key principle states that nurturing and maintaining connections is required to aid continuous learning. It is crucial to stay connected and grow in understanding over time. The 6th and 7th key principles highlight the ability to see connections between fields, ideas and concepts as a core skill as well as being current and up-to-date, as knowledge constantly evolves in this digital age. The last key explains the importance of decision-making, as it involves assessing information and choosing what to focus on.

Corbett and Spinello (2020) explain that connectivism is built on four foundations for learning which include autonomy, connectedness, diversity and openness. Mukhlis et al. (2024) add that autonomy is the ability of learners to take charge of their own learning by controlling and organizing their own learning while interconnectedness refers to the importance of forming relationships and networks in the process of acquiring knowledge. Additionally, diversity highlights the variation on sources of knowledge and viewpoints. The final foundation, which is openness, means the transparency and accessibility of knowledge and learning (Mukhlis et al., 2024).

Group work online: Challenges and benefits

The learning environment in higher educational institutions worldwide, especially the setting, has seen numerous changes recently, particularly in the wake of the COVID-19 pandemic. This includes group work online, which has encountered many challenges and difficulties despite its growing popularity as a teaching or instructional method (Koh and Hill, 2009). Among the challenges faced are a lack of a sense of community (Song et al., 2004) and connection between the group members (Gillett-Swan, 2017). According to Bowers and Kumar (2015), one factor that contributes to the increased attrition rates in online courses is a lack of connection. This is supported by Kamaludin et al. (2022), who stated that the distance in terms of time and space resulted in group members feeling alienated from one another, which could lead to a loss of support and a sense of belonging. Other challenges include differences in terms of the time zones, delayed or lack of response, or delayed peer feedback among the group members (Chang and Kang, 2016; Koh and Hill, 2009), and communication difficulties due to problems with the Internet as well as language difficulties (Harianingsih et al., 2021).

Besides that, students tend to be less engaged in collaborative or group work that is done online compared to group work that is done through face-to-face sessions (Chen et al., 2008). This is supported by Jackson (2015), who shared that different levels of responsiveness and engagement are some of the challenges faced by small group work. Moreover, group work that is done in an online setting is more time-consuming (MacNeill et al., 2014), especially when linked back to the lack of response and peer feedback experienced by the students. Last but not least, unequal contributions of tasks among group members may lead to more trouble in online group work environments, since it is easier for students to be less attentive and involved than in face-to-face or in-person group work settings (Chang and Kang, 2016). All of these contributing challenges thus could impede the overall learning process of the students (Harianingsih et al., 2021), making group work difficult to handle and implement online.

Despite the challenges and attributes associated with group work online, there are still many benefits of this instructional strategy mentioned by past researchers. For instance, implementing group work in an online learning setting allows flexibility (Law and Kaur, 2025; Koh and Hill, 2009; Petrides, 2002), eases the learning process, and improves self-confidence among the students (Harianingsih et al., 2021). According to Harianingsih et al. (2021), group work that is conducted online allows for flexibility, as learning can be done anytime and anywhere, depending on the availability of the Internet. The researchers also mentioned that since most educational institutions are using more long-distance learning because of the COVID-19, online group work might ease the learning process of the students. Other than that, acquiring critical thinking skills, higher-order abilities, and constructing knowledge and meaning (Conrad and Donaldson, 2011; Pallof and Pratt, 2010) are some of the other benefits of conducting group work in an online environment. Lastly, students tend to improve their ability to manage their course workload, which enables them to learn from their peers' strengths and unique viewpoints (Chang and Kang, 2016). These advantages thus show that it is still possible to conduct group work in an online environment, regardless of its challenges.

