

University of Tartu
Faculty of Social Sciences
Institute of Education
Curriculum: Educational Technology

Laris Grikis

OUT-OF-CLASS COMMUNICATION BETWEEN STUDENTS AND TEACHERS USING
GOOGLE CLASSROOM BEFORE AND DURING EMERGENCY REMOTE LEARNING

MA thesis

Supervisor: Senior Research Fellow of Educational Technology, Leo Aleksander Siiman, PhD

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Abstract

Out-of-class Communication Between Students and Teachers Using Google Classroom Before and During Emergency Remote Learning

This investigation, consisting of three related studies, examined communication by high school students and teachers prior to and during Emergency Remote Learning (ERL) using Google Classroom (GC) in the 2019-20 school year. Study A examined 1015 comments sent by 87 students and their teacher. The comments were predominantly private, the largest group had the purpose of sharing information, and students initiated more comments than the teacher with an increase in activity during ERL. Study B surveyed 119 students and Study C surveyed their 12 teachers to determine their perceptions of communication in GC during ERL. Both of these studies found that the dominant responses were very positive and the more broad and general the survey question, the higher the means and percentages of agreement.

Keywords: Emergency Remote Learning, Google Classroom, student-teacher communication, outside-of-class communication, Canadian, student perception, teacher perception

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Introduction

Background

Modern learning spaces are spaces where students and teachers have opportunities to communicate face-to-face and in digital environments. With the increase in digital communication, internet based Learning Management Systems (LMS) and online classrooms have been developed to facilitate classroom communication including information sharing, content delivery, open communication and direct person-to-person communication. The first generation of online LMS were being used in the late 1980's and early 1990's (Paulsen & Rekkedal, 2001). Since then, many open source and cloud based LMS and online classrooms have been used in both corporate and education environments. LMS facilitate student-teacher interaction by centralizing the workflow in the classroom. A key benefit of many LMS is the ability to leverage direct communication between teacher and student by email, through direct messaging services and through comments on work to be assessed. Released in 2014, Google Classroom (GC) is a widely used K-12 online classroom space with millions of users worldwide that can be used by teachers to deliver content and facilitate direct communication with students through the use of instant notifications, private messages and classroom comments when it is used as a classroom social networking site (Siu, 2016).

As GC is authorized by the West Vancouver School District, the location for this study, many teachers choose to use it to supplement regular classroom interaction. The 2019-20 school year, the time frame for this study, became unique in that the year began with regular classroom teaching until Spring Break, from March 16-27. It was decided during Spring Break that regular classroom instruction would cease due to the SARS-COV-2 (COVID-19) outbreak and that education would shift to an entirely remote model dubbed Emergency Remote Learning (ERL), with the first week of instruction from March 30 - April 3 as time to reconnect with students and time for teachers to prepare for online study. From April 6 - May 29, teachers had to engage with students entirely online using various forms of digital communication. Teachers relied on email, comments and private comments in GC and Google Meets scheduled in GC to maintain functional digital classrooms.

This thesis investigates how grade 8 Science students (age 13-14) and their teachers used GC before and during ERL and how each group of participants perceived the value of GC during ERL. The body of research surrounding digital messaging between student and teacher

occurring outside the classroom is limited but growing. The data collected in this study are intended to increase the body of knowledge regarding student-teacher communication and to provide unique insight into communication patterns and perceptions during the COVID-19 crisis in Canada.

Literature Review

There are many relationship building interactions that happen between students and teachers and in-class communication is only one of them. Communication extends beyond the classroom using a variety of media, including school administration systems, e-mail, and social networking sites or LMS, which bring with them technology for instant messaging.

As early as 2007, it had been reported that text messaging had become a dominant form of communication among university students and that it was crucial to them for maintaining their social networks (Harley, Winn, Pemberton & Wilcox, 2007). This marks an important point in time when young people began the transition away from email and towards text messaging for communication. Short messaging service (SMS) messaging is a mobile phone service which is still commonly used, but it is limited to 160 characters. Computer based instant messages tend to be less constrained with longer messages and can be found as an integrated feature of many social networking sites and social media platforms such as Facebook, WhatsApp, WeChat, SnapChat, Facebook Messenger, Google Hangouts, and Instagram.

An Irish study carried out by Hayes, Weibelzahl and Hall (2013) investigated out-of-class communication (OCC) with text messages and their impact on affective learning. They found that prior research studies had indicated that there was an overall improvement in learning across factors such as attitude, interest, motivation, attendance, retention and engagement when the instructor responded to students with increased immediacy, where immediacy was defined as the behaviors that increased psychological closeness between communicators (Mehrabian, 1968, 1971). Although the response time for communication is important, the content, and therefore effectiveness of the response is of greater importance to the learning experience.

