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Enhancing Team Performance in Hybrid-Flexible Courses: The Role of Team Communication and Atmosphere

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Abstract

Hybrid-flexible (hyflex) courses have become a prominent open and distributed learning (ODL) approach post-COVID-19, offering students the flexibility to attend classes online, in-person, or both. While this model promotes instructional continuity and student-centered learning, it presents unique ODL challenges in managing effective team collaboration. This quantitative study investigated the underexplored relationships among effective communication, team atmosphere, and team performance in hyflex learning environments; the study sought to provide novel insights into optimizing team dynamics and enhancing learning outcomes in ODL-integrated educational settings. The study comprised data from 310 college students enrolled in the authors' hyflex course offered on China's Super Star learning platform at an ODL institution with over 700 million registered users. An online survey was conducted using validated scales; confirmatory factor analysis (CFA) and multiple linear regression analyses were used to test the hypotheses. The study found effective communication significantly enhanced team performance ($\beta = 0.389$, $p < .001$). Team atmosphere moderated this relationship ($\beta = -0.118$, $p < .05$); while a positive atmosphere generally supported performance, an overly positive one may have reduced the critical engagement necessary for optimal outcomes. The study concluded that both effective communication and a balanced team atmosphere were critical for maximizing team performance in hyflex courses. We suggest ODL educators foster communication strategies that encourage open dialogue and critical thinking while maintaining a supportive team environment. Overemphasis on maintaining positivity may hinder constructive critique and diminish performance in distance and hybrid settings.

Keywords: input-process-output theory, team atmosphere, team communication, team performance, hybrid-flexible course

Introduction

According to Thurnau and Byun (2022), hybrid-flexible (hyflex) courses have become one of the 10 most prominent pedagogical innovations since the COVID-19 pandemic, yet their implications for collaborative learning dynamics remain underexplored. While hyflex was first conceptualized and implemented by Beatty (2005) as an extension of established ODL principles, it gained unprecedented visibility in post-pandemic education. As an established but increasingly adopted approach in education, hyflex courses have provided unique flexibility, allowing students to attend classes online, in person, or through a combination of both. This model has played a critical role in maintaining instructional continuity while promoting student-centered learning, particularly during the global transition to remote education (Cumming et al., 2024; Detyna et al., 2023). Such flexibility, a crucial and fundamental characteristic of ODL, has been researched broadly across its various approaches for decades (Bozkurt, 2019). It has led to significant shifts in team-based learning dynamics and pedagogical approaches, requiring educators to adapt to new ways of facilitating collaboration and interaction in mixed-modality environments (Kohnke & Moorhouse, 2021; Wong et al., 2023).

However, this flexibility has also introduced new challenges in managing effective team collaboration and ensuring equitable participation among students, particularly when team members engage in different modes of learning simultaneously. Prior research has indicated that achieving equity in hybrid learning environments was often hindered by issues such as proximity bias, where in-person participants tended to dominate interactions with varying levels of engagement among online and in-person students as a result (Lohmann et al., 2021; Qureshi et al., 2023; Zhang & Li, 2024). Additionally, the use of diverse digital communication tools can further complicate team dynamics, potentially leading to misunderstandings and reduced cohesion if not managed effectively (Wilson & Alexander, 2021).

While numerous studies have investigated team communication (Johnson et al., 2014; Razali et al., 2015), and team atmosphere in traditional learning environments (Kanaris & Mujtaba, 2023; Lyons, 2024; Sargeant et al., 2008), there is a paucity of studies that integrated these dimensions within hyflex learning environments. Moreover, existing research on distributed learning frameworks has often focused on fully online or asynchronous settings, leaving a gap in understanding how hybrid modalities, such as hyflex courses, uniquely shape team dynamics (Brown, 2024). This study addressed this gap by examining the interplay between communication and team atmosphere in hyflex courses, as exemplified in Appreciation of Traditional Fujian Arts and Crafts, a course offered at Huaqiao University. Our intent was not only to advance our theoretical understanding of team dynamics in hyflex learning settings but also to provide a fresh perspective on team collaboration in ODL environments. Furthermore, this study was designed to provide practical guidelines for educators in the design and implementation of hyflex courses.