Past studies

Past studies on challenges of group work online

Although substantial research has shed light on the usefulness of online group work (Gasmi, 2022; Kelly et al., 2022; Aderibigbe, 2021), its application in teaching and learning is not without any issues and challenges. Recent research has continued to highlight the persistent challenges of online group work in higher education. For instance, a large-scale study by Jafar et al. (2023) involving 761 students across Peninsular Malaysia looked into students' readiness and challenges of e-learning during the COVID-19 pandemic era. The study utilized a cross-sectional survey and revealed various challenges faced by students while engaging in online group work, namely social isolation, decreased focus, and mental health disorders. In addition, technical issues such as limited access to a stable internet connection were among the issues highlighted. The study also indicated that such challenges were identified as key factors that diminished students' ability to engage effectively in group-based online tasks. Another study which looked into the application of online platforms in learning is a study by Law and Kaur (2025). The qualitative study aimed to explore students' online learning experiences, focusing on the advantages and challenges of online learning. The

study elicited responses through the use of qualitative interviews with 30 students at a private institution in Malaysia. While the study revealed numerous positive sides of online learning such as flexibility and accessibility, the study also highlighted the challenges students faced while involving in online learning, namely lack of collaborative effort from group members (difficulties in initiating group discussion), feelings of isolation, declining focus and motivation as well as diminishing engagement and satisfaction due to lack of communication with peers and instructors. Apart from that, technical issues are also among the key challenges of online group work. The study further suggested that while online learning offers substantial advantages, the challenges that come with its implementation need to be addressed to ensure total benefit from its application.

While online group work provides advantages such as increased flexibility, diverse perspectives, and access to digital resources as indicated in the above studies, it is evident that challenges are inevitable. Common issues include unequal participation, communication breakdowns, and scheduling conflicts, as well as technological constraints and varying levels of digital competence. This suggests that the benefits of online group work must be balanced with strategies to address its persistent limitations.

Past studies on benefits of group work online

Despite some studies having pointed out the challenges of online group work, other studies have emphasized its benefits. The study by Gasmi (2022) investigated learners' perspectives on the effectiveness of online discussion forums in a virtual English language course offered in a university in Oman. Purposive sampling was employed to select thirteen students for the study. The participants were from different major fields of study but were enrolled in the same English language skills course. This study employed a mixed-method design. Data of the study were collected through questionnaires and observations. Although challenges existed, the results highlighted positive findings. Firstly, online discussion forums not only enhance students' skills on reading and thinking critically, but also on critical reflection on varied topics of discussion and learning experience in general. Secondly, online discussion forums contributed to greater participation of learners in terms of behavioural, emotional and cognitive engagement while learning. In addition, it was found that the approach also enhanced learners' social skills. Another study by Aderibigbe (2021) focused on the value and quality of the learning process in online discussions. Forty participants from a Canadian public university took part in this study. They were given one week to participate in selected forum discussions. Apart from the post, they completed reflective assignments to share their learning outcomes from online discussions. The significant finding of the study showed that online discussions can foster deep learning if students receive clear guidelines and reasonable time to engage effectively online.

Next, the study by Koh and Hill (2009) examined university students' perceptions of group work in an online course. The study contributed to understanding the factors of online group work that students recognize as beneficial and challenging in the learning process. In the mixed-method approach, thirty-seven students participated in the survey, and five students participated in the follow-up interview. All participants were university students in the Southern United States. The findings of the study revealed that despite the challenges, many students considered online group work to be advantageous. Flexibility emerged as the primary reason for the participants to perceive online group work positively, though they indicated that online group work to be more difficult than

face-to-face group work. Next, the study by Kelly et al. (2022) evaluated the effectiveness of utility-value intervention designed to enhance students' perceptions of online group work and their group work skill use. A total of sixty-eight students participated in this study. Thirty-six students were placed in the intervention group and thirty-two in the control group. Participants in the intervention group viewed a video on the benefits of online group work, whereas participants in the control group viewed a video on the requirements for the group work project and how it would be graded. Both groups of participants then completed the post-video quiz and an essay. The findings of the study pointed out the effectiveness of utility-value intervention as students in the intervention group expressed greater recognition of its benefits. Most importantly, the study placed strong emphasis on incorporating group work in online courses.

