

# The sustainability of hybrid learning: An investigation of how international virtual learning groups develop into effective learning teams

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**Abstract:** Trends indicate that blended learning is and will maintain a key role in higher education. A virtual learning group is only truly effective once it becomes a virtual learning team. This study aims to explore the stages of development of virtual learning groups' as they progress towards teams by analyzing the perceptions of multinational teams of students (N=95). The data were gathered using a quantitative instrument based upon Tuckman's group development model and adapted to an educational setting. The study extends previous research into how teams skip stages by also finding that progression through the stages of development is not linear, with some teams stagnating at a given stage and others regressing to an earlier stage. There is also weak agreement between team members on their perceived effectiveness as a team. It is recommended that practitioners increase the use of monitoring during on-line team tasks and allow time after task completion for team reflection on their effectiveness with constructive discussion between members and feedback from the instructor. Findings also indicate the need for initial lessons in task-based e-learning to foster openness and constructive criticism between students.

**Keywords:** hybrid; virtual learning; group; team; development model; blended learning

## 1. Introduction

Although there have been many returns to the status quo after the Covid pandemic, blended learning maintains a key role in higher education (e.g., Anderson, 2021; Singh et al., 2021; Guppy et al. (2022); Sukiman et al., 2022) and even prior to the pandemic, studies such as Castro's (2019) review of studies involving blended learning capabilities and trends indicated virtual learning, in some form, was here to stay, though the costs and benefits are still de-bated (Müller & Mildenberger, 2021). At the beginning of 2023, some universities in the host country of this study have only just restarted in-person lectures and academics are given the choice of whether to hold seminars and lectures in-person or online in some cases. Recent articles also see the emergence of hyper-hybrid learning spaces with cross-national student collaborations in a higher education setting (Nørgård & Hilli, 2022).

Team-based learning (TBL) is indicated in the literature to be highly beneficial for students (Jaiswal et al., 2021; Livingstone & Lynch, 2002), such as higher-level learning and improving a range of skills (Kurfiss, 1988), with teamwork often seen as an essential area for development of students (Guaman-Quintanilla et al., 2022). However, in order to be truly effective, the group needs to evolve into a team in active and collaborative learning environments (Richter et al., 2021). With the advent of blended learning, virtual teams are a part of any course with a team-based learning approach. According to Makani et al. (2016), virtual learning teams are claimed to facilitate "deeper" learning, but the authors maintain that there is a lack of empirically research in an academic context.

There has been a surge in research focus on on-line learning following the pandemic with some investigating virtual learning teams. For example, studies such as Swartz and Shrivastava's (2022) study of 200 students across four countries examined the effect of virtual teamwork on cultural understanding. Other studies examined the satisfaction of students in virtual learning teams with their effectiveness to complete tasks (Kuznetsova et al., 2023).

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Concerns with the effectiveness of learning in a virtual team should consider that the virtual learning group is only truly effective once it becomes a virtual learning team, in terms of sharing responsibility, decision-making, teamwork and shared team goals (Tuckman, 1965).

The group development model (GDM) (Tuckman, 1965) has been used in studies to discover the evolution of teams from work groups into effective teams through the 4 stages of forming, storming, norming and performing though this evolution is not necessarily linear (Zoltan & Vancea, 2016). On-line platforms for working in teams remotely, such as WhatsApp, have supported the building of remote teams and communities (Ibem et al., 2017). and recent studies have embarked upon examining Tuckman's group development model in the public sector (Lacoursiere, 1980; Spitz & Sadock, 1973; Braaten, 1974) and in higher education (e.g., Richter et al., 2021; Chimruang & Yampinij, 2021; Samad et al., 2023). Other higher education studies have taken qualitative approaches or literature reviews and alluded to the same developmental stages occurring as found in Tuckman's (1965) model (e.g., Donelan & Kear, 2023). Moreover, Ukhova et al. (2021) found that Tuckman's model can be used in virtual settings in higher education.

Despite these studies, researchers have expressed the need to explore this further (Ito & Brotheridge, 2008), especially to confirm the findings of qualitative studies through quantitative methods. Moreover, scant research exists that examine the validity of existing group development models such as that of Tuckman (1965). To address this research gap, this study poses the research question: how do virtual learning groups evolve into teams in the on-line remote setting? The aim of this study is to explore the nature of groups' evolution in higher education.