Team Communication in Hyflex Course Learning

Defining Hyflex Course Learning and Course Learning Team Communication

Hyflex courses represent a pedagogical model that offers students multiple participation options, accommodating diverse learning preferences and circumstances. Students can choose to attend classes in person, participate synchronously online, or engage asynchronously through recorded materials. While not new to the field of ODL, the hyflex model originated in 2005 when Brian J. Beatty developed

it to address the needs of working graduate students by providing multiple participation pathways (Beatty, 2019). Drawing from established ODL principles of flexibility, student choice, and equivalence of learning experiences, hyflex represented an evolution of hybrid learning approaches that have long been fundamental to distance education (Miller et al., 2013). This model, increasingly significant in higher education after the COVID-19 pandemic, enhanced accessibility and flexibility by allowing students to tailor their learning experience and switch between modes as needed (Beatty, 2019; Detyna et al., 2023; Kohnke & Moorhouse, 2021). Unlike other ODL formats, which have often focused on asynchronous delivery or fully online formats, hyflex combines multiple modalities to meet varied student needs (Vetrivel & Mohanasundaram, 2024). Research has shown that this flexibility improved student engagement by helping them balance academic and personal responsibilities while enabling institutions to address diverse learning requirements (Graham et al., 2013; Wong et al., 2023).

Course learning team communication refers to the structured exchange of knowledge, ideas, and feedback among students working on academic tasks (Johnson & Johnson, 1991). It supports collaborative learning by enabling students to discuss concepts, address misunderstandings, and solve problems together (Penrod, 2023). This communication has often involved formal mechanisms like group projects, peer reviews, and structured discussions aligned with course objectives (Johnson et al., 2014).

In hyflex courses, team communication must bridge the gaps among in-person, synchronous online, and asynchronous participants, ensuring effective collaboration despite differences in time, space, and technological access (Wong et al., 2023). Effective communication is essential for fostering engagement and connection across participation modes, supporting the diverse ways in which students learn, and creating an inclusive learning environment.

The Challenge of Team Communication in Hybrid-Flexible Course Learning

The effectiveness of hyflex courses has been widely studied, highlighting benefits such as increased student engagement and satisfaction (Bockorny et al., 2024). Research has indicated that hyflex courses improve learning outcomes by fostering a more inclusive environment that accommodates diverse learning ways (Graham et al., 2013). Additionally, their flexibility reduces barriers for non-traditional students, such as those balancing work and study, thereby supporting a more diverse student population (Detyna et al., 2023; Kohnke & Moorhouse, 2021).

However, hyflex courses also present unique challenges due to their integration of multiple participation modes. This hybrid nature has created a complex communication landscape that is distinct from other ODL formats, which often focus on either synchronous or asynchronous online learning (Wilson & Alexander, 2021). Research has indicated that remote participants in hyflex courses have often experienced proximity bias (Raes et al., 2020), feeling marginalized compared to in-person peers. For example, online participants may struggle with reduced visibility in discussions, leading to less active participation and a sense of isolation (Qureshi et al., 2023; Wong et al., 2023). Additionally, reliance on digital tools like Zoom or Microsoft Teams can introduce technological barriers, exacerbate varying levels of digital literacy, and present communication challenges, further hindering team cohesion (Detyna et al., 2023; Zhang & Li, 2024).

Despite extensive research on team communication in traditional and fully online settings, there is limited exploration of the unique challenges posed by hyflex environments. Studies on ODL have

frequently focused on fully online or asynchronous learning, overlooking the hybrid nature of hyflex courses, where in-person and online participation coexist (Penrod, 2023). While effective communication strategies are critical for fostering collaboration and trust (Sargeant et al., 2008), little research has examined how these strategies can be adapted to hyflex contexts. This is particularly important as hyflex courses require communication approaches that ensure equitable participation and engagement across all modes (Wong et al., 2023).

Addressing this research gap is essential for understanding how communication dynamics influence student engagement and learning outcomes, specifically in team environments within hyflex courses. Developing tailored communication strategies that address the hybrid nature of hyflex learning can help educators support interactions across different modes, fostering a more cohesive and equitable team experience (Brown, 2024; Lohmann et al., 2021; Wong et al., 2023). By tackling these challenges, institutions can enhance educational experiences and ensure equitable participation for all students.

Team Atmosphere in Hyflex Course Learning

Team atmosphere in hyflex course learning refers to the collective emotional and social environment among students. It is characterized by the quality of interactions, mutual support, and the sense of belonging, which can significantly influence engagement and collaboration (Beatty, 2019). A positive team atmosphere fosters trust and open communication, essential for effective teamwork and successful learning outcomes (Bower et al., 2015). In contrast to traditional face-to-face or fully online learning environments, the hyflex model introduces unique complexities in cultivating a positive team atmosphere due to its simultaneous integration of multiple participation modes (Vetrivel & Mohanasundaram, 2024).