Engaging in group work online has been found to foster critical thinking skills and deep learning among students. Critical thinking skills are essential as they can facilitate individuals to solve problems effectively and make informed decisions. While deep learning promotes a more profound understanding of the topics students learn, it can also be the source for learners to enhance their critical thinking skills. Furthermore, it is crucial to highlight that participating in group work online helps students develop their interpersonal skills, as they have to communicate effectively, listen actively, resolve conflicts, and work as a team, motivating and supporting each other.

Conceptual framework of the study

Connectivism is a theory in learning that states that knowledge is disseminated through connections and learning is done via these connections. The theory of connectivism is introduced by Siemens (2005). This theory is applicable more so in this post-COVID teaching era. Online interaction has become a norm in the world of teaching and learning. Online learners stay when they have confidence in the learning tasks, and they get satisfaction out of the learning. *Figure 1* shows the conceptual framework of the study. This study is anchored from Connectivism and merged with the group work online elements by Aderibigbe (2021). In Connectivism, openness refers to the willingness of the learners to share the materials and also build a network of materials for learning. This stage in connectivism relates well to cognitive presence, where group work enables team members to share resources and in doing so, improve on the existing materials. Next, social presence in online group work further encourages connectedness and diversity of interaction and exchange of ideas. Lastly, teaching presence in online group work helps anchor the flow of the lesson task. In learning, learners need to have a sense of autonomy to what they are learning. They need to ask the teacher questions freely about their queries. The presence of the teacher via online helps to keep the "classroom environment" even if physical presence is missing. This is sometimes needed for learners to feel they belong to the classroom and gain autonomy in their learning. This study also investigates whether there is a relationship between connectedness and diversity with autonomy. Moreover, this study also looks at the relationship between autonomy and openness as well as the relationship between openness and connectedness & diversity.

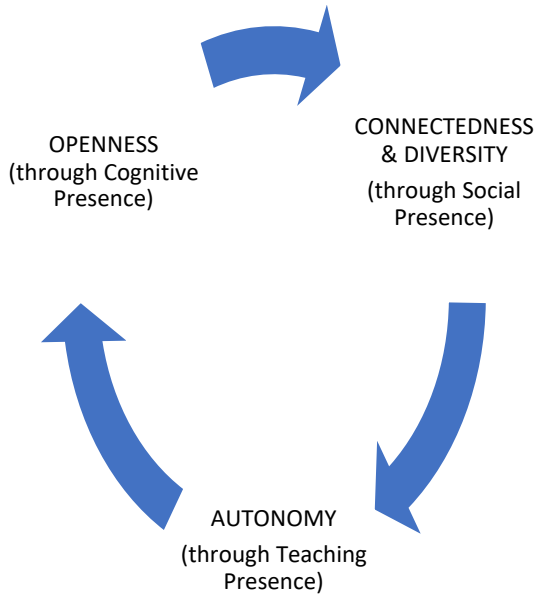

Figure 1. *Conceptual framework of the study mapping online group work with connectivism.*

Materials and Methods

This quantitative study is conducted to explore online group work using connectivism theory. A convenient sample of 180 participants responded to the survey. The instrument used is a 5-point Likert-scale survey. *Table 1* shows the categories used for the Likert scale; 1 is for Never, 2 is for Rarely, 3 is for Sometimes, 4 is for Very Often and 5 is for Always. *Table 2* shows the distribution of items in the survey. Section B has 7 items on Openness; Section C has 8 items on Connectedness & Diversity while Section D has 8 items on Autonomy. The table also shows the reliability of the survey. The analysis shows a Cronbach alpha of .746 for Openness, .813 for Connectedness & Diversity and .901 for Autonomy. The overall Cronbach Alpha for all 23 items is .899; thus, revealing a good reliability of the instrument chosen/used. Further analysis using SPSS is done to present findings to answer all the research questions for this study.