This paper will first consider the theoretical background of the study and then the empirical studies into GDMs in an educational context. We then examine the literature concerning the impact a virtual (e-learning) setting has upon the development of groups into teams. This section is concluded with hypotheses based upon findings in the literature. We then present the quantitative approach of this study, including the educational context and choice of analytical approach, following by the results of the research. The discussion section considers the empirical literature and hypotheses in light of the findings, with implications focused on those for practitioners of e-learning in particular. The conclusions section reflects on the effectiveness of the study as a whole, its limitations and directions for future research.

## 2. Theoretical background

Group development involves the process by which a collection of individuals grows and matures into an effective group or team (Wheelan, 2005). The GDM (Tuckman, 1965) describes the sequence of development of a group into an effective team through 4 distinct and identifiable stages. In the first stage, forming, the group are initially put together and, as such, there is a degree of confusion and uncertainty. The leader of the group (if assigned) needs to steer the group and offer advice. The second stage is storming. This stage sees the beginning of group conflict as members experience different perspectives, ways of working and tensions arise, in the form of internal struggles. Thus, conflict and hostility are therefore not problems to be avoided but are necessary as a means of progressing to the next phase in the evolution of a group towards a team. In the third phase, the group starts to accept certain norms or rules of behaving, involving some compromise and understanding between team members. Members may develop friendly relationships and become more supportive of one another at this stage. In the fourth stage, the group becomes an effective team, as Zoltan and Vancea (2016) point out "voluntarily or not" (p. 242). At this stage, the group can depend on one another, trust each other and work well together. Researchers added a fifth stage in their revised model (Tuckman & Jensen, 1977), referred to as 'adjourning'. In this stage the task is completed, and the team breaks up, constituting the end of the cycle. Although this model is associated with business, a number of studies have employed the model in the public sector (Lacoursiere, 1980; Spitz & Sadock, 1973; Braaten, 1974). The following section will examine studies in higher education that have used this model.

## **2.1. GDM in higher education**

In this section, we will consider the empirical studies relevant to the context of this study that add to the discussion of how groups develop over time.

Raes et al. (2015) aimed to empirically test how team learning is affected at each stage of existing group developmental models and. As with Tuckman's model, the later phases were more effective, in relation to team learning behaviors, referred to as the 'trust and structure' phase and the 'work and termination' phase. In the earlier phases, referred to as the 'dependency and inclusion' phase and 'counter-dependency and fight' phase the teams were not actually functioning as a team but rather as a fragmented group of individuals. Cooperation was seen as a key to encouraging team learning and evolving into an effective team, alongside the need for psychological safety and group potency.

In a study comparing group development of autistic with non-autistic students, it was found that group development was impeded by groups with difficulty expressing individual differences and addressing team conflict (Zolyomi et al., 2018). This is further highlighted in a study which found that the teams' ability to grow was influenced by how well they addressed previous challenges (Ito & Brotheridge, 2018).

In some studies, the GDM is used as a teaching tool for enhancing student awareness of themselves and others, as well as instilling a sense of achievement (Weber & Karman, 1991; Casper, 2017). Chimruang and Yampinij (2021) use the model as a benchmark for assessing satisfaction with group development and knowledge transfer by IT students in tertiary education. In this way, the model was adapted to consider all stages simultaneously rather than development from one stage to another over time. In relation to this study, the authors find such models from the 21st century as important for research into on-line learning. Richter et al. (2021) examined the development of teams as a means of developing effective teamwork strategies and assessing their usage by practitioners in higher education.

Whilst not one of the original stages, there is a fifth stage referred to as 'mourning' or 'ad-journing' (Raes et al., 2015). This stage has importance in terms of the stress relating to the group dissolving, tasks ending and roles terminating, with time dedicated to reflection and consideration of improvements for greater team effectiveness in future. In the above educational studies, the focus was very much on group development into an effective team. Moreover, the courses or projects in these studies were 'stand-alone' and without a notion of continued teamwork. Thus, as the focus was purely on how groups on a particular course develop into an effective team, the mourning or adjourning received little attention. As shown later in the methodology section of this paper, the questionnaire that is administered at the middle and end of course serves as a form of reflection on the effectiveness of the group, though only on a superficial level, without in-depth discussions, and deep critical reflections that are associated with the adjourning stage.