Research has shown that a supportive team atmosphere enhances engagement and collaboration across participation modes, helping students feel connected regardless of how they attend (Garrison et al., 1999; Graham et al., 2013). According to Detyna et al. (2023) and Lyons (2024) a strong sense of community encouraged active participation and bridged the gap between online and in-person learners. However, challenges such as feelings of isolation among remote participants, proximity bias favoring in-person learners, and varying levels of technological proficiency have been shown to hinder team cohesion and effective communication (Hadjipieris, 2024; Qureshi et al., 2023; Zhang & Li, 2024). The ability to use digital tools effectively has emerged as particularly critical in hyflex settings (Wilson & Alexander, 2021).

Despite these challenges, it is crucial to cultivate a positive team atmosphere in hyflex courses as it not only influences individual student performance but also affects overall group dynamics. It has been shown to mitigate feelings of isolation, enhance motivation, and promote peer support, leading to better learning outcomes (Kohnke & Moorhouse, 2021; Lohmann et al., 2021; Penrod, 2023). Research on hyflex environments, characterized by the coexistence of synchronous and asynchronous participation modes, has been limited compared to studies of fully online settings (Wong et al., 2023). Further studies are needed to explore how specific communication practices, technology use, and instructor interventions can influence student interactions and foster a sense of community among diverse participants in hyflex settings (Sargeant et al., 2008). Addressing these challenges will help educators to optimize hyflex course design and improve student experiences.

Team Performance in Hyflex Courses

Team performance in hyflex course learning refers to the effectiveness with which student teams collaborate to achieve educational objectives within a flexible learning framework (Beatty, 2019). This performance encompasses various dimensions, including communication, collaboration, and the ability to adapt to different modes of participation whether in-person, synchronous online, or asynchronous (Beatty, 2019). Effective team performance is essential for maximizing learning outcomes and ensuring that all members contribute meaningfully to group tasks. Recent studies have emphasized that in hyflex learning, adaptability and responsiveness to different participation modes are critical for maintaining team cohesion and achieving learning objectives (Detyna et al., 2023; Kohnke & Moorhouse, 2021).

Research has demonstrated that structured collaboration and effective use of technology are critical for success (Akcaoglu & Lee, 2016; Al-Rahmi et al., 2015; Jarwati, 2024) Using collaborative tools such as Google Docs and Zoom have facilitated communication and ensured equitable participation among team members (Graham et al., 2013; Kohnke & Moorhouse, 2021). However, compared to traditional ODL courses, where asynchronous communication often dominates, hyflex courses require teams to balance synchronous and asynchronous interactions, which can create disparities in engagement and participation (Heilporn & Lakhal, 2021). Challenges such as proximity bias (Raes et al., 2020), where in-person participants dominate discussions at the expense of remote members, have hindered effective collaboration (Zhang & Li, 2024). Moreover, disparities in technological proficiency may also exacerbate engagement issues, impacting the overall effectiveness of team interactions (Brown, 2024; Hadjipieris, 2024).

Despite these insights, there remains a notable gap in comprehensive studies examining how specific factors such as team communication and atmosphere influence performance outcomes in undergraduate hyflex educational context. Hyflex courses have introduced a hybrid dynamic that requires further investigation beyond traditional ODL research (Keshavarz, 2023). There is limited understanding of how these elements interact with team atmosphere to shape outcomes in hyflex courses (Penrod, 2023). This gap is particularly significant as hyflex courses demand integrative approaches that address the interplay among synchronous and asynchronous communication, team atmosphere, and performance outcomes (Heilporn & Lakhal, 2021). Understanding this interplay will provide insights for educators aiming to enhance collaborative learning experiences in ODL environments.

Theoretical Framework: Input-Process-Output Theory

The proposed framework for this study is grounded in the input-process-output (IPO) theory, a well-established model in organizational behavior research (Hackman & Morris, 1975). The IPO model delineates how various inputs—such as team composition, communication styles, and environmental context—impact team processes, including collaboration and conflict resolution, ultimately influencing outputs like performance outcomes (Forsyth, 2014; Hackman & Morris, 1975). In the context of higher education, the IPO model has increasingly been employed to understand team dynamics within flexible learning environments, such as hyflex courses.

Compared to traditional face-to-face educational settings, where inputs such as physical presence, synchronous communication, and standardized learning materials are the norm, the hyflex context has introduced more complex and dynamic inputs. These include asynchronous and synchronous

participation modes, a variety of digital communication platforms, and the need for technological proficiency among team members (Beatty, 2019; Kohnke & Moorhouse, 2021). Due to the physical and temporal separation of team members, these unique inputs not only shape but also challenge team processes such as effective communication, task coordination, and conflict resolution (Bond et al., 2021). Thus, the IPO model in hyflex settings must account for the fluid and multimodal nature of interactions, which is less emphasized in traditional IPO applications.