Table 1*. Likert scale use in this study.*

Category	Description
1	Never
2	Rarely
3	Sometimes
4	Very often
5	Always

Table 2*. Distribution of items in the survey.*

Section	Connectivism (Siemens, 2005)	Elements (Aderibigbe, 2021)	No of items	Cronbach Alpha
B	Openness	Cognitive presence	7	.746
C	Connectiness & diversity	Social presence	8	.813
D	Autonomu	Teaching presence	8	.901
		Total items	23	.899

Results and Discussion

Demographic Analysis

Table 3 presents the demographic analysis of the respondents, which includes their gender, course of study, online learning experience, duration of online learning per week as well as class type. A total of 180 students from a public university in Malaysia became the respondents of the study. As displayed in Table 3, 46% of the respondents were comprised of male students, while the remaining 54% were female students. In terms of course of study, the majority of respondents come from the Science and Technology courses, with a percentage of 65%. This is followed by students from the Social Sciences and Humanities courses (25%) and lastly, Business and Administration courses (10%). Besides that, the majority of the respondents (72%) involved in this study reported having more than 1 year of experience in online learning, while only 28% reported having less than one year of experience. For the duration of online learning per week, the table above summarizes that 44% of the respondents spent 5-8 hours per week learning online, while 29% of them spent 2-4 hours per week learning online. Only 27% of the respondents reported that they spent more than 8 hours per week learning in an online setting. Lastly, in terms of class type, most of the respondents reported that the online classes cover more lectures than activities (48%). This is followed by 36% of them who mentioned that the classes were mostly lectures. However, only 11% of the respondents mentioned that the online classes cover more activities than lectures, while another 5% said that the class type was mostly on activities.

***Table 3**. Demographic profile in percentage (%).*

Question	Demographic profile	Categories	Percentage (%)
1	Gender	Male	46%
		Female	54%
2	Course of Study	Science & Technology	65%
		Social Sciences & Humanities	25%
		Business and Administration	10%
3	Online Learning Experience	Less than one year	28%
		1 year and above	72%
4	Duration of online learning per week	2-4 hours per week	29%
		5-8 hours per week	44%
		More than 8 hours per week	27%
5	Class type	Mostly activities	5%
		More activities than lectures	11%
		More lectures than activities	48%
		Mostly lectures	36%

Descriptive statistics

Findings for openness

This section presents data to answer research question (1): How do learners perceive openness during online group work? In the context of this study, this is measured by cognitive presence. *Figure 2* above presents the mean for openness/Cognitive Presence. The highest mean is 4.1 for item 4 (mean=4.1, SD=0.8), which states that online group work allows exchange of information among the group members. Next, three items have the same mean of 4. The first is item 5 (mean=4, SD=0.8) states that the team members are able to share new information during an online group discussion. Next is item 6 (mean=4, SD=0.8) which states that online group work allows the team members to connect their ideas. Item 7 (mean=4, SD=0.8) states that at the end of the online group

discussion, the team would use the new ideas discussed. The lowest mean is item 2 (mean=3, SD=0.9) which reports the learners saying that in online group work, they are confused over different types of ideas discussed.