Text messaging had been found to be used across four main purposes: classroom dialogue, administration, support, motivation (Hayes et al., 2013). The Hayes et al. (2013) study had a relatively small sample size (n=44) in an isolated university environment measured over two

13-week semesters. They reviewed over 1000 text messages sent during the study period and found that messages could be categorized across three primary purposes (administration, information and motivation). The participants were also asked to complete a 30-question survey using a 7-point Likert scale. Results for each question were analysed by taking the mean and standard deviation and by recording the percentage of scores over 5 to indicate agreement. The positive outcome of their results provides evidence that out of class text messaging has an overall positive impact on the learning experience. Most participants agreed that messaging with the instructor was a good idea and that it improved their relationship. Attitudes towards the course were improved, as was instructor approachability. Over half of the study participants perceived improved motivation, engagement and participation. Other valuable observations included that participants felt more comfortable asking questions in and out of class, and that text messaging was better than email for updates on short notice.

In her 2018 article, *Using Text Messaging Systems as a Class Communication Tool*, Dianna Rust reported that text messaging in education can be an effective tool for rapid communication between students and teachers outside of class or for distance education (Rust, 2018). Communicating in this way leverages a form of communication that is frequently used by students and can promote discussion beyond the classroom. Text messages serve as a form of instant communication where messages are often immediately read and acted upon, which can lead to increased collaboration and interaction. According to a Dynmark study, “90% of text messages are read within the first 3s” and that they have a “final read rate of 98%” (Dynmark, 2018, 5). With a high read rate, text messages can serve to refocus students when they become disengaged, particularly around holiday breaks, or in the case of distance education, they can be used to re-engage students that may feel isolated. Strategically sent messages can promote desirable behaviors or provide reminders to prepare for upcoming assessments and assignments (Rust, 2018).

Rust also commented on concerns expressed by teachers that text messaging with students could lead to less formal relationships. By maintaining professional and formal language when communicating with students, by email or text message, the classroom hierarchy is supported allowing the relationship to remain more formal. To facilitate communication with increased efficiency, messages can be scheduled or broadcasted to larger groups (Rust, 2018). This function is currently available in Google Classroom as well as in other LMS.

Student-teacher relationships play an important role in the classroom and they are developed through the communication taking place. The Teacher-Student Relationship Inventory (TSRI) developed by Rebecca Ang (2005) in Singapore using a small group of teachers (n=11) aims to measure teacher perceptions around their relationships with students from Grade 4 through junior high school. She identified three key factors or dimensions in teacher-student relationships as related to academic and behavioral outcomes. They include Instrumental help (aid), which is characterized by extra help or advice and encouragement; Satisfaction, characterized by positive and satisfactory teacher-student relationship; and Conflict, characterized by conflict, absence of nurturance, and critical and negative feedback (Ang, 2005). The TSRI is primarily concerned with teacher-student relationships, not communication between them. The three dimensions of teacher-student relationships inspired the idea to initially use these as classifications to measure the purposes of comments in this thesis.

Social networking sites are widely used by people all over the world and enhance communication. Prior to LMS like GC, teachers had to resort to alternative methods to engage with students outside the classroom in order to provide additional support or study materials. Social networking sites like Facebook provided a platform with multiple modes of contact where users could communicate through Facebook Groups, Messenger instant messaging, on a user's Wall or on Event pages. In 2017, Hershkovitz and Forkosh-Baruch used Ang's (2005) TSRI framework of Satisfaction, Instrumental help and Conflict to measure perceptions of teacher-student relationships with students aged 12-19 (n=667) from Israel. The study found that students who communicated with their teachers through Facebook Groups experienced more satisfaction and less conflict than those who did not and open responses revealed that the students seeking to connect with teachers on Facebook were primarily doing so for practical reasons (Hershkovitz & Forkosh-Baruch, 2017).

Facebook offers convenient methods for communication that can serve to replace more formal communication pathways, such as email, but there are critical issues around privacy and the blurring of boundaries between students and teachers (Hershkovitz & Forkosh-Baruch, 2019). Privacy issues can be solved through formally managed LMS like GC. Boundaries between students and teachers can also be more easily maintained as the roles of participants are well defined in these digital learning spaces.