Moreover, processes in hyflex learning environments are mediated by technological interfaces that facilitate or hinder communication and collaboration. For instance, while traditional IPO applications have often assumed consistent face-to-face interactions, hyflex processes must consider asynchronous discussions, time lags, and technological barriers as integral components of the team process (Raes et al., 2020). This complexity adds new dimensions to the IPO framework, where the quality of digital tools, Internet accessibility, and digital literacy become critical process variables.

Outputs in the hyflex context are also distinct, as performance outcomes are not limited to academic achievements but extend to students' digital collaboration skills, adaptability, and technological proficiency, reflecting a broader spectrum of success metrics compared to traditional learning environments (Kohnke & Moorhouse, 2022). Applying the IPO model in hyflex settings thus requires a nuanced understanding of how digital communication tools and flexible participation modes shape collaborative processes and learning outcomes.

To investigate the effects of communication and atmosphere within hyflex course learning teams on team performance in undergraduate hyflex education setting, we formed the following core research questions:

1. Does effective hyflex course learning team communication significantly enhance team performance?

2. What is the impact of a positive team atmosphere on team performance?

3. How does team atmosphere moderate the relationship between communication and team performance in a hyflex learning environment?

To address these research questions, we proposed three hypotheses.

Hypothesis 1: Effective course learning team communication significantly enhances team performance in an undergraduate hyflex setting.

Effective communication is particularly crucial in hyflex learning environments. Recent research in higher education has emphasized that clear and structured communication channels are essential for maintaining team cohesion and ensuring active participation across different learning modalities (Brown, 2024; Detyna et al., 2023). Studies have indicated that open communication channels enhance collaboration and information sharing, which are essential for achieving high team performance (Mathieu et al., 2006). Furthermore, effective communication has been shown to mitigate misunderstandings and foster a sense of belonging among team members, ultimately leading to improved outcomes (Höddinghaus et al., 2023).

Hypothesis 2: A positive team atmosphere positively influences team performance in an undergraduate

hyflex setting.

A supportive atmosphere encourages active participation, idea sharing, and effective collaboration among members (Baker et al., 2006). Research in educational psychology has shown that a positive emotional climate can significantly increase students' willingness to engage in collaborative activities, thereby enhancing overall team effectiveness in hybrid learning settings (Keshavarz, 2023; Salas et al., 2005).

Hypothesis 3: Team atmosphere moderates the relationship between communication and team performance in an undergraduate hyflex setting.

This hypothesis highlighted the interplay between communication and the emotional climate of the team. A positive atmosphere may amplify the benefits of effective communication by creating an environment where members feel valued and understood (González - Romá et al., 2009). Conversely, in the absence of a supportive atmosphere, students may be less likely to engage actively in discussions, limiting the effectiveness of communication strategies (Brown, 2024; Wong et al., 2023). Both factors must be considered together to fully understand their impact on team outcomes. It is crucial for educators designing hyflex courses to foster environments where communication and atmosphere complement each other to support optimal team performance (Detyna et al., 2023).

Methodology

Context

This study adopted a quantitative survey design using a seven-point Likert scale to investigate relationships among team communication, atmosphere, and performance in a hyflex setting. The research was conducted at a Chinese undergraduate institution. Students participated in hyflex learning teams in the *Appreciation of Traditional Fujian Arts and Crafts* course on the Super Star learning platform, a major ODL platform in China with over 700 million registered users. This hyflex learning environment enabled students to choose among in-person attendance, synchronous online participation, or asynchronous engagement with course materials, all of which were well-established open and distributed learning practices

Participants and Sampling

The target population consisted of undergraduate students enrolled in *Appreciation of Traditional Fujian Arts and Crafts* over two semesters from September 1, 2023 to July 20, 2024. A total of 332 responses were collected using in-class surveys administered via Wenjuanxing, an online crowdsourcing platform used in China, and similar to Amazon Mechanical Turk. Screening criteria excluded responses with insufficient answering time (less than 45 seconds, $n = 17$) or patterned answers ($n = 5$). This process resulted in 310 valid responses included in the analysis.

Survey Instrument Design

The survey instrument was designed to measure three key constructs: team atmosphere, team communication, and team performance. All survey items were presented in Chinese, and responses were collected using a seven-point Likert scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*).