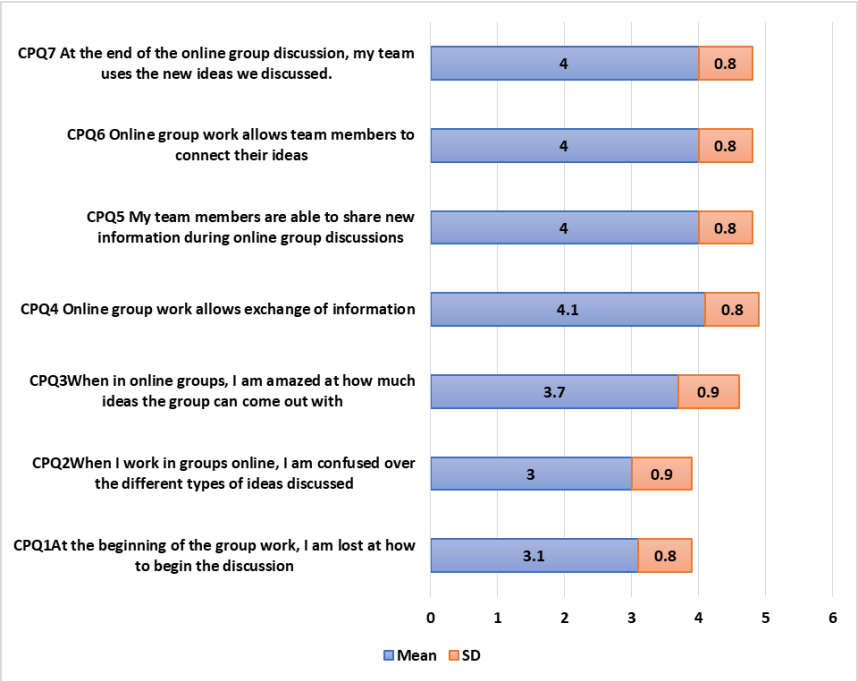

Figure 2. *Mean for openness/cognitive presence.*

Findings for Connectedness and Diversity

This section presents data to answer research question (2): How do learners perceive connectedness and diversity during online group work? In the context of this study, this is measured by social presence. *Figure 3* presents the mean score for items under social presence. As shown above, item 8 which states that "Online group discussions give me a chance to collaborate on a project with the team members" recorded the highest mean score of 4. In addition, item 7 tailed closely with a 3.9 mean score, which states that online group discussions allow students to communicate clearly with their team members. Three out of the eight items under this variable recorded the same mean score namely "in online group discussions, I can feel how happy my team is" (SPQ1), "being online lets me show my feelings without being seen by my friends" (SPQ3) and "I am not afraid to disagree with any ideas when I am online" (SPQ5) with all items recorded 3.7 mean score. Item 2 recorded the lowest mean score of 3 which states that "in online group discussion, I can feel how unhappy the team is" (SPQ2).

