

Investigating Team Effectiveness Using Discord: A Case Study Using a Gaming Collaboration Tool for the CS Classroom

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ABSTRACT

Because of the increasing importance of teams in industry, educators have been incorporating more team projects in their classes. Academia is also experiencing an increasing number of students taking online classes. Put those two together and you get more team projects needing to take place in virtual environments. Student teams who meet face-to-face often have negative experiences due to communication problems, scheduling issues, personality clashes, conflicting ideas, and lack of participation. Research has largely reported even more challenges and negative results for virtual teams. However, we hope that new technological tools can help improve the team experience and mitigate some of the issues that teams have. Our paper offers insights into the use of Discord, a collaboration tool primarily used in the gaming industry, to facilitate virtual teamwork. Although students liked Discord, we experienced a number of challenges and have many lessons learned.

CCS CONCEPTS

• Information Systems • Collaborative and social computing systems and tools

KEYWORDS

Teams, Collaboration, CS, Virtual Teams, Information Technology, Computer Science

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1 INTRODUCTION

The utilization of teams in education and industry has increased over the last few decades. This is due to the growing need for large, complex projects that require the skill set of many people to accomplish [1]. Learning to work effectively in teams is a process built upon in education which helps students prepare for professional teamwork [2]. Student often work in face-to-face teams (F2F), but there are many factors that prevent teams from collaborating physically and thus virtual teamwork is necessary.

Virtual teams are arrangements where geographically dispersed group members have limited F2F contact, and work interdependently using electronic communication tools. Tools such as instant messaging (IM) [3] assist in promoting interactions that lead to more positive team experiences [4]. The need for virtual teams is increasing in education because enrollment in online courses is growing tremendously [5]. Therefore, it is crucial for educators to implement effective communication tools to facilitate collaboration for student virtual teams.

Our university is non-residential, thus students live off-campus. Plus, a majority of our course's students work more than twenty-hours per week. Consequently, it was essential for them to function like virtual teams. In this paper, we offer our novel experience in using Discord, a chat tool used in online gaming, to assist virtual teams with communication and collaboration. Because this tool is well-liked in the gaming industry, we hoped that it would provide a useful and enjoyable environment for student communication and collaboration on educational projects. Our goal was to see if this popular gaming tool would foster communication as well as other elements important to teamwork and offer a tool that educators could use to monitor team health. We found that students liked Discord to assist with communication and many other team processes such as brainstorming, discussing, listening, writing, research and information sharing, and making it easy for everyone in general to contribute; however, there were challenges. Despite these challenges, Discord shows promise as a useful tool that educators can use for team projects. We discuss existing problems with virtual teamwork in education, collaboration tools, our experience with Discord and suggestions other educators could employ to better facilitate teamwork.

2 BACKGROUND

The spread of virtual teamwork is growing due to its financial viability and efficiency for global communication by means of online tools – a medium people are quickly adapting to [6]. While there are benefits to the implementation of virtual teams, there are also challenges. Compared to F2F teams, remote teams run a higher risk of disconnection between teammates which can contribute to a loss of faith between one another. This is often due to a possible communication deficiency because of co-location as well as the increased chances of personal schedule conflicts [7]. Virtual teams also have more issues in terms of how they

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communicate. According to the Project Management Institute, virtual team communication is roughly four times more challenging than in person [8]. An issue faced by both physical and remote teams is 'social loafing' - a team behavior in which some team members do not contribute their fair share to the project. This is one primary reason students give for disliking teamwork [9]. Social loafing is especially difficult for virtual teams to handle [4]. Researchers found that team members respond to the social pressure to at least appear busy [10]. It is possible that a communication tool could assist with this to aid in mitigating the problem of social loafing. It is fortunate that due to the general popularity of digital communication, students have an easier time adapting to these tools as they are becoming more efficient and closer to standard F2F interactions [11].