The final instrument was developed using recommended translation and back-translation procedures performed by five experienced hyflex educators. A pilot study involving 75 students was conducted to test the validity and clarity of the questionnaire and led to refinement before its use in the main study.

Team atmosphere was measured using nine items adapted from Fan et al.'s (2017) team atmosphere scale, with minor modifications to fit the hyflex learning context. The scale evaluated three dimensions: personal relationships, psychological safety, and team trust, with reliability coefficients (α) of 0.77, 0.76, and 0.79, respectively. The complete items have been provided below.

1. Colleagues are reliable in important matters.
2. We invest emotional effort in working relationships.
3. I take the initiative to share my thoughts, problems, or feelings with my course team leader.
4. The course team leader seeks input from team members when making decisions.
5. Team members can maintain their own opinions even after decisions are made.
6. Team members can express disagreement with leaders.
7. There is mutual trust among team members.
8. We believe everyone acts with good intentions.
9. We trust that the information shared is truthful.

Team communication was measured using the following four items adapted from He et al. (2014) and Wang (2008), with a reliability coefficient (α) of 0.83.

1. Team members express their opinions clearly and accurately.
2. Communication among team members is characterized by mutual respect and a positive atmosphere.
3. Team members frequently share views and opinions.
4. There are multiple ways for team communication and information exchange.

Finally, team performance was assessed across two dimensions: goal achievement and member satisfaction. Each dimension consisted of three items, adapted from Huang (2011) and Zheng (2006), with Cronbach's alpha reliability coefficients of 0.79 and 0.78, respectively. The complete list has been provided below.

1. I have a clear understanding of the team's objectives.
2. Team members complete their tasks accurately.
3. The team consistently meets its goals.

4. I am satisfied with how the team works.
5. I am satisfied with my own performance.
6. I am satisfied with the performance of other team members.

Validity and Reliability

The reliability of the scales was confirmed using Cronbach's alpha values for each construct. The final Chinese version of the questionnaire was developed using the recommended translations and back-translation procedures (Brislin, 1970). Five experienced teachers from the research site who had extensive experience in hyflex courses conducted the back-translation of the questions. The accuracy of the translated items was tested through a pilot study involving 75 students who had previously participated in a hyflex team-learning course. Based on the pilot results, the questionnaire was refined and finalized. Random post-pilot interviews were also conducted with 30 students to further validate the instrument's content.

Data Collection

As mentioned above, data was collected over two semesters from 332 learners enrolled in the authors' hyflex course delivered through Super Star learning platform. Unlike typical Wenjuanxing surveys, this study was administered during scheduled learning sessions, ensuring that only students who had experience with the hyflex course could participate, thereby minimizing the risk of duplicated or ineligible responses.

To mitigate the possible risk of common method variance, the sequence of questionnaire items was carefully structured. Respondents' anonymity was fully protected.

Data Analysis

After data cleaning and screening, statistical analyses were performed on the final dataset of 310 valid responses. Analytical techniques included descriptive statistics and regression analyses to examine relationships among team atmosphere, communication, and performance. All analyses were conducted using IBM SPSS Amos 28, a structural equation modeling software.

Results

We began by conducting a confirmatory factor analysis (CFA) to validate the four measurement models, followed by multiple linear regression to test the hypotheses. The CFA assessed the reliability and validity of the constructs, while the regression analysis tested the relationships between variables. Centered values from the CFA were used in the regression analysis. To address potential multicollinearity, which could bias the regression estimates, we used variance inflation factor (VIF) analysis. Additionally, the condition number was calculated to evaluate the model's stability, confirming reduced multicollinearity and ensuring the robustness of the model.

Table 1

Model Fit Indices

Fit index	Model value	Reference value	Overall model fit
χ^2/df	1.695	< 3	Yes
CFI	0.969	> 0.9	Yes
IFI	0.969	> 0.9	Yes
GFI	0.916	> 0.9	Yes
SRMR	0.030	< 0.05	Yes
RMSEA	0.047	< 0.08	Yes

Several indices were used to assess the model fit, including degrees of freedom (*df*), chi-square value (χ^2), χ^2 /*df* ratio, comparative fix index (CFI), goodness-of-fit index (GFI), Bollen's incremental fit index (IFI), standardized root mean square residual (SRMR), and root mean square error of approximation (RMSEA). Table 1 shows that all indices met the recommended reference values, indicating an overall good fit for the measurement models.

