

Review into Physical and Virtual Communication in Remote Project Teams

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Summary

In recent years, organisations have been moving from a focus on physical communication to more of a reliance on a virtual communication medium. This research performed a focused systematic literature review to identify the current field of knowledge on physical and virtual communication within organisations and remote project teams. A literature review was performed using a keyword search in six selected key journals between the years 2003 -2023. The literature shows that there are barriers and challenges to both virtual and physical communication and this research identifies if developments in integrated virtual-physical communication can overcome them. The research concludes that the advancement in technology helps to remove some of the barriers to organisations and project teams when using virtual communication; however this cannot fully compensate for not using physical communication. Future research opportunities have been identified, including research directed at identifying the advancements in virtual technology since the COVID-19 pandemic.

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Introduction

In recent years, there has been interest in and research into physical and virtual communications in organisations and remote project teams. Moving from physical to virtual communication mediums has allowed organisations to change from using mainly co-located project teams and take advantage of the added flexibility and benefits of using both co-located and remote project team members (Lumseyfai, 2020; Tigre, Curado and Henriques, 2023). The developments in virtual communication mediums have increased the flexibility of organisations to take advantage of using remote project teams. However, this has also increased workplace challenges associated with using more virtual communication. These associated challenges are present in organisations having more team members working remotely and using virtual mediums as the main communication method (Swart, Bond-Barnard and Chugh, 2022; Willox, Morin and Avila, 2023) over physical communication.

However, with the constant advancement of virtual communication mediums and technology in recent years, the challenges for organisations and remote project teams have changed. There is the question that with the advancement in technology, have the barriers and challenges to virtual communication been reduced or removed. Removing these barriers and challenges with using virtual communication mediums is important for organisations and remote project teams as they can cause uncertainty (Song *et al.*, 2007, p. 64), ambiguity, and misunderstandings (Lee-Kelley and Sankey, 2008, p. 55). This can impact on organisations ability to operate efficiently and when using remote project teams, the impact can be on team communication, working and project progress.

The purpose of this paper is to identify if the advancement in virtual communication mediums have reduced the barriers and challenges that have previously impacted on organisations and remote project teams when using virtual mediums rather than physical mediums to communicate. This paper will draw upon the recent literature into the differences in physical and virtual communication, what barriers, challenges, and opportunities organisation and remote project teams will be impacted by. This will be achieved by undertaking a limited systematic literature review into the research in physical and virtual communication over the last 20 years from a number of key selected journals. Papers will be selected for their relevancy, reviewed and results presented.

Since 2019 there has been increased pressure introduced due to the advent of the worldwide pandemic of COVID-19 because of '*(partial) shutdowns, curfews, quarantines*' (Berg, Hess and Matthias, 2021, p. 511) that were enforced to reduce the spread of COVID-19. The pandemic '*has affected workers in a variety of ways*' (Tigre, Curado and Henriques, 2023, p. 40) and forced a number of organisations to adapt their working practices from office based to '*the digital realm*' (Faraj, Renno and Bhardwaj, 2021, p. 2), due to this team members were unable to meet face-to-face and used virtual communication to compensate.

As '*the process of digitalisation has been accelerated*' (Berg, Hess and Matthias, 2021, p. 512) due to the environmental pressure of the COVID-19 pandemic, organisations are using more virtual technology to allow staff to work remotely and in distributed teams. This paper is not directly looking on the impact from the COVID-19 pandemic, however due to the increased pressures and advancement in technology over this period, it will be a factor for future research into this subject area. What barriers, challenges, and opportunities have organisations and remote project teams faced during this period with limited physical communication and a

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forced move towards virtual communication? This can have implications on the efficiency of organisations and in remote project teams.

Background

Communication is considered to be the transfer of information between stakeholders (Čulo and Skendrović, 2010; Barrett, 2013; Zulch, 2014), within projects, communication has been identified as *'one of the main factors impacting a projects success or failure'* (Müller, 2003, p. 345). Reed and Knight, 2010 also identify that *'communication or inadequate communication is a key risk on many projects'* (Reed and Knight, 2010, p. 425) this is regardless of the project teams being remote, if information is poorly communicated it could lead to misunderstandings, miscommunication, and ambiguity.

During a project, if the *'needs, issues, problems and suggestions'* (Toor and Ogunlana, 2008, p. 427) of stakeholders are clearly communicated then *'not many confrontations will occur'* (Toor and Ogunlana, 2008, p. 427) during a project's lifecycle. However, if communication has lapses within remote teams, then it can incur *'cost and delays'* (Toor and Ogunlana, 2008, p. 427) as the focus of the team will be on communication issues or problems and not on the work.