## **2.2. Virtual teams and GMDs**

This study also distinguishes from other studies in that it is focused on group development for virtual teams. Other studies highlight some key characteristics of on-line virtual teams that may affect group development (Haines, 2014), but they also offer important considerations for this study. Virtual teams have less tools to hand in forming relationships and are likely to take more time building relationships and/or use different techniques to do so (Haines, 2014). These two aspects will be considered further.

Findings disagree on whether a lack of tools for relationship building may slow down progress to other stages of group development. The use of alternative techniques for building relationships in virtual teams may lead team members to 'overshare' or reveal more about themselves to compensate for the lack of face-to-face meetings (Haines, 2014, p. 213). Other studies find that virtual teams are suggested as having the same developmental process as face-to-face teams (Walther, 1995), and this finding emerged before the advent of platforms such as Zoom and Microsoft Teams. Recent studies considering the usage of these platforms in group development in a higher education context also indicate that development occurs in a similar way as with face-to-face teams (e.g., Velinov et al., 2021). Some studies of students using cloud computing in this context even report a higher level of involvement between team members and improved learning outcomes (Conde et al., 2020).

With regard to the issue of needing more time to form relationships and being slow to progress through the stages of group development, Glowacki-Dudka and Barnett (2007) examined how a group developed through critical reflection during a 16-week on-line course. Whilst they didn't use a GDM to do this, they claim that the development stages indicate evidence of progress through Tuckman's (1965) and Tuckman and Jensen's stages of development (Raes et al., 2015). An earlier study by Johnson et al. (2002), examined the development of virtual learning teams of Masters' students and, although not using the quantitative tool itself, used the GDM as a theoretical basis. The authors found that the storming stage was absent in their study and attributed this to the short amount of time that each team had to accomplish assignments, which was 2 weeks per assignment. In contrast, a study by Jurado-Navas and Munoz-Luna (2017) found that, when introducing an innovative scrum methodology to higher education teaching, the students appeared to have passed through the first three stages of the GDM within 2 weeks, though this was through observations and feedback from the group, i.e., it was clear to the authors and students that they had reached the performing stage within 2 weeks.

Some studies dispute these similarities with the GDM. With a qualitative approach, Yoon and Johnson (2008) found that virtual learning teams went through seven stages: orientation, scheduling, exploration, work and decision, progress check and evaluation, refinement and formatting, and termination. They also found that virtual learning teams progressed differently with some progressing in a linear fashion through stages and others moving backward to a previous phase for adaptation before proceeding, referred to as Adaptive progression. This was found to be due to obstacles to group development, referred to as negative shaping forces, namely: member absences; ineffective work procedures; limited access to information; lack of sharing; few agenda; non-participation; digression; and technical problems.

In summary, the literature provides a model for group development, according to Tuckman that has been used in many studies. However, there are other models and studies which question this view of team development and its underlying assumptions. Due to a lack of studies that test these stages of development in general, and in a virtual context, as well as the debate regarding the nature and process of team development, this study seeks to fill research gaps from these aspects.

Based on the literature, the following hypotheses are put forward to be tested in a study of virtual teams which will consider the change of perceptions of team members regarding the development of their team between two different points in time. The first two hypotheses are based upon the assumptions of the GDM that at the beginning of groupwork, students would start in the first two stages of team development, and later progress to the second two stages. Though some findings indicate that this may be slower or the same as face-to-face group development, researchers' findings do not agree, indicating a need for further study in this area. Thus, the first two hypotheses are based on the original concept of the model that figures for forming and storming would start high and then decrease as the group progresses through the stages from a group to a team, and vice versa for the Norming and Performing stages:

- **H1: Values relating to forming and storming decrease over time.**
- **H2: Values relating to norming and performing will increase over time.**

It was found in the literature that in the early stages of group development, the group behaves as a fragmented group of individuals (Zolyomi et al., 2018) and there are degrees of con-fusion and conflict (Tuckman, 1965). It is also found that in higher education. virtual teams may not get beyond these early stages due to time restrictions and the potential to go back to a previous stage (Johnson et al., 2002; Yoon & Johnson, 2008). Therefore, the third hypothesis will test the homogeneity with-in teams according to their views of team development:

- **H3: Teams do not display homogeneous perspectives of the stage of development of their team.**

In relation to the findings in the literature that virtual teams in higher education may skip a stage (Johnson, 2002), or not follow a linear approach (Yoon & Johnson, 2008), the following hypothesis is put forward:

- **H4: Group development is not linear for all teams.**

### 3. Materials and methods

The study employs a two-phase approach to explore the group development of virtual teams in a higher education context. This section will first consider the study context, followed by the choice and method of sample followed by details of the two phases of the study.