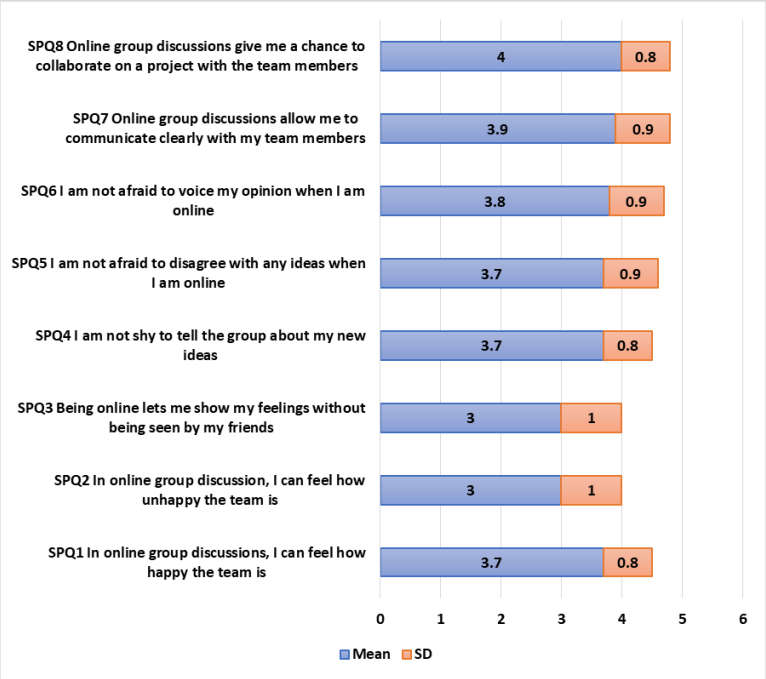

Figure 3. *Mean for connectedness & diversity/social presence.*

Findings for Autonomy

This section presents data to answer research question (3): How do learners perceive autonomy during online group work? In the context of this study, this is measured by teaching presence. *Figure 4* highlights the mean for autonomy/teaching presence. The highest mean score is obtained by item 6, with the statement 'When I see the examples used by the teacher, I can visualize (see) how I should write my example' with a mean of 4.3. The lowest mean is 4.1 which is obtained by item 1 'The teacher uses suitable teaching materials to explain the topic', item 2 'The teacher shows how to complete tasks online' as well as item 8, 'The explanation by the teacher about the task/ assignment/test is clear to me'. The remaining items share the same mean which is 4.2 and they are items number 3, 4, 5 as well as item 7. Items 3 & 4 state that 'the use of templates for tasks/homework/assignments by the teacher helped me to do the task' and 'I imitate what the teacher does to complete my tasks/ assignments'. While items 5 and 7 mention that 'the examples used by the teacher in class helps me understand the topic better' and 'the explanation by the teacher about the topic is clear to me'.

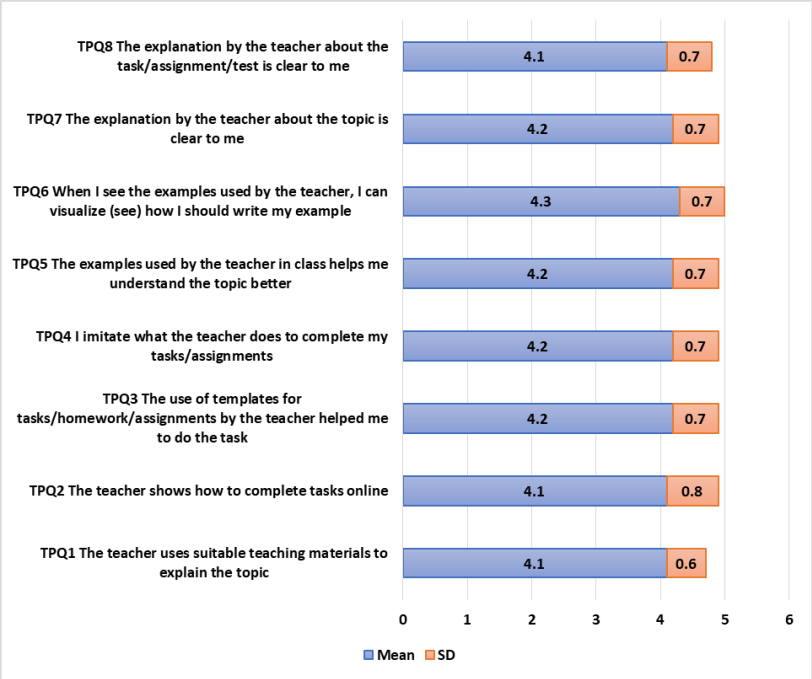

Figure 4. *Mean for autonomy/teaching presence.*

Findings for Autonomy

This section presents data to answer research question (4): Is there a relationship between all factors in online group work? To determine if there is a significant association in the mean scores between all factors in online group work, data is analysed using SPSS for correlations. Results are presented separately in *Table 4*, *Table 5* and *Table 6*. *Table 4* shows there is an association between connectedness & diversity and autonomy. Correlation analysis shows that there is a high significant association between connectedness & diversity and autonomy (r=.491**) and (p=.000). According to Jackson (2015), coefficient is significant at the .05 level and positive correlation is measured on a 0.1 to 1.0 scale. Weak positive correlation would be in the range of 0.1 to 0.3, moderate positive correlation from 0.3 to 0.5, and strong positive correlation from 0.5 to 1.0. This means that there is also a strong positive relationship between connectedness & diversity and autonomy. *Table 5* shows there is an association between autonomy and openness. Correlation analysis shows that there is a high significant association between autonomy and openness (r=.523**) and (p=.000). According to Jackson (2015), coefficient is significant at the .05 level and positive correlation is measured on a 0.1 to 1.0 scale. Weak positive correlation would be in the range of 0.1 to 0.3, moderate positive correlation from 0.3 to 0.5, and strong positive correlation from 0.5 to 1.0. This means that there is also a strong positive relationship between autonomy and openness. *Table 6* shows there is an association between openness and connectedness & diversity. Correlation analysis shows that there is a moderate significant association between openness and connectedness & diversity (r=.499**) and (p=.000). According to Jackson (2015), coefficient is significant at the .05 level and positive correlation is measured on a 0.1 to 1.0 scale. Weak positive correlation would be in the range of 0.1 to 0.3, moderate positive correlation from 0.3 to 0.5, and strong positive correlation from 0.5 to 1.0. This means that there is also a moderate positive relationship between openness and connectedness & diversity.