Hsu et al 2012 have also identified that projects have been *'delayed and or cancelled'* (Hsu et al., 2012, p. 329) due to communication breakdowns, this can also result in *'additional work or mistakes'* (Hsu et al., 2012, p. 329) within remote teams. The impact of rework and mistakes on a project can be increase costs and delays, ensuring communication breakdowns are reduced is critical to project success.

What is communication?

(Barrett, 2013) has defined communication as *'the transmission of meaning'* between stakeholders, the meaning is to create a common understanding and the transmission can be *'verbally or non-verbally'*. The research performed by (Fatimayin, 2018, p. 1) also suggests that communication should mean to share a *'common understanding'* between stakeholders, this also includes a feedback loop that distinguishes it from just information into a *'communication process'* (Fatimayin, 2018, p. 4).

(Čulo and Skendrović, 2010, p. 229) identify that communication should cover *'the effective exchange and understanding'* of information between stakeholders, communication should also be *'clear and timely'*. The selected communication medium can have an impact on the communication being clear and timely. The definition of communication can be seen to share a common understanding between stakeholders in a timely manner, where the common understanding is from an information exchange through a selected communication medium.

Communication within has been defined as a process of gathering *'all relevant information, interpreting this information and effectively disseminating the information'* (Zulch, 2014, p. 1001). A communication model has been developed by (Čulo and Skendrović, 2010, p. 229), shown in Figure 1.

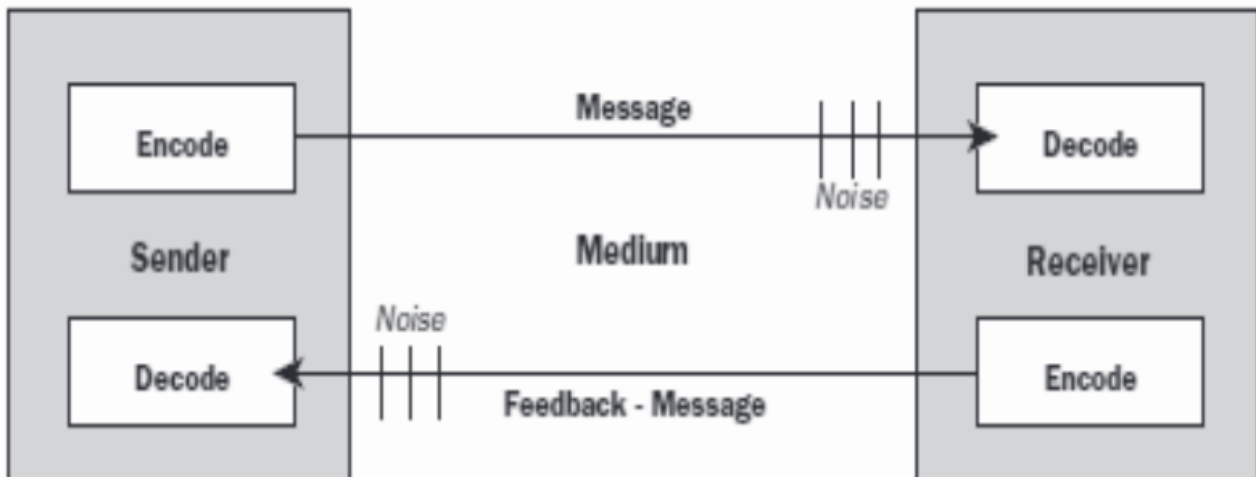


Figure 1: Basic communications model (Čulo and Skendrović, 2010, p. 229)

Prahinski and Benton (2004) suggest collaborative communication had '*positively influenced*' (Prahinski and Benton, 2004, p. 59) team members relationships. The collaborative communication between team members included an '*influence strategy, formality and feedback*' (Prahinski and Benton, 2004, p. 60) these factors are needed to ensure successful communication of information. The model was built from research that suggested communication included four key areas '*content, medium, feedback and frequency*' (Prahinski and Benton, 2004, p. 41).

These key areas are similar to research performed by Muller (2003), that included '*frequency, contents and media*' (Müller, 2003, p. 345), where frequency refers to the '*number of formal communication events*' (Müller, 2003, p. 346), content is the '*information exchanged*' (Müller, 2003, p. 346) and media refers to '*the way a message is conveyed*' (Müller, 2003, p. 346) through the selected medium. Physical and virtual communication medium are both used to transfer information, this paper aims to research the change in recent years to using virtual communication medium for remote project teams.