Table 2

*Summary Statistics of CFA (*N = *310)*

Construct	Index number	Convergent validity			Model-fit indices					
		SMC_{min}	CR	AVE	$\chi2$	*df*	$\chi2/df$	GFI	AGFI	RMSEA
TC (Team communication)	4	0.51	0.84	0.57	6.58	2	3.29	0.99	0.95	0.086
TA (Team atmosphere)	9	0.63	0.90	0.51	64.68	27	2.40	0.96	0.93	0.067
TP (Team performance)	6	0.49	0.89	0.56	25.08	9	2.79	0.97	0.94	0.076

The constructs—team communication (TC), team atmosphere (TA) and team performance (TP) —were evaluated for internal consistency reliability, convergent validity, and discriminant validity (see Table 2). The results showed that the composite reliability (CR) for each construct ranged from 0.81 to 0.90, exceeding the acceptable threshold of 0.60, thus confirming internal consistency reliability (Bagozzi & Yi, 1989; Fornell & Larcker, 1981). Additionally, the factor loadings for all items in the four-factor model were all significant ($p < .001$), providing evidence of convergent validity. The average variance extracted (AVE) for all constructs ranged from 0.51 to 0.58, exceeding the 0.50 threshold, further supporting acceptable convergent validity.

Overall, the CFA results confirmed the reliability and validity of the measurement models. These validated constructs were subsequently used in the regression analysis to test the study's hypotheses.

Table 3

Mean, Standard Deviation, Reliability, and Correlations of Constructs

Construct	Mean	SD	TC	TA	TP
TC	5.19	1.03	0.755		
TA	5.22	0.98	0.519**	0.714	
TP	5.35	1.05	0.553**	0.542**	0.748

*Note:*** $p < .01$ (two-tailed); $N = 310$.

The square roots of AVE for discriminant validity are in parentheses along the diagonal.

Table 3 shows the mean, standard deviation, reliability, and correlations of the variables. TC was positively corelated with both TA ($r = 0.519$, $p < .01$) and TP ($r = 0.553$, $p < .01$). Similarly, TP was positively correlated to TA ($r = 0.542$, $p < .01$). Additionally, the square roots of the AVE of each variable, shown along the diagonal in Table 3, were higher than the correlations among the constructs, indicating strong discriminant validity.

To address potential multicollinearity and improve the interpretation of interaction effects, all continuous independent variables were centered by subtracting each variable's mean from its raw value. This centering reduced correlations between main effects and interaction terms, ensuring clear interpretation of the regression results.

Table 4

Regression Coefficients

Items	Unstandardized coefficient		Standardized coefficient	*t*	*p*	Collinearity statistics	
	B	*SE*	Beta			Tolerance	VIF
(Constant)	5.470	0.032		172.126	0.000		
TC (centered)	0.389	0.046	0.382	8.457	0.000	0.326	3.071
TA (centered)	0.267	0.037	0.296	7.196	0.000	0.394	2.538
TC*TA	-0.139	0.018	-0.306	-7.592	0.000	0.411	2.434

Note: Dependent factor was team performance.

Table 4 presents the regression coefficients for the model. The maximum variance inflation factor (VIF) values ranged from 3.071 to 2.434, well below the recommended threshold of 10, indicating minimal multicollinearity (O'Brien, 2007). The condition number after the regression was calculated as 3.418, confirming the absence of multicollinearity and ensuring the stability of the regression model. The model produced an R^2 of 0.796, with a significant F change ($p < 0.001$), and a Durbin-Walson statistic of 1.877, indicating a good fit and no issues with autocorrelation.

The following are the results of hypothesis testing. H1 was supported; TC had a significant positive impact on TP, with an unstandardized coefficient of 0.389 (t = 8.457, p <0.001). This result aligned with previous research, underscoring the crucial role of effective communication in enhancing team performance.

H2 was also supported; TA had a significantly positive effect on TP, with an unstandardized coefficient of 0.267 (t = 7.196, p <0.001). This finding was consistent with existing literature, which emphasized the importance of supportive team atmosphere in driving performance outcomes (Yamagata-Lynch, 2014).

H3 was confirmed; TA negatively moderated the relationship between TC and TP. The unstandardized coefficient was 0.389 (t = -0.139, p <0.001), implying that as team atmosphere improved, the positive effect of team communication on performance was diminished. This nuanced result highlights a complex interaction between communication and atmosphere, in line with theories suggesting diminishing returns in highly cohesive teams (Mathieu et al., 2008).

Discussion

Our findings suggested that effective communication is a critical driver of team performance in hyflex courses. Equally, a positive team atmosphere significantly enhances team performance, it also moderates the effect of communication. Specifically, our results revealed that while robust communication enhanced performance, its incremental benefits may diminish in a highly positive team atmosphere.