Table 4. *Correlation between connectedness & diversity and autonomy*.

Category		Connectedness & diversity	Autonomy
Connectedness & diversity	Pearson Correlation	1	.491**
	Sig (2-tailed)	-	.000
	N	180	180
Autonomy	Pearson Correlation	.491**	1
	Sig (2-tailed)	.000	-
	N	180	180

*Note: **Correlation is significant at the level 0.01(2-tailed).*

Table 5. *Correlation between autonomy and openness.*

Category		Autonomy	Opennes
Autonomy	Pearson Correlation	1	.523**
	Sig (2-tailed)	-	.000
	N	180	180
Opennes	Pearson Correlation	.523**	1
	Sig (2-tailed)	.000	-
	N	180	180

*Note: **Correlation is significant at the level 0.01(2-tailed).*

Table 6. *Correlation between openness and connectedness & diversity.*

Category		Opennes	Connectedness & diversity
Opennes	Pearson Correlation	1	.499**
	Sig (2-tailed)		.000
	N	180	180
Connectedness & diversity	Pearson Correlation	.499**	1
	Sig (2-tailed)	.000	
	N	180	180

*Note: **Correlation is significant at the level 0.10(2-tailed).*

To summarize, the data analysis of this study revealed interesting findings in exploring online group work based on connectivism theory. Firstly, in relation to openness or cognitive presence during online group work, it was found that online group work allows members to exchange information with one another. Past study has shown that this will allow learners to learn from their peers' strengths and different viewpoints (Chang and Kang, 2016) and at the same time, help learners improve and learn from one another. Moreover, Gasmi (2022) stated that online discussion forums or group work not only enhance students' skills in reading and critical thinking but also in critical reflection on varied topics of discussion and learning experience in general, especially during the information exchange. Next, with regard to connectedness and diversity (social presence), it was found that online group work allows learners the opportunity to collaborate on a project with their team members as well as allowing them to communicate clearly with members of the team. Fakir et al. (2024) stated that this connectedness shows the level of comfort in online communication, thus emphasizing psychological safety and trust among group members. However, few of the learners did argue that they can feel how unhappy the team is when it comes to having to conduct the group work online. According to Kamaludin et al. (2022), the distance in terms of time and space between group members can result in them feeling alienated or distanced from one another, thus leading to a loss of support and a sense of belonging.

These two factors could be some of the causes why the team members become unhappy when they are required to work in groups on online platforms. For the findings on autonomy or teaching presence during online group work, the learners stated that when they see the examples used by their teacher, they can actually visualize how they should come up with their own example. Besides that, the templates for homework assignments prepared by the teacher helped them to complete their task, while some also stated that they imitated or followed what the teacher did in completing their tasks, and the examples and explanations used by the teacher helped them a lot in understanding their lesson. All of these prove the effectiveness of the teaching materials and demonstrations by educators for online tasks. Aderibigbe (2021) supported this by stating that online discussions or group work can foster deep learning if students receive clear guidelines from instructors, and a reasonable time is given to engage effectively online. Thus, this demonstrates how important the role of educators and instructors is in ensuring that learners are able to perceive autonomy when it comes to group work online. Moreover, the presence of the educator via online helps to keep the "classroom environment" even if physical presence is missing.