Email and instant messaging (IM) are both common communication tools. Typically, IM is the preferred method due to a preference for the nearly immediate send and response times [7]. However, there are more comprehensive tools available. One such tool is Slack. Slack is an online, cloud-based communication tool typically seen used in business and some educational institutions [12, 13]. In a laboratory environment, scientists are utilizing Slack to quickly share departmental information as opposed to establishing multiple email threads [13]. While some teams have successfully used Slack, it has fallen short for others in terms of efficiency. One study [14] examined the use of a LMS and both Slack and Discord (for IM capabilities) to support a virtual classroom. In that study, Slack did not accommodate the needs for usage in a collaborative classroom setting and Discord took over as the primary communication tool. Discord was ultimately preferred over Slack as it increased the feeling of a virtual classroom. In our study, we needed students to have this same experience. When teams need a virtual space to communicate and collaborate, cost, efficiency, technical capabilities, user interface, and ease of use are all aspects that to be considered when choosing an online communication tool. One concern that many education could have with Slack is its cost. Slack has a free option that is very bare-bones with, essentially, just a chatroom which will only save up to ten thousand messages.

We chose to use Discord in our study to foster student-to-student group communication as well as monitor group interactions. Discord was originally created as a free platform for gamers to chat both text-based and verbally and has the capability to be an influential tool to facilitate participation and collaboration from students in a group setting. In an educational setting, Slack's limitations prompted users to make the change to Discord due to its features [14]. Our reason for choosing this tool stemmed from its popularity among gamers and the fact that many CS students love online gaming and would, thus, be comfortable with Discord. Because virtual teams rely so heavily on online communication tools, they have potential roadblocks involving the technology they use [15] and by having students already be familiar with Discord, it was easier for them to adapt for usage in the classroom. This tool offers text, voice, and video communication as well as open-source capabilities for creativity and efficiency. Discord is free to use, offers open source capabilities, and does not have a message limit. Due to Discord being primarily text-based, we utilized Discord History Tracker (DHT) to save and export student chat logs. DHT is a browser script that downloads and exports chat history as a text file. When active, the script

loads the entire history from beginning to end making it easy to archive these for further use.

3 Course Overview

Emerging Information Technologies is a spring semester, upper level course that is required for Information Technology (IT) students and an elective for Computer Information Systems (CIS) students. The class met face-to-face, once a week for three hours. The primary goal of the course is to introduce students in key trends of emerging information technologies in terms of technical infrastructure, architecture, and applications within the Information Technology (IT) realm. We follow the CompTIA four pillars framework, consisting of Infrastructure, Development, Security, and Data. Infrastructure content included coverage of trends in data centers, facility and service models, cloud computing, interconnect fabrics, remote device management, and edge computing. Development content included discussion on trends in programming languages, DevOps, containers, microservices, and trends in web development such as static websites, single page application, progressive web apps, bots, functional programming and motion user interface. Security content focused on technologies that will assist with privacy, the General Data Protection Regulation, and continuous adaptive risk and trust. Data content included discussion on data governance, trends in database administration, big data, and blockchain. Lastly, we covered content within the Internet of Things, augmented reality, virtual reality and robotics – all through the lens of an IT professional. Classes consisted of lectures, guest speakers, and new technology demonstrations and discussions. Student's course grades consist of class participation (10%), five individual writing assignments (30%), three team projects and presentations (45%) and a final test (15%).

Pre and post surveys that contained multiple choice, short-answer, and open-ended questions were administered. In the pre-survey, we collected general demographic information as well as specific information about each student's teamwork preferences, professional IT experiences, as well as their previous experience and opinions of communication/collaboration tools. The post-survey also included questions related to how their teams used Discord as well as the self-perceived usefulness and value of using Discord to collaborate on team projects. We told students that we would not view the post-survey results until after we submitted course grades. We did this so that students would feel comfortable providing honest answers and not feel that their answers would affect their course grade.