What is physical and virtual communication?

Physical communication in research has been considered to be a traditional medium of communication that include '*face-to-face, telephone, and written communication*' (Montoya *et al.*, 2009, p. 142), this has also been identified in other research as comprising of '*verbal, personal and written communication*' (Müller, 2003, p. 350; Froehle and Roth, 2004, p. 5). These are communication mediums that either transfer information physically or using a personal interaction.

Muller (2003) goes further to identify different physical communication media's that included: '*Face-to-face*', '*Written status reports*', '*Verbal status updates*' and '*Written and verbal analysis*' (Müller, 2003, p. 350). This suggests there is a physical interaction of stakeholders during communication. The medium used in physical communication can introduce its own 'noise' that could impact on the message being transferred. Face-to-face and verbal status update suggests a physical interaction, allowing for simultaneous feedback between communicators and this will assist in identifying if the message has been transferred and understood by the receiver.

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Whether it is verbally talking face-to-face or by telephone or in written communication, this is information that has been transferred using a physical medium and research has defined this as physical communication.

Virtual communication is a common medium for communication within remote teams. However, it is also commented by researchers that it can also be used by co-located teams, giving team members the ability to *'communicate with each other by sending e-mails, instant messages or using other tools'* (Verburg, Bosch-Sijtsema and Vartiainen, 2013, p. 69). This suggests that using a virtual communication medium is not only used by remote teams but can also be a useful tool for project team members in the same office or building.

Virtual communication can include *'email or web-based video conferencing, electronic bulletin boards, computer conferencing and computer-assisted decision-aiding technologies'* (Henderson, Stackman and Lindekilde, 2016, p. 1718; Ilk, Shang and Goes, 2020, p. 571; Song and Song, 2010, p. 571; Tang, Mu and Thomas, 2015, p. 408). These can be identified as mediums for transferring a message between a 'sender' and a 'receiver' and equally used as mediums for feedback between both parties. However, the mediums that have been selected to transmit information can introduce different types of 'noise' into the message and this can impact on what is being received.

Virtual communication can provide a *'rich communication environment'* (Reed and Knight, 2010, p. 424) for team members that are remote and have restricted face-to-face encounters, this includes using virtual mediums such as *'web conferencing, instant messaging, document sharing sites'* (Reed and Knight, 2010, p. 424). The virtual mediums that include *'Internet-based synchronous messaging and conversation programs'* (Song and Song, 2010, p. 385) can act as spontaneous communication where it is not possible to have face-to-face communication, and this can result in greater project team collaboration. While some of the virtual communication mediums are spontaneous, others are not and this can impact on the feedback from the receiver of the message, causing challenges in understanding if the message has been transferred successfully.

While technology is at the heart of virtual communication and includes opportunities to create greater project team collaboration. By increasing the speed of communication, it can also *'lower its cost compared to face-to-face communication and interactions'* (Enberg, 2012, p. 773), as when used in dispersed teams, as face-to-face communication can include travel of team members. This will make face-to-face communication onerous and costly compared to virtual communication. However, with technology being at the heart of virtual teams, *'without internet, email, video conferencing and audio bridges, virtual teams can't even exist'* (Daim et al., 2012, p. 200) this can be a barrier to consider when setting up a virtual element where internet access is limited or intermittent.

There are communication media's that cross the boundaries of physical and virtual communication as it uses both *'physical'* and *'virtual entities'* (Papadonikolaki, van Oel and Kagioglou, 2019, p. 381), this includes *'physical documents with diagrams and drawings'* (Papadonikolaki, van Oel and Kagioglou, 2019, p. 381), this would also include physical documents sent via electronic form, such as email.

Some research suggest that face-to-face communication is considered to be the *'richest medium'* (Prahinski and Benton, 2004, p. 41), with electronic to be considered the *'least rich'*

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medium' (Prahinski and Benton, 2004, p. 41). This research aims to investigate if the barriers of using virtual communication methods have changed over the recent years with technology being able to compensate for the move away from physical into virtual mediums of communication. There is a current climate of working from home, making team members more remote and organisations using remote project team members.

Research methodology

Using a systematic approach to a literature review will enable a trail of keywords that were searched, journals selected, and the reasons of selecting/excluding keywords and journals. A systematic literature review is a method for producing a replicable approach to identifying and evaluating a research field (Fink, 2005). The approached used in this paper is shown in Figure 2. There are five stages for the systematic literature review, with each stage setup to either identify, refine, select, or synthesise the research in the papers selected.