In regard to the relationship between all factors in online group work, it was found that there is a strong positive relationship between connectedness and diversity and autonomy. There is also a strong positive association between autonomy and openness. For openness and connectedness and diversity there is only a moderate positive relationship between them however, it is still considered a positive outcome. Hence, these findings show that there is a clear and strong intercorrelation between all factors in the online group work approach. According to Fakir et al. (2024), knowledge is dispersed throughout networks and that learning occurs when individuals form connections with information sources, other people, as well as technological tools. Fakir et al. (2024) also added that the interconnected nature of all the variables thus emphasizes the importance of building an inclusive, connected, and autonomous learning environment for learners. This thus supports the strong relationship between the variables/factors in group work online as all factors are interrelated with one another.

Conclusion

Theoretical and Conceptual Implications

The empirical findings of this study demonstrate the relevance of connectivism theory in exploring learners' perceptions of online group work. It is evident that online group work allows exchange of information among group members including new information, also to connect ideas and use the new ideas discussed in learning activities. Therefore, cognitive presence is observed among the learners during online group work especially through discussions as they can process information and apply it when needed. This is aligned with the study by Gasmi (2022) that found online discussion forums contributed to learners' cognitive engagement while learning. Moreover, the relevance of the theory for its connectedness and diversity is undeniable when the findings of the current study revealed that online group work assisted learners with effective collaboration and communication with their team members. Despite participants' feelings which were less observable by the online learners and their team members when they participated in online group work, communication was not affected as they were not afraid or shy to share their ideas. Finally, the theory is constructive in

observing autonomy or teaching presence in online group work. Learners autonomy is significant in the learning process. The theory suggests teaching presence allows learners to feel the sense of autonomy and the findings of this study are consistent with the premise. Guidance from the teacher in completing online activities appears inevitable. Learners appreciate explanations and examples from teachers as well as the opportunity to ask them questions when needed. Overall, the findings of this study correspond to principles proposed by Siemens (2005). It is apparent that online group work is an essential part of digital learning that enhances knowledge networking, diversity and sense of autonomy.

Pedagogical Implications

Although group work, especially integrated online, can be challenging, findings of this study have strengthened participants' positive perceptions of online group work through connectivism. Connectivism demonstrates its significance in promoting open communication, sharing of ideas, and maintaining networks within digital environments. Therefore, there is a need to adopt these principles in education to support learners in their learning process. Online group work is an established practice. However, those concerned should look into integrating connectivism strategies in promoting knowledge sharing and digital collaboration skills among learners that can help them excel academically. Teachers play a vital role in applying these principles as they have the authority to plan or design courses. According to Garrison (2011), the instructor has the control and responsibility in the planning and implementation of interactive and collaborative blended learning courses. Furthermore, engaging learners in purposeful and collaborative activities is demanded to be the primary goal of instructional design. Similarly, Lu and Smiles (2022) asserted instructors have a crucial role in creating and maintaining positive collaborative learning experiences among learners. In essence, instructors are encouraged to design courses taking into account the principles proposed not only to foster collaboration but also enhance learners' capacity for deep learning.

Suggestions for Future Research

The current study has provided an invaluable insight into understanding the incorporation of online group work based on the theory of connectivism. However, it is acknowledged that due to certain operational limitations, the study presents a number of suggestions for future research. Firstly, future researchers should explore the role of AI in online group work through connectivism theory. A comparative study would be interesting to observe the correlation among the principles of connectivism in online group work among students with and without AI support. Secondly, researchers could also examine learner readiness for online engagement. This can enhance instructor preparedness in planning and designing courses. Moreover, studies could also explore the effectiveness of learning approaches incorporated other than group work to observe online collaboration among students. This can lead to promoting different effective approaches that can be adopted in teaching and learning practices.

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Conflict of interest

All authors declare no conflict of interest.

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