3.1 Students

Thirty-three undergraduate IT and CIS students were enrolled in this course. There were 6 females and 27 males. The class had a fair amount of ethnic diversity with 17 students identifying as White/Caucasian, 9 as Hispanic/Latino, 4 as Asian/Pacific Islander, and 3 as Black/African American. We also had a great mix of traditional and non-traditional students with 15 traditional and 18 non-traditional students [16]. Our university is non-residential, thus all students live off campus. A large majority of students in the class had a lengthy commute with 40% commuting 20+ miles to campus, 27% commuting 11-20 miles to campus, 27% commuting 5-10 miles to campus and only 6% commuting

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less than 5 miles to campus. Twenty-eight students worked an average of 31 hours per week – only 5 students identified as not having a job outside of school. There were 21 full-time students and 12 part-time students. This class was composed of a very diverse group of busy individuals.

3.2 Teams and Team Projects

During the semester, student teams completed three projects. Each project consisted of an Evaluation, Feasibility or Recommendation Report and a group presentation based on a topic of their choice. In the first project, they dug deeper into a subject related to IT infrastructure. In the second project, their focus had to be on emerging technologies in security or within the internet of things. The last project could be on any relevant, emerging information technology that the team found interesting. Teams chose different topics (such as DRaaS, 5G networks, RFID, virtualization, SSDs, retail security, security as a service, smart homes, IoT security, medical robotics, penetration testing, and AR in network education) and met virtually using Discord to produce these deliverables.

Because of class time constraints, we formed 6 teams so that each team would have 20 minutes to present. Eleven students indicated worked as IT professionals, so we randomly assigned one of these students to each of 6 groups. Then we randomly assigned all other students to those groups, thus each group had between 5 to 6 group members. Although we did not assign students to teams based on their category, each team had a relatively even mix of traditional and non-traditional students. At the end of each project, the students completed a peer evaluation of each team member including themselves. The evaluation included questions related to how much each team member helped in researching, creating and designing project materials, quality of contribution, equally splitting workload, and level of cooperation to create an overall percentage of total project contribution for each student.

We did not assume that students had the prerequisite knowledge on how to work in teams, find high quality information on emerging technologies, or write the type of reports that are often specific to the IT discipline. Thus, we first covered foundational topics. These topics included: strategies for identifying high quality sources beyond academic journals and conference papers, methods used to determine trends from fads, criteria used to evaluate resources such as newspaper and magazine articles, online information, and white papers, techniques used by executives to evaluate emerging technologies, guidelines to write executive summaries, feasibility reports, and evaluation reports, guidelines on how to create effective presentations, and research and recommendations on how to work effectively in teams.

3.3 Discord Setup

For our research purposes, we wanted to utilize Discord's features for students in an educational, group setting. We did this by first creating a Discord server. In this scenario, a server is created to act as a virtual container for students to join that gives them a space to communicate with one another. For students to join the server, they needed their own account with Discord, which we asked them to make. They made a username which identifies them

in the server. After all students created an account and joined the server, we virtually sorted them into teams. We did this by creating a role for each team. A role is a way to organize users within Discord. Each role is certain access, permissions, and restrictions regarding what they can/cannot do within a server. Roles are created and assigned by the server administrator. We created roles for each group and then assigned the corresponding team role to the students within their respective groups.

Next, we created text channels for each group to have their own private space to collaborate. Channels are separate chatrooms that can be used for multiple purposes as they can be named and labeled based upon their description. Discord currently offers text, voice (VOIP), and video chatting capabilities. While the functionality of each of these are useful in their own way, we restricted communication to only text channels for the students by disabling the voice chat capabilities. This is because we wanted to save their chat logs and get a representation of participation between group members. Since there is currently no feature to give data regarding voice and video calls between users that we could collect and analyze, we had to enforce text chat only. However, students could still fully collaborate by sending messages and sharing files and links in the text channels. For students to utilize the text chatting capability, a text channel was created for each group and restricted with a privacy setting so only students with a certain role could access that channel (i.e. only students assigned the Blue team role can access the Blue team text channel). This kept the server organized and prevented students from interfering with the work of other groups. Over the course of the semester, we allowed the students to collaborate and communicate organically and did not interfere with the teams, though we monitored their chats as they worked on their projects. After teams had sent messages and presented their projects, their chat logs were saved and exported via DHT for further analysis. We examined properties such as overall team word count and individual word count to better gauge participation levels in this virtual environment.