In the current digital world, it is common practice to communicate by SMS on mobile phones and by instant messaging through social networking sites. WhatsApp, with 1.5 billion users (Mansoor, 2020), is the most widely used instant messaging service and has been adapted for OCC by many teachers. One benefit of using WhatsApp for communication is that it is a widely accepted technology used by both students and teachers and it can lead to increased accessibility to students.

A study published by Hershkovitz, Abu Elhija and Zedan (2019) used Ang's (2005) TSRI dimensions of Satisfaction, Instrumental help and Conflict to investigate perceptions of student-teacher relationships from the student's point-of-view. The study participants were Arab students aged 11-18 from villages in Northern Israel characterized by relatively low socioeconomic status. Included in the study was an investigation about OCC practices using WhatsApp (n=211). This investigation used a 15-question survey designed to capture student perceptions of WhatsApp communication with a specific teacher. It was adapted in the following ways from the 30-question survey prepared by Hayes et al (2013) for university undergraduates:

- The survey was shortened with the intention of making it easier to complete for the school aged participants.
- A 5-point Likert scale ranging from "1" (strongly disagree) to "5" (strongly agree) was used instead of a 7-point Likert scale.
- The term "teacher" was substituted for "lecturer" and the term "WhatsApp messages" was substituted for "text messages".

Analysis was carried out by calculating the mean of all items, including one reverse coded question.

It was found that the most popular communication method was through a whole class WhatsApp group and that OCC was positively associated with Satisfaction and Instrumental help (Hershkovitz et al., 2019). WhatsApp groups behave in a similar way to public messages posted in GC. It was also reported that improving student-teacher communication could lead to increased quality of learning and teaching.

Research Overview

The research undertaken in this thesis is unique in that it studies student-teacher OCC in Canada, in a young population (13-14 year olds), and during a school year (2019-20) when there was a global pandemic which required normal classroom instruction to be replaced by remote teaching and learning. It aims to provide both baseline results that could be explored further in subsequent studies and results that can be compared to the work of others. Previous studies carried out by HersHKovitz and Forkosh-Baruch (2017) and HersHKovitz et al. (2019) in Israel called for research from different countries and cultures using different social networking sites and communication platforms from their studies. In their 2013 study conducted in Ireland, Hayes et al. investigated text messaging and called for further research across different institutions, cultures and subjects (Hayes et al., 2013).

This thesis provides three linked studies to address the following main questions:

Study A: How did students and their teacher use GC comments before and during ERL?

Study B: How did students perceive the value of GC during ERL?

Study C: How did teachers perceive the value of GC during ERL?

The smaller studies reveal the coexisting aspects of a complex interaction among a particular technology (GC); grade 8 Science students who use it in two very different social and pedagogical contexts (before and during ERL); and their teachers in Science and the students' other courses who used GC during ERL.

Methodology

Context

The setting for this thesis is a French Immersion high school located in West Vancouver, British Columbia, Canada, where junior students (grades 8-10) are divided into two streams, English and French. The students in each stream do not take core academic courses together and are taught by different teachers. This study focuses on the English language stream of grade 8 students. French Immersion students were excluded from the study as students receive all of their instruction in French with the exception of their English 8 class and there was a language barrier for the researcher.

All students and teachers have access to internet enabled devices (laptop PC, Macbook or Chromebook), most have mobile smartphones and Wi-Fi is available throughout the school. The school district authorized software package for classroom management is G Suite for Education where individuals have school district email accounts and access to apps such as Google Classroom (GC), Google Docs, Google Sheets and Google Forms. It is not mandated that teachers or students use this software package, but it is authorized and supported by the school district. Teachers have varying levels of skills with technology and the use of G Suite and GC.

Research Design

The research for this thesis was designed to provide a composite, multi-dimensional view of the use and perception of GC by grade 8 students (age 13-14) and their teachers in the 2019-20 school year, when there was an unprecedented change in learning with the shift to ERL during the COVID-19 global pandemic. The main design principle was that the answers to the broader questions would be based on the results of the three linked studies, herein called Study A, Study B, and Study C, each with its own purpose, participants, and procedure, all of which are discussed in the following sections.

At the core of the design was the decision to use grade 8 Science students as the student participants. The 87 students in Study A were a subset of the 119 students in Study B. The teacher in Study A was one of the 12 teachers in Study C. The teachers chosen for Study C were the English language teachers of the students in their core content classes: English, French, Math, Science, and Social Studies.