#### 3.1. Study context

The study took place during a 12-week course that was conducted online, due to the Covid pandemic. The course studied is offered annually and is compulsory for all students at the University of the courses held in English in a format using Microsoft Teams and groups working separately on case study tasks in Breakout Rooms. Preparation was encouraged and access to forums of the course and inquiries regarding the cases were encouraged from the lecturer. Each week, feedback was given on the previous task, prior to each team completing the next task. In each group a team representative was elected by the team as a point of contact for the lecturer in returning feedback.

The course was conducted in the Spring semester. Teams were set up in the first two weeks of study and attempts were made to mix nationalities during the formation of teams. Group size ranged from 3 to 6 persons, although the majority comprised 4 members. To study the development of teams, participants were asked to take part twice, as two phases were needed to assess the progression across stages. As per the following timeline of the study shown figure 1, there was a 5-week gap between the first and second phase and the initial few weeks involved introducing students to the format of the course, putting into teams:

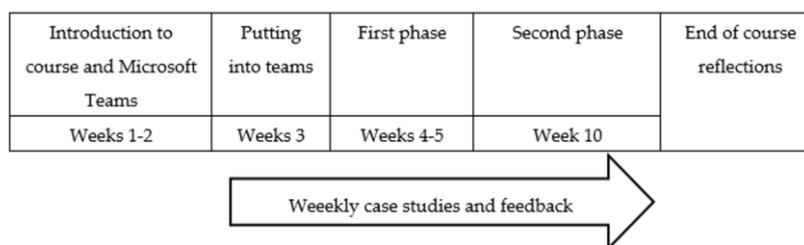


Figure 1. Timeline of research study. *Source: Author's own*

As can be seen in figure 1, the first two weeks were spent in preparing students for the group-work, with an introduction to the course, planned research, and familiarization with Microsoft Teams. These presentations also took place on-line. In the third week the students were put into teams and into 'Breakout rooms' where time was spent ensuring the removal of potential technical issues and ensuring the smooth-running of teamwork in the virtual setting.

The following sections introduce the sample and the tools used in the phases of the research.

#### 3.2. Sample

The online course was held in 2021 and involved a total of 104 students placed in a total of 27 groups. Three groups declined to take part in the study, as this was purely voluntary for students, resulting in a net sample of 24 groups, and a total of 95 students. Each group comprised a mixture of nationalities. The course was for BA students only and mandatory for all students of the BA courses held in English.

#### 3.3. Quantitative tool

For both the first and second phases of the study, a quantitative approach was used. The questionnaire is based upon an adaptation of the questionnaire relating to the original model (Tuckman, 1965) adapted for use in an educational context, as used in a number of studies such as (Arshad & Ismail, 2018; Samuel, 2020). Reliability and content validity of the questionnaire based upon the stage development model (Tuckman, 1965) was tested and

evidence was found for this as a suitable method for analysis of group development (Miller, 2003).

One question was deleted, "We get a lot of work done" as it was found in the pilot study that this could be misconstrued, and the amount of work is dictated in the task by word limits or space provided on worksheets. Participation in case studies in teams required completed tasks each week by the end of each 90-minute session and therefore, this question had less meaning. Although there was no established 'Team Leader' in the setting up of the tasks, in many teams a leader emerged, often the Group Representative was found to take on the role of organizing pre-task meetings, circulating feedback and since they were described and described themselves as leaders in some cases and in others a leader seemed to evolve from the group, the questions relating to Team Leaders were left in, but were checked for internal consistency using Cronbach's Alpha.

Paired sample t-tests were run to examine whether students' ratings of the groups' development changed over time. With a sample of 24 teams, paired sample t-tests were run instead of ANOVA, due to the sample being less than 30, for comparison of differences between phase 1 and phase 2 of the study. These tests serve to address the first two hypotheses.

For the third hypothesis, initial analysis involved looking at the standard deviations within teams for both phases. Following this, Fleiss' Kappa was run to determine if there was agreement between team members' judgement of the stage of development of each team in phases one and two. In order to reduce potential bias for this part of the study, all participants were instructed to complete their questionnaires independent of other team members, separately and not to discuss their responses with other team members, thereby ensuring the independence of responses.