4 RESULTS

Findings from the survey responses suggest that students found Discord very useful for many aspects of their team projects and a great majority of the students plan on continuing to use Discord for other academic courses as well as for their personal use. However, there were several aspects of Discord that some students either did not like. We now take a closer look at the usefulness and challenges of Discord as well as how it compares to other communication and collaboration tools.

4.1 Teams Using Discord to Facilitate Teamwork

When asked "Did Discord help your team to communicate, collaborate and perform tasks (function as a group)?" 85% of the students thought that it helped their teams communicate and collaborate effectively. In general, they liked how easy it was for team members to just hop on and talk about the projects and ideas. They also liked that they didn't have to hunt for email addresses. Because it was a central hub for communication, it gave them a quick and easy way to communicate about the project regardless of the time of day and made the whole process smoother:

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It provided an easy platform to discuss things as a group. As someone who already uses Discord on a daily basis, I am very happy to see it as a tool used in this class, since it made everything significantly easier for me and the team. Even without voice channels, it makes everything easier since we can have our discussions and documents in the same place, all in real-time without having to wait for emails or separate our texts and files.

The fact that Discord keeps a record of all their conversations makes it easy for students catch up on missed discussions or recall earlier conversations. They also acknowledged that this feature helped them save time because they did not have to ask their questions again, which would bother others that might be busy. This feature helps smooth out the conflicts that virtual team members have with schedule conflicts:

It's much more convenient than a group text or physical meeting and it keeps logs of conversations so I can go back to review stuff we talked about previously. People can upload their finished portion of the project and allow us to view what they did and comment on it or revise it.

Research shows that virtual teams run a higher risk of disconnection between team members. Knowing that others are available for communication and collaboration helps build trust. In Discord, it is easy for students to see who is connected. In fact, some students indicated that they really enjoyed being constantly connected. Also, students liked to know if other students were available to chat:

I like that it is easier than sending emails and you can easily view what was previously said in a chat and that you can tell who is online.

To gain better insight into how Discord might have helped with team processes, we asked the students specifically if Discord helped with brainstorming, discussion, writing the project report, contributing, assisting others, and/or respectfully listening to others. Eight-four percent of the students said that Discord helped their team with brainstorming. Ninety-two percent said that it helped their team with discussions. Discussing ideas is important to the interchange of information. Here are some of the student comments on discussion:

It facilitated the flow of ideas. Because the whole group was usually on at the same time, we were able to discuss ideas and brainstorm topics.

It was super convenient to get everyone together and share everything from ideas to reports.

Discussion was so much easier to start up and callout on responses.

Eighty-four percent said that Discord assisted with helping them to contribute. This is very important because one of the primary problems all teams have, and especially virtual teams, is "social loafing":

I was able to see their contributions at all times, even when I was away from school or at work.

It gave me confirmation that people are indeed working.

Only 28% thought that Discord helped their teams with presenting. Many students commented that they used Google Slides to collaborate on this task. Another teamwork process that Discord was weak in assisting with was writing. Only 40% of the students felt that Discord helped with the writing process. Although Google Docs was the primary collaboration tool used for writing, students did comment that they used Discord for posting their research, reviewing others' work, and for posting links to the slides and documents in Google Drive.

Sixty-eight percent felt that Discord helped team members in assisting others. Assisting others is a very important team process because research has found that when members of a team feel supported by others, those teams are higher performing [17]:

It really helped to assist team members by creating a place where someone could ask a question, and whoever was on could help you.

Whenever I had a question, someone would reply either instantly or quickly. Everyone contributed and made me feel that my information was valuable.

Communication is always the key to everything. We used Discord to give each other tasks and also to be supportive if someone was feeling worried about the presentation.