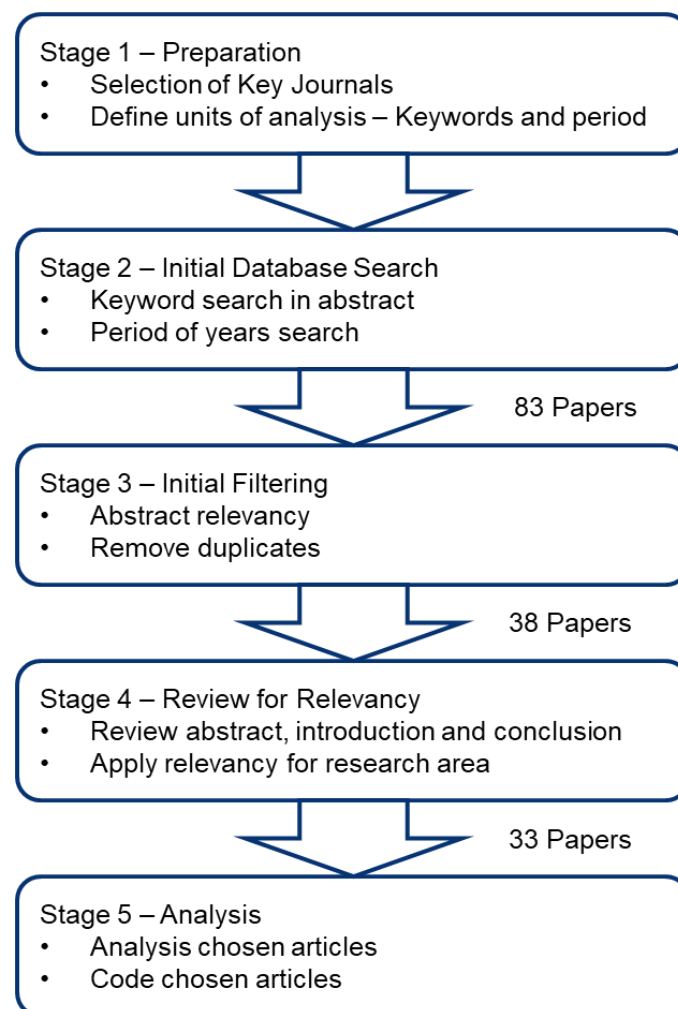


Figure 2: Systematic Literature review process flowchart

The research was framed around a 'Review into Physical and Virtual Communication in Remote Project Teams'. The first stage was to select six core peer reviewed journals, the journals selected hold a comprehensive selection of papers related to the research area, allowing for a focused and rigorous systematic literature review. The second stage was to scope the framing of the questions, with the recent changes in virtual communication, the period from

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2003 – 2023 years was chosen. Twenty years of literature was chosen to allow for review into literature that identified changes in communication mediums. Keywords were developed from the initial physical and virtual keywords; this included a Thesaurus search and refinement from literature. A specific keyword search was performed in paper abstracts, the keyword phrasing using is shown in Table 1. Communication ‘AND’ was used to maximize collection of papers with the theme within the field of interest. The third stage filtered the papers identified in the keyword search, a review of the abstracts for relevancy and removing duplicates of papers. Stage four, the papers abstracts, introductions, and results were reviewed and ranked as either ‘relevant’ and ‘not relevant’. Relevant papers were considered to include key information in this research area. Stage 5, the papers were analysed and coded according to the keywords and the results synthesised. The description of criteria used in each stage has been specified in Table 1.

Table 1: Process of the systematic approach to the literature review

Stage	Description
Stage 1	The selected journals for this literature review were the International Journal of Project Management, Journal of Operations Management, Academy of Management Review, British Journal of Management, Journal of Product Innovation Management, and International Journal of Management Reviews
Stage 2	Keyword searches of Abstracts performed in selected journals during the period of 2003 – 2023: ‘Communication’ AND (‘Physical’ OR ‘Visible’ OR ‘Tangible’ OR ‘Real’ OR ‘Face-to-face’ OR ‘In person’ OR ‘Virtual’ OR ‘Indirect’ OR ‘Digital’). During this stage, 83 papers were identified from the keyword search.
Stage 3	The papers were filtered before downloading by a review of the abstracts for relevancy to the research subject and duplicates were removed. During this stage, 38 papers were filtered for downloading.
Stage 4	The papers abstracts, introduction and conclusions were reviewed against the relevancy for this research and classified as ‘relevant’ and ‘not relevant’. Relevant papers were considered to have abstracts that had clear indication that the subject addressed communication and different mediums used. This narrowed down the papers and removed ‘not relevant’ papers from the systematic literature review. During this stage 5 papers were removed as either not relevant to the research field subject or was a duplicate.
Stage 5	The relevant papers were analysed and coded according to the relevance of information to the keywords and the results synthesised. The results are presented later in this review

Initial methodology findings and analysis

This section describes the initial findings from the literature review, the distribution of papers across the journals searched, journal rankings and the methodological approach applied in the papers.