To test the fourth hypothesis of the linearity of the teams in progressing from one stage to the next, the perceived stage of development for each individual in a team was recorded. This is based on a need for showing the spread of responses rather averages alone. For example, if two team members were to perceive the team as at the forming stage (stage 1) and two members of the same perceived the team as at the norming phase (stage 3) in phase one, then all four members perceive the stage as Storming (stage 2) in the second phase (for some reason) then two members have perceived a progression of stages from Forming to Storming and two members have perceived a regression back from Norming to Storming. If the results were simply presented as averages per team, then the team would appear stagnant with the team remaining in the storming stage (stage 2) for both phases. Thus, for the fourth hypothesis the focus is on the spread of results per team rather than averages per team. With this approach, the results can also be considered in light of the third hypothesis.

## 4. Results

Cronbach's alpha was used to test internal consistency of the questionnaire as tested in other instruments using a Likert scale (see e.g., Croasmun & Ostrom (2011) for this usage in a higher education context). The following table displays Cronbach's alpha for the constructs for both phases of the study:

**Table 1. Reliability analyses of Tuckman's stages of group development instrument. Source: Author's own**

	Forming	Storming	Norming	Performing
Phase one	0.822	0.781	0.808	0.788
Phase two	0.881	0.866	0.913	0.820

This instrument can be said to be reliable as it has fulfilled the requirements of Cronbach's alpha reliability  $>0.7$ .

For the paired sample t-tests significant differences were found for Storming and Norming, but not for Forming and Performing. However, all four stages indicated a negative t-value, despite the values being placed with phase one first and phase two second. Moreover, for the significant storming and norming, the t-value is high, indicating a large difference between the two sample sets.

Table 2. Paired sample t-tests for the four stages of group development comparing phases one and two. Source: Author's own

Dimension	Phase 1 vs. Phase 2 df 24	
	t	Sig. (2-tailed)
Forming	-0.59	0.561
Storming	-3.149	0.004
Norming	-2.298	0.031
Performing	-0.323	0.75

Fleiss' Kappa was run to investigate the homogeneity of responses and the results can be seen in the following table:

Table 3. Fleiss' Kappa of overall agreement within teams. Source: Author's own

Team	Kappa	Asymptotic Standard Error	z	Sig.	Asymptotic 95% Confidence Interval	
					Lower Bound	Upper Bound
T1	0.249	0.028	9.020	0.000	0.247	0.251
T2	0.346	0.027	12.631	0.000	0.344	0.348
T3	0.223	0.027	8.385	0.000	0.221	0.224
T4	0.096	0.038	2.526	0.012	0.093	0.098
T5	0.307	0.021	14.462	0.000	0.306	0.308
T6	0.072	0.028	2.579	0.010	0.071	0.074
T7	0.110	0.027	4.058	0.000	0.108	0.112
T8	0.180	0.017	10.790	0.000	0.179	0.181
T9	0.231	0.027	8.427	0.000	0.229	0.233
T10	0.251	0.039	6.444	0.000	0.249	0.253
T12	0.274	0.028	9.895	0.000	0.272	0.276
T13	0.127	0.037	3.384	0.001	0.124	0.129
T14	0.172	0.027	6.347	0.000	0.170	0.174
T15	0.167	0.026	6.306	0.000	0.165	0.168
T16	0.075	0.027	2.812	0.005	0.073	0.076
T17	0.529	0.027	19.686	0.000	0.528	0.531
T18	0.189	0.027	7.007	0.000	0.187	0.190
T19	0.142	0.028	5.065	0.000	0.140	0.144
T20	0.041	0.038	1.088	0.277	0.039	0.044
T22	0.035	0.028	1.276	0.202	0.034	0.037
T24	0.320	0.027	12.027	0.000	0.319	0.322
T25	0.182	0.037	4.928	0.000	0.180	0.185
T26	0.169	0.026	6.488	0.000	0.168	0.171
T27	0.079	0.028	2.885	0.004	0.078	0.081

It has been suggested that the assessment of how good the strength of agreement is can be based upon the values of Cohen's kappa coefficient – see Bland and Altman (1999) and Landis and Koch (1977). In this case, figures <0.20 indicate a poor strength of agreement, 0.21-0.40 fair, 0.41-0.60 moderate, 0.61-0.80 good, 0.81-1.00 very good. Thus, only T17 has a moderate strength of agreement, a number of teams have a fair strength of agreement (T1, T2, T3, T5, T9, T10, T12, T24). The remaining 13 teams have a poor strength of agreement. The significance level is significant for all teams ( $p < 0.05$ ), with the exception of two teams, T20 and T22.