To answer “How did students and their teacher use GC before and during ERL?” (Study A), public and private comments were collected throughout the year and later analyzed in terms of monthly distribution of comments sent, of initiating author, of audience, and of comment purpose. A survey was used to answer “How did students perceive the value of GC during ERL?” (Study B). To answer “How did teachers perceive the value of GC during ERL?” (Study C) a parallel survey with similar questions was used, but from the perspective of the teacher.

Consent was collected through the surveys sent, and all of the data collected was anonymized during analysis. The data is stored on a secure server located in Canada that is

managed by the school district IT department. Basic assumptions made were that all students had access to an internet enabled device and a smartphone with the GC app installed, that notifications from the GC app were enabled, and that all students had access to GC for their coursework.

Study A - Student-Teacher Comments in GC

Purpose.

The purpose of Study A is to establish how students used GC with their teacher before and during ERL during the 2019-20 school year.

Participants.

Study A comprises a total of 87 students, 45 male (51.7%) and 42 female (48.3%), from 4 grade 8 Science classes, and their teacher. The students in Study A are a subset of the students participating in Study B.

Procedure.

Study A was carried out by manually reviewing and analysing over 1000 public and private comments in GC. Public comments were collected from the “Stream”, a tab in GC where assignments, questions, and other activities are posted in chronological order. The “Stream” is a virtual forum where teachers and students can post publicly. This creates a “micro” social networking site restricted to the participants of the class. Notes introducing assigned work were not counted as comments. Private comments, where students can correspond directly with their teacher without being visible to the rest of the class, were collected from posted assignments.

All comments were coded at the end of the school year once classes were no longer in session. The comments were divided into two time periods, the seven months of pre-ERL learning (September 3, 2019 - March 31, 2020) and the two months of ERL (April 1 - May 30, 2020). Comments from June 2020 were coded, but not included as there was a modification to the learning environment where students could optionally attend school in a blended learning model. Once coded, all comments were organized chronologically by date and monthly comment counts and corresponding percentages were calculated.

The comments were coded for the following variables:

- Audience (public comments versus private comments)
- Initiating author (teacher, student, male student, female student)
- Purpose

To categorize comment purpose, this study used the three dimensions of student-teacher relationships as first outlined by Rebecca Ang in her 2005 study on teacher-student relationships. Each comment from GC during the time period of study (September - May) was reviewed, anonymized and coded according to Ang's dimensions of Satisfaction, Instrumental help, and Conflict. Satisfaction refers to experiences between students and teachers and positive adjustments to school. Instrumental help refers to the student-teacher relationship with the teacher as a resource (advice, help, sympathy). Conflict refers to negative and unpleasant experiences related to behavioral problems and engagement in class (Ang, 2005).

The Instrumental help category did not capture the more interesting differences among message purposes. As a result, this category was further subdivided into the three new classes of Question, Information, and Feedback. Question refers to comments where a question is being asked or where clarification is requested. Information refers to comments where information is shared between individuals or where simple conversation is taking place with no specific questions or feedback. Feedback refers to comments where feedback is given on work submitted.

Examples illustrating public and private comments and how they were coded according to comment purpose are shown in Table 1.

Table 1. Examples of GC comments and coding according to purpose

Public comment thread between two students with two comments.

Student A: “What should we include on our study guide? Where can we get the information?” (Instrumental help - Question)

Student B: “you can use a text book to get your information” (Instrumental help - Information)

Private comment thread between teacher and student with five comments.

Teacher: “Please review again. I will provide more detailed feedback on a later effort.” (Instrumental help - Information)

Student: “Aren't we allowed to edit responses until tomorrow?” (Instrumental help - Question)

Teacher: “For sure and after that too. I just wanted to send back for the ones that did it quickly.” (Instrumental help - Information)

Student: “Oh, okay.” (Instrumental help - Information)

Teacher: “Careful with the terms - don't forget definitions. Wavelength can also be measured as the same place on 2 waves next to each other. If it starts at 0 going up, 1 wavelength would be the next time it goes through 0 AND is going up.” (Instrumental help - Information)

Private comment thread between student and teacher with 6 comments.

Student: “Hi. I finished the quiz, can you manually check my answers again?” (Instrumental help - Question)

Teacher: “For sure.” (Instrumental help - Information)

Teacher: “Nice work. Some of you still need to write definitions in addition to the terms.” (Instrumental help - Feedback)

Student: “Can I know which question is the one I got wrong on so I can re do that question?” (Instrumental help - Question)

Teacher: “Once I send it back you will be able to see and resubmit” (Instrumental help - Information)

Teacher: “Nice work.” (Instrumental help - Feedback)

Study B - Student Perceptions of GC during ERL

Purpose.