Distribution of papers

The quantity of papers identified by the keyword search was 83, after filtering, 38 papers were deemed relevant by the filtering for literature on physical and/or virtual approach to communication in the six journals. Shown in Figure 3, the International Journal of Project management (15 papers) was the highest contributor to this research review. The Journal of Product Management (13 papers) was the next highest contributor.

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The Association of Business Schools (ABS) Journal ranking 2021, is a method of identifying the ranking of a journal. The ABS ranking is a technique of measuring the quality and impact of each journal in their research field. The six key journals selected for this research were identified as ranging from 2 to 4* star rankings.

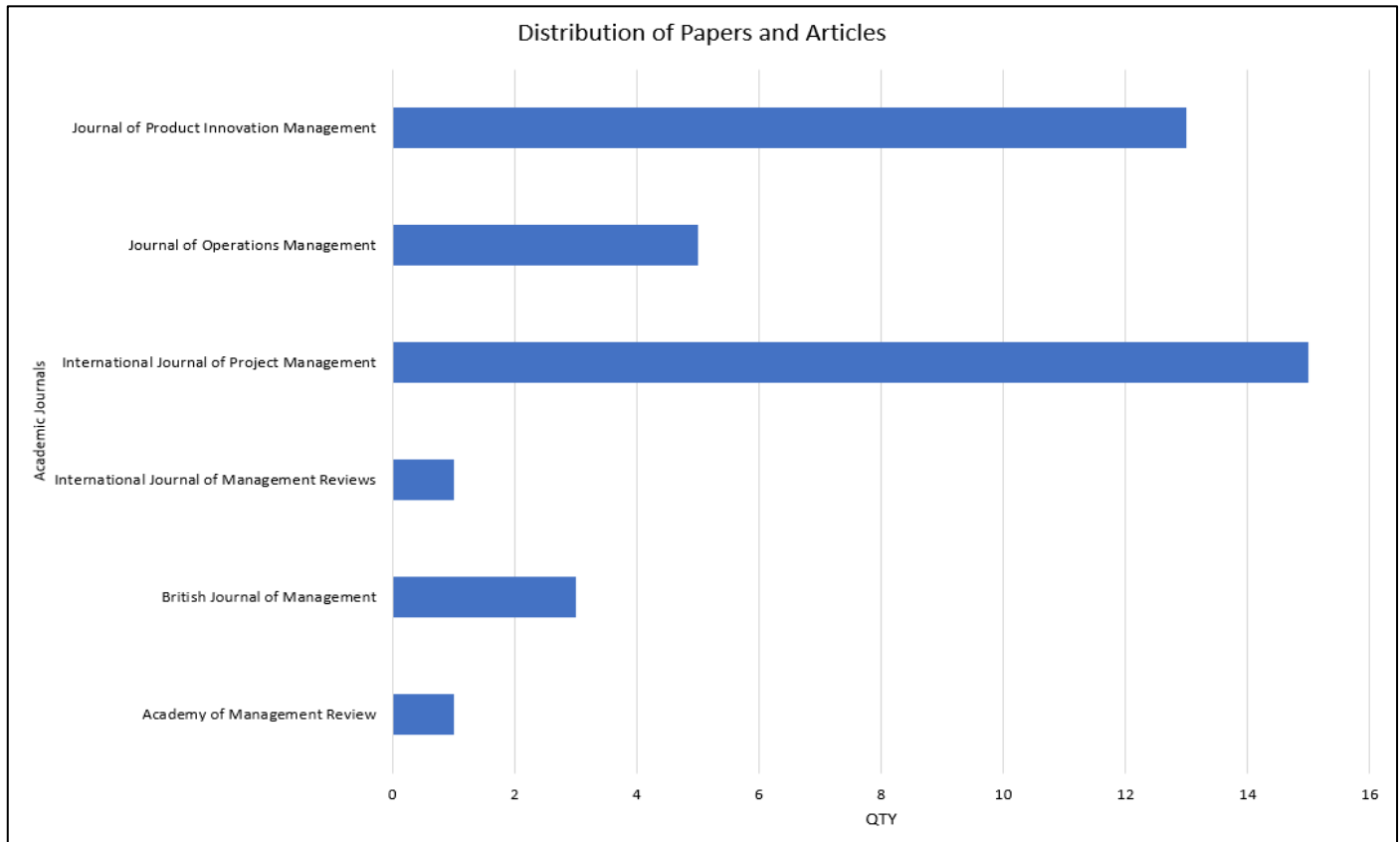


Figure 3: Distribution of Papers

The 38 papers that were selected during the systematic literature review were reviewed and coded. This was realised according to the relevance of information to the keywords used to perform the systematic literature review and any keyword identified from themes reviewed in the literature and relevance to the research subject. This meant that each paper was aimed to be coded to at least one keyword but could be coded too more. There were 5 papers that were not coded to any keywords, this was due to a lack of relevance of information in the papers to the research subject.

Keywords identified from themes in the literature relevant to this research included 'Face-to-Face', 'In-Person', 'electronic', 'frequency', 'information exchange', and 'knowledge transfer'. The codes have been grouped into three overarching areas of communication, these are 'physical communication', 'virtual communication' and 'communication content'.

Communication content group includes the keywords 'frequency', 'information exchange' and 'knowledge transfer'. While these themes are important to communication and worth highlighting, they are outside the scope of this systematic literature review. This systematic literature review has been designed to review the literature areas of 'physical communication' and 'virtual communication'.

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Methodological approach taken in the literature

The methodologies and methods used for the data collection in the 38 papers were reviewed. There were five methods used in the two methodologies of Quantitative and Qualitative data collection, these included Literature review, Questionnaire, Interview, Case Study and Survey. The breakdown of methodologies shows that quantitative data collection in the papers was 74% and qualitative data collection was 26%.

Physical and Virtual communication from literature review