Table 4 displays the perceived dominant stage of group development, comparing the first and second phases. The changes have been grouped into four categories: maxed early (groups that reached the performing stage already in the first round); unchanged; evolved

(signs of members progressing to next stage); and devolved (signs of members regressing to a previous stage).

The results indicate that the teams did not all sequentially progress from one stage to the following one. Some teams reached the later stages quite early on with 5 teams (T10, T17, T2, T3, T5) reaching the performance stage already in the first round of questionnaires, shown in the table as 'maxed early'. Eight teams experienced no change at all in the 5-week period (T1, T14, T18, T20, T24, T26, T27, T4). Whilst it may be argued that the period did not allow enough time for the teams to evolve, or due to the limited time each week for interactions, these arguments only stand if not other teams were able to evolve. However, 4 teams evolved (T12, T15, T16, T6) to the next phase, indicating that time may not be the issues but possibly something else. One surprising result was that 8 of the groups experienced a form of regression (T13, T19, T22, T23, T25, T7, T8, T9). This does not necessarily indicate a failure of the entire team, as the results indicated rather that one or two members, in most cases, regressed to an earlier stage whilst others remained the same.

**Table 4. The dominant phase of group development indicated by team members concerning their group at phase one and phase two. Source: Author's own**

Team code	No.	First Phase				Second Phase				Change
		F	S	N	P	F	S	N	P	
T1	4			1	3			1	3	unchanged
T2	4				4				4	maxed early
T3	4				4				4	maxed early
T4	3		1		2		1		2	unchanged
T5	5				5				5	maxed early
T6	4		4						4	evolved
T7	4		2		2		1	2	1	regressed
T8	6				6			2	4	regressed
T9	4				4		2		2	regressed
T10	3				3				3	maxed early
T12	4			1	3				4	evolved
T13	3		1		2			2	1	regressed
T14	4			2	2			2	2	unchanged
T15	4			2	2			1	3	evolved
T16	4			2	2				4	evolved
T17	4				4				4	maxed early
T18	4			1	3			1	3	unchanged
T19	4				4			2	2	regressed
T20	4		2		2		2		2	unchanged
T22	3				3		1		2	regressed
T24	4			1	3			1	3	unchanged
T25	3				3		2		1	regressed
T26	4			2	2			2	2	unchanged
T27	4			3	1			3	1	unchanged
<b>Total</b>	<b>98</b>									

## 5. Discussion

This section will consider the results in light of the findings in the literature and present some practical implications of the study.

Tucker's original theoretical model assumed that teams evolve sequentially across stages. The findings indicate that not all teams sequentially progressed from one stage to the following one. The findings indicated a lack of progression away from Forming and toward Performing stages and all four stages indicated a negative t-value. This is especially notable for the storming and norming stages where the t-value is negative and high, indicating a large difference between the two sample sets. Thus, this study confirms, empirically, the findings of the qualitative study of Yoon and Johnson (2008) that progression to the next stage cannot be assumed for virtual learning teams. The confirmation of these findings indicates the need for further research into the driving and restraining forces for or against the development of teams in this context. However, it also means that the first hypothesis (Values relating to forming and storming decrease over time) and the second hypothesis (Values relating to norming and performing will increase over time), are rejected.

Tucker's model also assumed homogeneity within teams according to their views of team development, which is the basis for the third hypothesis: Teams do not display homogeneous perspectives of the stage of development of their team. The findings of this study are mixed with 9 teams agreeing to a good or moderate degree, but 13 teams having poor strength of agreement. Thus, the third hypothesis is accepted and extends the existing findings of the GDM and existing studies (Tuckman, 1965; Raes et al., 2015) through indicating that fragmentation of perspectives exists within teams across all stages, not only the earlier ones.