The student survey (Appendix 1) was designed to investigate student perceptions surrounding the use of GC during ERL.

Participants.

Study B consists of data collected from a survey sent to students (age 13-14) in their English language Science 8 class. It was sent to 160 students with a total of 129 students responding and 119 agreeing to participate in research. All data collected was anonymized during analysis. The students in Study A are a subset of the students in Study B.

Procedure.

The Study B survey was inspired by and based on previous studies investigating student-teacher communication using text messaging (Hayes et al., 2013) and WhatsApp messaging (HersHKovitz et al., 2019). The student survey included an informed consent section, a demographics section and the main section with 13 Likert-style questions (5-point scale) and two open response questions. In order to facilitate ease of completion, the survey questions were kept short. Open response questions were simple to allow respondents the freedom to elaborate on their thoughts around the use of GC.

The only background variable used to segment the population of students was gender. Students were asked if they used GC for communication before ERL and were prompted with the following note to clarify the meaning of communication in GC: "Communication in Google Classroom is done using comments in the stream, comments on assignments or private comments on assignments". They were also asked how often they communicate using GC messaging during ERL in each of their academic courses (English, French, Math, Science and Social Studies). The survey was distributed after 7-8 weeks of ERL with most students responding within one week.

The Likert questions for the student research survey are a subset of the 15-question survey from the WhatsApp study published by HersHKovitz et al. (2019), which in turn is a subset of the 30-question survey reported on by Hayes et al. (2013) concerning text message communication. In the case of the current student research survey, each instance of the word

WhatsApp was changed to GC. The following two questions from the Hershkovitz et al. (2019) WhatsApp study were omitted:

1. I like receiving non-academic WhatsApp messages from my teacher.
2. The contents of WhatsApp messages I receive from my teacher are appropriate.

The omitted questions were replaced with the following open response questions:

1. In what ways did using Google Classroom prior to Emergency Remote Learning (September 2019 - March 2020) make the transition to Emergency Remote Learning easier?
2. What is the best thing about Google Classroom?

The general open response questions were designed to allow students the flexibility to express their thoughts about using GC without constraining prompts.

Statistical methods used to analyse the Likert questions were mean, standard deviation and percent of responses with a score of 4 or 5 taken as an indication of agreement. This method of analysis was used for consistency with the previous studies on the topic of student-teacher communication.

The survey was prepared using Google Forms and was securely distributed to students registered in Science 8 through their Science 8 GC. The Google Form was restricted to users within the school district and its trusted organizations. Data from the survey were exported to Google Sheets for anonymization and analysis. Google Forms was chosen as the tool for collecting data as it is a familiar tool for the intended audience, they are intuitive to use, and they can easily be completed using any internet enabled device.

Study C - Teacher Perception Survey

Purpose.

The teacher survey (Appendix 2) was designed to investigate teacher perceptions surrounding the use of GC during ERL.

Participants.

Study C consists of data collected from the core academic subject teachers (English, French, Math, Science, Social Studies) of the students in Study B. Core academic subjects were chosen as these courses are required to be taken by all grade 8's in the English language

stream. Not all grade 8 students are taught by teachers of elective courses at that grade level. The survey was sent to 14 teachers, with 12 teachers responding and giving consent to participate. All data collected were anonymized during analysis.

Procedure.

The survey used for Study C was adapted from the Study B survey, but was changed to evaluate perceptions of teacher-student communication from the teacher's point-of-view. The survey was distributed after 7-8 weeks of ERL, with most teachers responding within one week and the remaining teachers completing the survey before the end of the school year in June.

As a subset of the student survey, but from the teacher's perspective, questions were altered to reflect the audience. In other words, "teacher" in the Study B survey was replaced by "student" in the Study C survey. The following six questions were removed:

1. I enjoy GC messaging with my teacher.
2. I like receiving messages in GC about school-related issues.
3. GC messaging with my teacher is beneficial to me.
4. I like Science more as a result of communicating with my teacher in GC.
5. GC messaging with my teacher has helped me in the learning process.
6. Open response question: In what ways did using Google Classroom prior to Emergency Remote Learning (September 2019 - March 2020) make the transition to Emergency Remote Learning easier?

The six removed questions were replaced with two new questions as follows:

1. GC messaging with my students has helped me to adapt lessons in my daily learning environment.
2. GC messaging with my students has improved my relationship with them.