Within the last century communication has gone from *‘face-to-face and mail communication, to the telephone, to email and desktop computing, to IM and text, and now to web-based video communication’* (Henderson, Stackman and Lindekilde, 2016, p. 1728). This review of the last 20 years of research into the subject of physical and virtual communication methods identifies the benefits and weaknesses of both methods.

Results from Physical communication

Physical communication within the literature has been described as communication that requires a physical presence that *‘allow human beings to mingle, share and empathise challenges and to build mutual rapport’* (Lee-Kelley and Sankey, 2008, p. 57). Without physical presence in communication, this can lead to a lack of *‘physical cues’* causing possible *‘conflict from ambiguity and misunderstandings’* (Lee-Kelley and Sankey, 2008, p. 55) and can cause *‘stability issues’* (Lee-Kelley, 2006, p. 236) within a project team.

A project team that has *‘a lack of physical proximity’* (Henderson, Stackman and Lindekilde, 2016, p. 1726) will identify this as a barrier to communication between team members. Other research has identified barriers to not having physical communication, include a *‘a lack of face-to-face contact’*, *‘low information or knowledge sharing’* and *‘extended communication’* (Lee-Kelley, 2006, p. 236). These barriers can increase the threat of ambiguity and misunderstandings, causing a project team to work ineffectively, as communication between team members will be impacted.

Face-to-Face communication

Physical presence increases *‘face-to-face communication frequency, communication duration, and communication content’* (Khazanchi *et al.*, 2018, p. 595) and is considered the most *‘common formal method of transferring knowledge’* (Reed and Knight, 2010, p. 426) as this type of communication is considered to be a more *‘powerful communications’* (Cooper and Sommer, 2016, p. 516) type than other mediums.

Face-to-face communication displays rich personalisation, high in interactivity and social presence (Lee, 2009, p. 266; Montoya *et al.*, 2009, p. 142), this is also highlighted by (Müller, 2003, p. 348; Froehle and Roth, 2004, p. 5; Prahinski and Benton, 2004, p. 41) that face-to-face communication is a rich medium for communication. This rich personalisation of communication includes body language and tone of voice (Daim *et al.*, 2012, p. 203; Verborg, Bosch-Sijtsema and Vartiainen, 2013, p. 70), Daim *et al.* goes on to suggest that *‘Face-to-face interaction is often the most effective precursor to establishing good communication’* (Daim *et al.*, 2012, p. 204). With the recipient of the message receiving body language and tone of voice information during face-to-face communication, this can allow for less uncertainty and ambiguity in the information being received. Less uncertainty and ambiguity between project team members will increase the effectiveness of project communication.