The fourth and final hypothesis was: Group development is not linear for all teams. In this study, teams did not progress from stage to stage over time, some skipped stages confirming existing studies (Johnson et al., 2002). Some either stagnated or regressed, empirically confirming existing qualitative findings (Yoon & Johnson, 2008) for virtual learning teams. Thus, the fourth hypothesis is accepted. Additionally, the skipping of the storming stage found in a qualitative study is now confirmed (Johnson et al., 2002) but extended through the findings that initial forming and storming stages also appear to be skipped. and for 5 teams the norming stage was also skipped as they 'maxed early'.

In the literature, the issue of time being a limiting or driving force for the progress of teams was somewhat contested (Glowacki-Dudka & Barnett, 2007; Johnson et al., 2002; Jurado-Navas & Munoz-Luna, 2017). The findings of this study confirm that virtual learning teams do progress quickly to the performing stage (Johnson et al., 2002; Jurado-Navas & Munoz-Luna, 2017). However, this was not evident across all teams and further research would be needed to confirm if this is related to the factors driving this rapid progression across stages, e.g., based upon reactions to time pressures (Jurado-Navas & Munoz-Luna, 2017), perceived need to over-come conflict and social awkwardness quickly, or some other cause that may be specific to a higher education setting.

Students were isolated during the lockdowns and the need for social interaction and be amongst others during such a challenging time may well have pushed students to be more communicative and interactive. However, not all teams behaved in this way with some teams experience no linear progress and 'stagnating'. This confirms the findings in the literature that teams with the same task, same situation progress to stages at varying rates (Yoon & Johnson, 2008), and that some teams regressing or appear 'stuck' at the one particular stage (Zolyomi et al., 2018; Ito & Brotheridge, 2008; Yoon & Johnson, 2018).

The finding of fragmentation of perspectives of the effectiveness and development of the virtual team highlights the importance of monitoring in an on-line setting, as well as time being allocated for reflection within teams after team tasks. This puts the teacher in the role of mediator and problem-solver, with, for example, the tutor moving across Breakout rooms in Microsoft Teams, and setting aside time near the end of the class for feedback and constructive discussion, not only of the task they completed but how they worked as a team, areas that went well and areas needing development.

Teachers want students in virtual teams to complete the tasks to the best of their ability. However, a virtual learning group is only truly effective once it becomes a virtual learning team, sharing responsibility, decision-making, teamwork and sharing team goals. The finding that teams may regress or stagnate, indicates the need for practitioners to monitor and support progress in the on-line setting. In other words, the teacher needs to encourage open and frank discussion about obstacles to development after each team task. To support this, it is recommended that the first few weeks of courses are spent fostering a culture of openness, expressing oneself tactfully and how to offer constructive criticism for others.

## 6. Conclusions

This study sought to investigate the nature of team evolution in an education setting with the research question: how do groups evolve in the on-line remote setting? The aim being to explore the nature of groups' evolution in higher education.

The research method served well in testing the hypotheses and answering the research question, with two hypotheses rejected and two accepted. However, there is a clear need to dig deeper into this topic with the aid of qualitative research, with regards to the perceptions of students of their team's progression, or whether other factors may be at play, impacting students' perceptions of the team dynamics and development as a team.

The findings of this study raise questions of what teachers of seminar groups should expect from their students regarding how they work as a team. Progression is not automatically occurring from one stage to the next. Although this study did not aim to uncover factors affecting this progression, it is recommended that researchers consider further not only obstacles to progression but the reasons for some teams skipping stages and becoming an effective virtual team, whilst others are stagnating or even regressing to an earlier stage.

In the cases where entire teams had high variance within each team, we are unable to say if one member or all members are the cause of this variance between members. This could be an interesting direction for future research, in how perceptions of the team itself may shape the teams progress, alongside other factors.

It was found in the literature that studies in an educational setting focus purely on the four development stages of the team, as a means of focusing on how teams reach full effectiveness (performing stage). This study also is, to some extent, limited in not including the fifth stage, although this is due to the focus on research the fourth stage as a means of achieving the best results of virtual team tasks. There is scope for further research into the role of the fifth stage (mourning / adjourning) in e-learning and virtual teams, especially as this may have a positive impact upon the progress through the stages of development of teams in later courses. Such studies will need to change the focus from individual courses or projects, to taking a wider view of how the team adjourning on one course, may improve the chances of effectiveness on another course later on or enable the team members to progress at a faster pace through stages, though further research would be needed to confirm whether this is the case, or not.

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