Effective communication is essential for collaboration in ODL environments, especially in hyflex courses where students predominantly engage synchronously or asynchronously online, with minimal or no face-to-face interaction. Clear communication strategies are vital to overcome the spatial and temporal barriers inherent in ODL, ensuring equitable engagement despite physical separation (Detyna et al., 2023; Kohnke & Moorhouse, 2021). Providing multiple interaction channels (e.g., discussion boards, video conferencing, collaborative documents) further enhance meaningfully engagement with peers and course content (Wong et al., 2023).

The positive impact of communication on team performance aligned with findings from studies indicating that collaborative learning activities can foster deeper understanding and retention of material (Johnson et al., 2014). In a hyflex ODL environment, where students are rarely or never physically co-located, leveraging technology to facilitate communication is crucial. Tools such as Slack, Microsoft Teams, and other online collaboration platforms have been shown to reduce communication barriers in hyflex settings, helping to create a more inclusive learning environment (Brown, 2024; Detyna et al., 2023; Penrod, 2023).

Our findings suggested that although effective communication was vital, its benefits may be less pronounced in an already positive environment. Literature has supported this notion by highlighting that in some cases, an overly harmonious atmosphere has led to complacency among team members, potentially stifling critical discussions and constructive feedback (Garrison & Vaughan, 2008; Yamagata-Lynch, 2014). In such cases, teams may have experienced diminishing returns on communication efforts as they prioritized maintaining harmony over engaging in challenging conversations necessary for growth and improvement. This phenomenon can be explained through the

lens of group dynamics theory, which posited that highly cohesive teams often develop strong social bonds that may inadvertently discourage dissent or critical engagement (Forsyth, 2014). Such dynamics are particularly relevant in hyflex courses, where the diverse modalities of participation may further reduce the likelihood of dissenting opinions being expressed, especially in asynchronous settings where immediacy and direct feedback are limited.

Cultural factors may also partially explain the diminishing returns of communication benefits in highly positive team atmospheres observed in this study, as participants were Chinese university students from a cultural background that emphasizes group harmony, interdependence, and respect for authority (Hofstede, 1984; Triandis, 2018). This collectivist orientation may have amplified tendencies to avoid conflict in highly cohesive teams. In ODL contexts, these cultural dynamics are further complicated by the reduced social presence and limited non-verbal cues inherent in online communication (Garrison et al., 2010). Research has shown that the absence of face-to-face interaction in virtual teams can exacerbate cultural tendencies toward conflict avoidance (Ke & Kwak, 2013). Maintaining harmony in online collectivist contexts often supersedes critical engagement, even when constructive disagreement could enhance team performance.

Moreover, research has indicated that while collaboration is beneficial, there comes a point where too much emphasis on consensus can hinder decision-making processes (Murray, 1983; Priem et al., 1995). In hyflex courses, fostering an environment that encourages critical engagement and constructive dissent is especially important; it can balance the need for harmony with the need for rigorous academic discourse (Brown, 2024; Kohnke & Moorhouse, 2021; Wong et al., 2023). This balance is particularly critical in hyflex settings, where the heterogeneity of participation modes necessitates deliberate efforts to ensure that all voices are heard. For example, asynchronous participants may require structured opportunities to contribute their perspectives, while synchronous or in-person participants may need to be encouraged to actively seek input from their peers in other modes (Lyons, 2024).

Contributions and Implications

Our study has contributed to the existing body of literature on ODL and hyflex learning by providing empirical evidence that highlights the importance of effective communication and team atmosphere in enhancing team performance. Previous studies have emphasized the role of communication in collaborative learning settings (Beatty, 2019; Hadjipieris, 2024; Penrod, 2023), but often overlooked the unique challenges of building team cohesion without physical co-presence. Our research addressed this gap by demonstrating the moderating role of team atmosphere in ODL contexts where spontaneous interactions are limited. This adds complexity to existing theories surrounding team dynamics, suggesting that while effective communication is essential, its impact on performance varies based on the level of supportiveness within the distributed team environment (Detyna et al., 2023; Kohnke & Moorhouse, 2021).

The observation regarding diminishing returns on communication benefits within a highly positive team atmosphere introduced a critical nuance to existing theories. While positive atmospheres are generally associated with enhanced performance, our findings indicated that an overly harmonious environment may lead to complacency or reduced critical engagement among team members. This aligns with recent discussions in educational psychology, which have emphasized the need for a balance between support and critical dialogue to maintain team effectiveness (Brown, 2024; Salas et al., 2005). In the context of ODL, this balance is particularly important. Moore's transactional distance theory

established that spatial separation increases psychological distance between educational participants, necessitating structured dialogue mechanisms (Moore, 2013). Garrison's community of inquiry framework further emphasized the essential equilibrium between social and cognitive presence in effective online learning environments (Garrison, 2016). Empirical investigations have confirmed that successful ODL implementation requires balanced interaction structures that support both interpersonal cohesion and critical discourse (Miao & Ma, 2022). By highlighting this potential pitfall, our research encourages educators to maintain this balance in environments where face-to-face regulatory cues are absent.