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The literature has shown that '*Frequent FTF communication*' has a positive impact on reducing '*conflicts and differences*' (Khazanchi *et al.*, 2018, p. 596) between project team members. Identified in the literature is a common agreement that '*some level of face-to-face contact*' (Lee-Kelley and Sankey, 2008, p. 53) within project team members is essential to effective team communication. Face-to-face communication with project team members opens up '*informal backdoors for interactions*' (Song and Song, 2010, p. 389), *this improves conflict and differences resolution*. Face-to-face communication within project teams is important as it is '*invaluable for building trust among team members*' (Song *et al.*, 2007; Daim *et al.*, 2012)

There is a suggestion from the research that the propinquity effect of increasing physical proximity increases the chance encounters and '*frequency of FTF interactions*' (Khazanchi *et al.*, 2018, p. 595) and consequently '*face-to-face communication*' (Song *et al.*, 2007, p. 56) requires little effort to initiate in co-located teams and frequent face-to-face communication can also '*resolve functional conflicts and differences*' (Khazanchi *et al.*, 2018, p. 596) due to reducing the uncertainty and ambiguity face-to-face communication allows.

In-Person communication

In-person communication includes the interactions and personal communication between team members, these interactions can '*improve product innovation performance*' (Wang, Tong and Yang, 2023, p. 260) in project teams and is '*extremely valuable*' (Froehle and Roth, 2004, p. 2) between customers and employees. However, some research has countered this by suggesting that project teams have identified that the '*importance of written media*' (Müller, 2003, p. 350) ranks higher than '*personal and verbal communications*' (Müller, 2003, p. 350).

Froehle and Roth have suggested that communication can be '*technology-mediated*' (Froehle and Roth, 2004, p. 2), as communication that doesn't require the personal interaction that is part of in person communication. Communication where fixed information is transmitted, for example online purchasing of items, technology-mediated communication would be more preferable than in-person. This suggests that the selection of the communication medium is reliant on the situation, and depending on the information being transmitted or the situation for the communication can change the medium being more effective from physical to virtual.

Results from Virtual communication

Virtual communication within the literature has been described as '*the technology-oriented*' (Verburg, Bosch-Sijtsema and Vartiainen, 2013, p. 69) approach to communication. With technology-oriented defined as the '*frequency and the quality of electronically mediated communication*' (Verburg, Bosch-Sijtsema and Vartiainen, 2013, p. 69) and the technology-oriented communication methods '*include telephone, e-mail, groupware, web-based chat rooms*' (Tang, Mu and Thomas, 2015, p. 411). Reed and knight suggest that the electronic technologies '*Web conferencing, instant messaging, email, texting, document sharing sites, blogs, wikis, social networks*' (Reed and Knight, 2010, p. 425) and Daim *et al.* suggest that the '*internet, email, video conference and audio bridges*' (Daim *et al.*, 2012, p. 200) create a rich communication environment for remote project teams. While these virtual communication mediums can help replace physical communication mediums, such as Face-to-Face, they also have benefits, barriers and challenges that organisations and remote project teams need to consider.

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'In today's world, virtual project teams are indispensable' (Daim et al., 2012, p. 207) virtual communication mediums can increase the success of remote project teams and how the project team members communicate. To help increase the success of virtual communication, rules on how the virtual mediums should be used is highlighted. (Verburg, Bosch-Sijtsema and Vartiainen, 2013, p. 78) recommend the *'establishment of trust and clear communication rules'*, as this can help remove any uncertainty when using virtual mediums to communicate. This is also recommended and developed further to include sharing using *'different media'* (Henderson, Stackman and Lindekilde, 2016, p. 1718) depending on the information that is being shared. (Henderson, Stackman and Lindekilde, 2016, p. 1718) also recommend *'prioritising message importance'* for remote project teams over co-located project team members. This could help with the engagement of team members that don't have a physical presence in the office.

While there are benefits to using virtual communication mediums, the literature shows that there is a *'risk for miscommunication or misinterpretation'* (Daim et al., 2012, p. 205) when communicating virtually to team members. The barriers to using virtual communication mediums can include *'low information or knowledge sharing, poor time management and technology infrastructure'* (Daim et al., 2012, p. 205). (Lee-Kelley, 2006, p. 237) highlight that the technology *'connectivity between the interfaces'* will also be a barrier to virtual communication. The barriers will need to be overcome if remote project teams are to communicate successfully.