The remaining open response question was included to allow teachers the ability to express their thoughts about using GC without prompts.

The same statistical methods as were used for the student survey were used to analyse the Likert questions (mean, standard deviation and percentage of responses with a score of 4 or 5 taken as an indication of agreement). These methods were used to maintain consistency with

the student survey and previous studies carried out on the topic of student-teacher communication.

The teacher survey was handled similarly to the student survey, being prepared using Google Forms and including the same restrictions. Upon completion, the data were collected and exported to Google Sheets for anonymization and analysis. The survey was distributed by email through the school server.

Results and Discussion

Study A - Student-Teacher Comments in GC

The first study investigates the type of communication taking place between student and teacher through public and private comments in GC. A total of 1015 comments were individually classified. During the period September - March, prior to ERL, many comments were singular with no response as students were seen in the classroom and comments could be addressed face-to-face. Throughout the year, prior to ERL and during ERL, many comments were “call and response” with a question and reply. There were also cases where several comments comprised a series or thread.

Comment Initiation.

There were a total of 316 comments initiated, with 144 initiated by the teacher and 172 initiated by the student. In seven of the nine months of the study, the 87 students initiated a greater proportion of comments (54.4%) than the teacher (45.6%) (Table 2).

Table 2. Monthly distribution of comment initiation expressed as percentages

Comment Initiator	Total	Prior to ERL								
		During ERL								
		<u>Sep</u>	<u>Oct</u>	<u>Nov</u>	<u>Dec</u>	<u>Jan</u>	<u>Feb</u>	<u>Mar</u>	<u>Apr</u>	<u>May</u>
Teacher	45.6	3.8	7.0	5.1	4.1	5.1	4.7	2.2	11.4	2.2
Student	54.4	0.6	7.9	6.0	5.4	8.5	7.0	2.8	10.4	5.7
Male	29.7	0.6	4.4	2.5	4.4	4.7	3.5	1.3	5.1	3.2
Female	24.7	0.0	3.5	3.5	0.9	3.8	3.5	1.6	5.4	2.5
All	100.0	4.4	14.9	11.1	9.5	13.6	11.7	5.1	21.8	7.9

The teacher initiated a greater proportion of comments than the students during the two months when the classes were facing a new learning situation, the beginning of the school year in September, and the beginning of ERL in April. The proportion of comments attributed to the teacher would have been greater had the introductory note in assignments been included in the comment count. Only in September are almost all comments initiated by the teacher (3.8%) compared to students (0.6%). The proportion of comments made by the teacher and students are similar in October, November and December, each of which have more student initiated comments. In January and February there are considerably more student initiated comments, with the most in January. This trend changed in April when the teacher initiated over half of the comments, corresponding with the start of ERL. Student initiated comments also peaked in April (10.4%). In May, students again initiated the greater number of comments. There is no overall gender difference among students with respect to the proportion of comments initiated. Males comprise 51.7% of the students, and they accounted for 54.6% of the student comments. Generally, the monthly distribution of comments reflected events in the school calendar with holiday breaks in December and March and term ends in November and early March. Commenting was greatest during the month prior to term end and the month after a holiday break.

Comment Audience.

Comments sent in GC are predominantly private (79.1%) indicating that most communication between teacher and student is taking place directly on a one-on-one basis (Table 3).

Table 3. Monthly distribution of public and private comments expressed as percentages

Comment Class	Total	Prior to ERL								During ERL	
		<u>Sep</u>	<u>Oct</u>	<u>Nov</u>	<u>Dec</u>	<u>Jan</u>	<u>Feb</u>	<u>Mar</u>	<u>Apr</u>	<u>May</u>	
Public	20.9	2.0	4.6	1.0	1.3	3.6	1.5	0.3	6.0	0.6	
Private	79.1	0.0	3.5	6.8	4.3	16.2	19.3	3.5	19.2	6.2	
Total	100.0	2.0	8.2	7.8	5.6	19.8	20.8	3.8	25.2	6.8	

The only months when public communication exceeds private communication are September and October, when the school year is beginning and as students are learning how to

communicate in GC with their teacher. Public comments are at a peak during ERL, as expected, but the number of private comments in February (19.3%) and April (19.2%) are nearly the same, implying that ERL did not necessarily increase the number of private comments.