Listening skills are important to good communication within teams. People who feel heard, feel valued. When people listen to one another, the team has a greater opportunity to tap into everyone's diverse experiences and knowledge. Sixty percent of the students responded that Discord helped team members respectfully listen to one another's ideas, opinions, and questions.

All of teams in this course had a high amount of diversity. There is a tendency for people in teams to categorize one another, essentially distinguishing in-group members (those who are similar) from out-group members (those that are dissimilar) [18]. Research indicates that in-group members tend to be trusted over out-group members and cooperation among in-group members tends to be better than team members in diverse groups. Results also indicate that as groups become more diverse, there tend to be more misunderstandings due to the lack of a common frame of reference. Thus, in-group teams tend to function more smoothly than out-group teams. Tools, such as Discord, act as an interaction buffer which allow users interact in a less direct way. This allows users to take the time to thoughtfully post content and take more time assessing and reacting to information. In this way, tools such as Discord can help to neutralize the potentially negative effects that diverse teams can experience due to the lack of a common frame of reference.

4.2 Discord's Effectiveness

We asked the students to rate how effective they thought Discord was (Excellent, Good, Fair, or Poor) for facilitating interactions

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within their group. Eighty-four percent thought that Discord was either Excellent or Good, with the majority of those responses being Excellent. When we asked them to expand on why they thought Discord as effective, we primarily saw comments that related to the fact that Discord was easy to use and communicate with, that many students appreciated that they were able to use Discord on an all of their devices, including their phones which helped them communicate anywhere and at any time, that they appreciated how fast communication could occur, and that they really appreciated that they could scroll back through all the messages to find out information they may have missed.

I liked it because I could communicate on the same device as the work I was doing, so I wouldn't have to look down from my computer to see a discussion on my phone.

In our pre-survey, we found that only 36% of the students were familiar with Discord because they used it while gaming or while at work. One of our primary reasons for choosing Discord was our hope that more students would already be familiar with the tool which would make it easier for them to have successful team interactions. We also felt that Discord is a very approachable, intuitive, and easy tool to use which would also help in its adoption by the students. A majority of the students commented that Discord was a very user friendly, easy tool to use and that they were comfortable collaborating with it. However, we also wanted to know what specific features within Discord they thought useful, so we asked how useful Discord's file sharing, mentions, direction mentions, and reactions features were. Seventy-two percent of the students felt that file sharing was useful. They appreciated how easy it was to embed files, pictures, and links directly in their chat messages.

Another feature of Discord is Mentions. Mentions highlight the message and ping the other person or persons mentioned. It gives importance to a message so that the user(s) take notice of it. Fifty-six percent of students appreciated mentions. Seventy-two percent of the students appreciated the Direct Mentions feature. Direct Mentions send the specific person mentioned a special notification. If someone turns off Discord notifications, that person will still get that particular notification.

Discord's @ tool is great for notifying the person that you need their attention.

Lastly, 52% of the students like Discord's Reactions feature.

The little thumbs up helps. It lets you know that the group agrees with you, or at least lets you know that they have read your suggestion or comment.

4.3 How Discord Compares to Other Tools

This was also a technically savvy group with a lot of experience with other communication and collaboration tools. Some of the tools mentioned by the students when we asked them about other communication tools they have previously used included

TeamSpeak, Ventrilo, Mumble, Evolve, Raid, Skype, Google Hangouts/Drive/Docs, GroupMe, Slack, email, phone text messaging, Facebook Groups, Facebook Messenger, and Yammer. When asked how they would compare Discord to other forms of communication such as Slack, Google Hangouts, etc. a majority of 68% thought that Discord was a better form of communication for their group.

One of the better chats I've used.

Discord is more robust as it has more features and options for communicating and organizing your communications.

However, 16% did not think that it was better.

Group text messaging is generally easiest because it's built-in to every device already.

Google is best.

Another 16% thought that all the tools were very similar or did not care which tool they used.