The practical implications of the moderation effect are particularly noteworthy. For instance, in highly cohesive teams where trust and mutual understanding are already well-established, educators may consider reducing the frequency of mandatory team meetings or communication check-ins to avoid redundancy and cognitive overload (Marks et al., 2001). Instead, they could focus on designing activities that challenge students to critically evaluate ideas or solve complex problems, ensuring that team discussions remain meaningful and productive. Educators should prioritize both effective communication strategies and a supportive team atmosphere across ODL contexts. In synchronous settings, for instance, supportive atmospheres could be developed through structured turn-taking in video conferences and collaborative digital whiteboarding (Martin et al., 2022). Asynchronously, support could emerge from consistent instructor forum presence and peer review protocols with constructive feedback guidelines (Borup et al., 2020), amongst other strategies. These structured communication approaches would ensure all students remained engaged, regardless of participation mode (Detyna et al., 2023; Keshavarz, 2023).

Educators must also be mindful of cultivating a balanced team atmosphere that encourages openness while avoiding excessive conformity. To achieve this balance, strategies such as role rotation, peer feedback sessions, and structured debates would encourage critical discussions while maintaining a positive atmosphere (Penrod, 2023). By actively promoting dissenting opinions in a respectful manner, educators can harness the benefits of both effective communication and a positive atmosphere.

Educators should implement online feedback mechanisms that allow students to reflect on their experiences regarding communication and team atmosphere. This could involve methods such as anonymous surveys, reflective journals, or real-time feedback tools that help instructors adjust strategies and maintain an optimal balance between support and challenge within teams (Brown, 2024; Detyna et al., 2023; Wong et al., 2023).

In conclusion, our findings have advanced hyflex pedagogy in two key dimensions. First, the discovery of a negative moderation effect of team atmosphere challenges conventional assumptions that more positivity is always better, a novel insight with direct implications for avoiding complacency in highly cohesive teams (Yamagata-Lynch, 2014). Second, we formed actionable strategies that addressed the core hyflex challenge of balancing flexibility with equitable participations, which is critical for institutions scaling hybrid online-physical models. By extending these insights to fully online and other ODL contexts, this study has provided a foundation for future research and practice aimed at improving team performance in increasingly diverse and flexible learning environments.

The findings have also offered important implications for institutional policies. Institutions should consider implementing policies that promote structured online communication and balanced team dynamics to maximize collaborative learning outcomes. For example, institutions could provide

training for instructors on how to foster a supportive yet critically engaging team atmosphere in both synchronous video sessions and asynchronous discussion boards. This training could include strategies for encouraging constructive dissent, such as using anonymous online feedback tools or assigning rotating leadership roles within teams (Forsyth, 2014).

While this study has contributed valuable insights into hyflex course learning, several limitations must be acknowledged. The findings were based on a sample from within a collectivist cultural context, which may limit their generalizability. Additionally, students in our study had access to face-to-face sessions, which likely influenced collaboration dynamics differently than in fully online environments. As hyflex learning is increasingly adopted worldwide, future research should examine how various combinations of modalities (physical/virtual) affect collaboration across different cultural backgrounds, thereby improving the external validity of the findings.

The cross-sectional nature of this study captured data at a single point in time, limiting the ability to infer causal relationships among communication, team atmosphere, and performance. This approach provided only a snapshot of team dynamics, making it difficult to understand how these interactions change over time. Longitudinal studies would allow researchers to track changes over time and assess how these dynamics evolve throughout the course.

Future research should also consider conducting longitudinal studies to examine the evolution of communication effectiveness and team atmosphere over multiple semesters or academic terms. Such studies might shed light on how teams adapt their communication strategies as they progress through hyflex courses, enabling programs and educators to develop more dynamic and responsive instructional strategies that support sustained team performance over time.

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Declaration of Use of Generative AI and AI-Assisted Technologies

While preparing this work, the authors used ChatGPT 4.0 to help generate ideas, enhance clarity, and improve the overall structure of the writing. After using this tool/service, the authors reviewed and edited the content as needed; they take full responsibility for the article's content and references.

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