Nearly one third (32.0%) of total comments were sent during ERL, with one quarter (25.2%) sent in April. There are additional notable increases in activity during January (19.8%) and February (20.8%), which can be attributed to the return from winter break when students are re-engaging in classroom learning, and the approaching end of term in early March with a push to complete missed assessments. Based on the distribution of comments, students were actively engaged with their learning during ERL and were communicating with their teacher as they might have in the classroom during regular classroom learning. Comments are not evenly distributed throughout the year, with 65.8% of all comments in three months and 25.2% of comments during the first month of ERL.

Comment Purpose.

The "dimensions of communication" defined by Ang (2005) were applied to the 1015 public and private comments in GC resulting in what appeared to be a heavily skewed distribution of purpose with 3.3% Satisfaction, 96.1% Instrumental help, and 0.7% Conflict (Table 4).

Table 4. Monthly distribution of comment purpose expressed as percentages

Comment Class	Total	Prior to ERL					During ERL			
		Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
Satisfaction	3.3	0.0	0.2	0.4	0.2	0.5	0.1	0.2	1.2	0.5
Instrumental help	96.1	2.0	8.0	7.2	4.9	19.3	20.7	3.6	24.0	6.3
Conflict	0.7	0.0	0.0	0.2	0.5	0.0	0.0	0.0	0.0	0.0
Total	100.0	2.0	8.2	7.8	5.6	19.8	20.8	3.8	25.2	6.8

Satisfaction and Conflict were not frequently expressed, with Satisfaction only comprising 3.3% and Conflict only 0.7% of all comments. There was an increase in Satisfaction based comments during April, with one third of all Satisfaction comments in that month.

Instrumental help was the most heavily used comment class, with significant activity in

January (19.3%), February (20.7%) and April (24.0%). As noted previously, the increased activity relates to the return from winter break, end of term and start of ERL.

The skewing of Instrumental help results was overcome by further subclassifying the 975 comments in this class into Question, Information and Feedback (Table 5). This subclassification revealed that 21.8% of comments were questions seeking direction, 12.1% were feedback on work completed and 66.1% was transmission of information. The Information purpose acted as a catch-all for comments that didn't fit any other purpose as comments or comment threads either contained specific responses to questions or short conversations between the teacher and student. Again, the monthly distribution for each subclass varies. For Information, the highest percentages are found in January and February, with April third, and for Feedback the highest percentage is found in April, with November second. Further subclassification of the Information comment purpose would provide further insight to the content of student-teacher communication.

Table 5. Monthly distribution of Instrumental help (IH) subclasses expressed as percentages

IH subclass	Total	Prior to ERL					During ERL			
		Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
Question	21.8	0.0	1.9	1.3	1.4	3.5	3.6	1.4	7.1	1.5
Information	66.1	2.1	5.6	3.0	2.2	16.0	17.4	1.6	13.6	4.5
Feedback	12.1	0.0	0.7	3.2	1.5	0.6	0.5	0.7	4.3	0.5
Total	100.0	2.1	8.3	7.5	5.1	20.1	21.5	3.8	25.0	6.6

Study B - Student perceptions about communication using GC during ERL

The second study investigates student perceptions about using GC for communication during ERL using a survey that is divided into sections, including informed consent (Appendix 1). The first section consists of questions collecting background information for gender, if GC was used prior to ERL in core content classes, and the frequency (using a Likert scale) with which GC was used for communication during ERL. The last section consists of 13 questions regarding perceptions of using GC for communication with teachers and two open response questions asking if using GC prior to ERL made the transition to learning remotely easier and what students like the most about GC.

Participation was voluntary and the rate of student participation was 119 out of 160, or 74%. Of the students participating in the research, there was a strong indication that they used GC to communicate with their teachers prior to ERL (Table 6). The exception was French, where significantly more students responded that they did not use GC for communication with their teacher.

Table 6. Student use of GC prior to ERL expressed as percentages

Subject	Yes	No
English	81%	19%
French	62%	38%
Math	79%	21%
Science	88%	12%
Social Studies	87%	13%

Mean scores and standard deviations for use of GC during ERL in each subject are shown in Table 7. Additionally, the number of scores of 4 or 5 are shown as a percentage of the total number of responses ($n=119$), and is taken as an indication of frequency with which GC is used by students. Most students indicate that they use GC to communicate with their teacher with some frequency, except in French, where it does not appear to be used as often. Means in all subjects are between 3.68 and 3.76, except French, where it is 2.88. It should be noted that the second lowest mean was in Science ($M=3.68$). The 119 Science students in this survey included the 87 Science students from Study A.