Electronic communication

Electronic communication is closely linked to virtual communication, during this literature review, papers have used the same virtual communication definition for electronic communication. However, some papers have also identified electronic communication as a method for transmitting *'explicit knowledge'* (Song et al., 2007, p. 64) and reducing *'uncertainty'* (Song et al., 2007, p. 64), whereas co-located communication can reduce ambiguity. (Lee, 2009, p. 266) identify that electronic communication is expected to be *'short and concise messaging'*. Electronic communication has an inability to transfer *'implicit knowledge'* (Reed and Knight, 2010, p. 426) as *'tone of voice'* may not be present during electronic communication (Daim et al., 2012, p. 203). While this is true in some forms of electronic communication, this is not accounting for phone calls or web conferencing, where the tone of voice can be transmitted.

Previous research has *'assess the media richness'* (Froehle and Roth, 2004, p. 5) of virtual communication mediums against the richness of physical communication, mainly Face-to-Face. When using virtual communication mediums to replace Face-to-face communication, research suggests that virtual tools are invaluable when being used *'remotely'* (Lee-Kelley and Sankey, 2008, p. 57) and including the benefits of using virtual communication mediums on reducing costs and time constraints (Song and Parry, 2009, p. 152; Enberg, 2012, p. 773) of travel with remote project teams or team members. However, research suggests that virtual communication is not a *'permanent replacement'* (Lee-Kelley and Sankey, 2008, p. 57) to physical communication. Reed and Knight give their explanation as this is due to the inability to transfer *'implicit knowledge or expertise successfully'* (Reed and Knight, 2010, p. 426) within the limits of virtual communication mediums. This suggests that using a combination of virtual and physical communication can reduce barriers to communicating and this is reliant

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on the levels of physical and virtual communication mediums that are used by organisations and remote project teams.

Conclusion

The information from the literature review has identified both benefits and weaknesses of using virtual and physical communication mediums over the last 20 years. It identified that in some application's virtual communication, while being limited, can be a rich communication method when transmitting 'implicit knowledge' in remote project teams. It also has the advantage of reducing costs and time constraints of travel for physical communication between remote team members by using virtual communication. Some issues of 'tone of voice' and 'body language' have started to be addressed in recent advances in technology, allowing for some of the barriers to be removed. With organisations moving to more virtual communication, in the advent of the pandemic, these barriers transferring 'implicit knowledge' can impact on the effectiveness of team communication and project progress. Currently, virtual communication is not a permanent replacement to physical communication.

Physical communication mediums involve some of the richest communication methods, of face-to-face and in-person communication. This type of communication is prevalent in teams and considered to be a more 'powerful communication' method in remote project teams than virtual communication in the literature, impacting on remote project teams' communication effectiveness. The literature also points towards advancements in technology that are creating a rich communication environment for remote project teams, as organisations adapt to using them, this will help increase the effectiveness of remote project teams' communication.

There are several barriers to organisations using a more virtual communication focus in remote project teams in place of physical communication. While these remote teams are still facing a number of issues, these have started to be addressed over the last 20 years. The rich communication environment provided by physical communication will need to be replicated using virtual communication mediums or miscommunication and uncertainty can impact on remote project teams. The literature review has identified that at this stage that virtual communication cannot fully compensate for the rich communication provided from a physical communication environment. The research concludes that as using only virtual communication mediums in organisations and remote project teams will increase the barriers and challenges to communication. Organisations and remote project teams will continue to use a combination of physical and virtual communication mediums to ensure that communication is not impacted.

Limitations and further research

While this paper investigated the physical and virtual communication research from 2003 until 2023, in six key journals, this is a limited search of the available data over the period of time. This gave the author a valuable understanding of the research field. Broadening the search area to include database's (Web of Science, Science Direct and/or Scopus) will help increase the data captured and assist in critically analysing the research area and capture a wider array of perspectives.

Due to only performing analysis of papers from six key journals, most of the literature reviewed as relevant in this paper was performed before the recent changes due to the impact of the COVID-19 pandemic. Since 2019, there has been a development drive for more reliable technology to allow remote working and working from home. There has been a climate of

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working from home, making team members more remote and organisations using dispersed teams. A question arises: has the advancement in technology and climate of working from home impacted the richness of physical communication as a barrier to virtual communication in organisations and remote project teams? There is an opportunity to perform research in several databases over a narrower period (suggestion of 2019 until 2024) to help understand the impact of the COVID-19 pandemic on physical and virtual communication developments.

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