4.4 Challenges with Discord

We received some very good insights from the students when we asked them what was the most difficult part of using Discord and what do you wish Discord could do to improve how you worked. One of the features most wished for by the students is the ability to voice and video chat with others. We had turned off voice and video chat so that we could study communication for a different study. We also turned it off because one of the students was deaf and Discord does not have a voice-to-text feature and we wanted to standardize the method of communication between all groups. Discord does have a voice chat feature and it appears that it would greatly assist communication between team members. Students also found it hard to organize their materials and conversations within Discord. They could not create "folders" to assist in organizing content and thus had to scroll back through all the past conversations to find things.

The Discord's free version is good for sharing files, pictures, links and other media as long as they are not larger than 8MB. The only option around this limitation is to upgrade to the paid version (Nitro), use another sharing method, or compress the file so that it fits within the 8MB limit. We also had a couple students wish that Discord had the ability to function more like an office application. They wanted the ability to create documents, like they can within Google Docs, and have their communication checked for proper spelling and grammar. The other features they identified, such as pinning and screen sharing, were available to them, but we failed to fully train them how to use Discord.

Lastly, some students felt that it is not a good idea to use Discord for a team project because they felt that it is easier for team members to not focus on the project.

No Discord, find another platform, because some students were more focused on their games on Discord than the homework or group projects on Discord

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4.5 Will Students continue to use Discord?

When students were asked how likely will would use Discord for group communicate in other classes or outside of class (Very Likely, Somewhat Likely, Slightly Likely, or Not at all Likely), we found that 68% responded that they would be very likely to use Discord. Some students commented that they had already started to use it for team communication in other classes.

5 LESSONS LEARNED AND CONCLUDING REMARKS

Although we have discovered that Discord worked very well as a communication and collaboration tool for our course and it appears to have a lot of potential for future team projects, there are definitely lessons that we have learned.

The first lesson learned is that we should have spent more time training students on how to use Discord. Our Discord training lasted 30 minutes and only covered making sure that everyone's cellphone was setup on Discord. We also demonstrated of how to setup Discord on their home computers along with the basics of how to post and respond to messages. Students wanted the ability to privately message team members, to pin important posts and links, and to share their desktop. Some of the students were also very annoyed with receiving notification – so annoyed, in fact that they stopped using Discord after a while and revert to simple text messaging. We could have averted all this with better training. With better training, we could have avoided some challenges that students experienced, but did not realize existed until we examined the post-survey. Although we could have asked them if they were having any problems with Discord earlier, we wanted a baseline usage of Discord for our studies and thus did not do anything to intervene. Next time we use Discord for team projects, we plan on creating an icebreaker assignment for the teams that requires every student to utilize the most primary aspects of Discord as well as start to get to know their new team members better. We would also turn on the voice and video chat. Being able to hear the tone used when someone is speaking or to see someone's facial expressions conveys much more meaning than just seeing texted words. Turning on these features would greatly facilitate communication between team members.

Another challenge for the students was their inability to organize communication and content. In Discord, you can have numerous channels and you can sort these channels by category labels. This is a method used by many scientific teams [13] with much success. An instructor could set up additional channels within the server for teams to use for organization. It is another feature that needs to be a part of our future training. Even though students reported that Discord assisted in collaboration, Discord cannot force people to respond to notifications – people can forget to check for them or ignore them. However, making an app on Discord opens up many possibilities for an instructor. Perhaps write a bot to monitor who logs on within agreed upon time frames to verify that all people are checking in. If team members do not login within the approved time frame, then the bot sends a

secondary notification (such as an email or text) to the team member. An instructor could also receive notification so that they could more closely monitor situation. Another idea is to write a bot that measures the amount of communication produced by each team member and if the communication percentages are too lopsided, a notification can be sent so it can be determined if intervention is necessary. Another bot idea is to have it run sentiment analysis on the communication to recognize continued frustration within teams and alert an instructor so it could be determined if intervention might be necessary.

We feel that Discord has tremendous potential to be a valuable tool for communication and collaboration within CS teams. It is our hope that this paper begins to bring more discussion about its possibilities to be used to assist and improve student teamwork.

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