Table 7. Frequency of student use of GC during ERL

Subject	Mean	SD	% ≥ 4
English	3.73	1.09	64%
French	2.88	1.46	38%
Math	3.76	1.12	59%
Science	3.68	1.19	58%
Social Studies	3.68	1.11	61%

Note. 5 = Very Often; 4 = Often; 3 = Sometimes; 2 = Rarely; 1 = Very Rarely.

The general perception of using GC during ERL was very positive (Table 8). Question 1 of the survey was the most broad and general and had both the highest mean ($M=4.23$) and percentage of agreement (79%). Almost all students felt that being in touch with their teacher during ERL was a good idea. In the Hayes et al. (2013) survey of university undergraduates, this question also had the highest mean and the second highest percentage of agreement (91%) out of 30 questions. In the current study this result is not surprising since most students had used GC before ERL and GC was the primary form of OCC in their Science 8 class.

Table 8. Student survey results for communication in GC during ERL

Statement	Mean	SD	% ≥ 4
1. Being in touch with my teacher in GC is a good idea.	4.23	1.04	79%
2. I like receiving messages from my teacher in GC.	3.82	1.11	68%
3. I would like to receive more messages from my teacher in GC.	3.33	1.05	43%
4. I enjoy GC messaging with my teacher.	3.48	1.05	48%
5. I like receiving messages in GC about school-related issues.	3.70	1.08	59%
6. My teacher is more approachable as a result of using GC.	3.50	1.14	51%
7. GC messaging with my teacher is beneficial to me.	3.86	1.00	63%
8. I like Science more as a result of communicating with my teacher in GC.	3.23	1.11	38%
9. GC messaging with my teacher has increased my motivation to learn.	3.21	1.17	43%
10. GC messaging with my teacher has increased my engagement in Science.	3.23	1.13	43%
11. GC messaging with my teacher has increased my participation in Science.	3.26	1.13	39%
12. GC messaging with my teacher has helped me in the learning process.	3.67	1.03	63%
13. Receiving GC messages from my teachers is intrusive. ^a	2.43	1.18	18%

Note. 5 = Strongly Agree; 4 = Agree; 3 = Neutral; 2 = Disagree; 1 = Strongly Disagree.

^a reverse coded question

Five of the survey questions were concerned with the student as a learner (7, 9, 10, 11, and 12). It is important to note that all five questions are structured the same way, starting with “GC messaging with my teacher is/has”. Questions 7 and 12 were more general, presenting the student as a recipient of general benefit or help with the learning process from GC messaging with the teacher. These two questions had the same relatively high level of agreement (63%) and the highest means among the five questions ($M=3.86$ and $M=3.67$). The low SD’s (1.00 and 1.03) suggest that there was greater agreement about these responses than about others in the survey. It is interesting that in the Hayes et al. (2013) study, these two questions produced distinctly different results, with the more general question about messaging being beneficial receiving almost as much agreement as question 1 (89% compared to 91%), and the question about messaging being helpful for learning having an agreement of 73%. A possible explanation could stem from the age of the respondents, where university students may have a greater awareness of their learning and what could benefit them.

Three questions (9, 10, and 11) ask whether GC messaging has increased students’ motivation to learn, engagement with Science, or participation in Science. In contrast to the more general questions with higher agreement (7 and 12), these three questions elicited more neutral responses ($M=3.21$, $M=3.23$, $M=3.26$), among the lowest in the survey, and had among the lowest percentages of agreement (43%, 43%, and 39%) as well. At the same time, the SD’s (1.17 and 1.13) indicate higher variability within the sample. Questions 9, 10, and 11 considered student characteristics (motivation, engagement and participation), which could be challenging for young students to assess or difficult for ESL students to understand. The “neutral” response for increased motivation to learn, increased engagement and increased participation due to messaging with their teacher in GC during ERL suggests that they may have chosen this response as a default and that they were using GC as a tool and trying to complete the work that was assigned to them during a challenging and unfamiliar new learning environment. The responses to the equivalent three questions in the Hayes et al. (2013) study are also clustered near the “neutral” response of 4 on the 7-point Likert scale ($M=4.31$, $M=4.34$, and $M=4.55$) with the percentage of agreement being 52%, 50%, and 52%, all among the lowest of the 30 questions. In both studies the internal spread among the three questions was remarkably small, with 2% for the university students and 4% for the high school students, even though the level of agreement was approximately 10% higher for the

university students. It is more difficult to argue that university students are unable to assess personal characteristics such as motivation.

Four questions in the survey specifically targeted receiving GC messages (2, 3, 5, and 13) and included one reverse coded question (13). A large proportion of students agreed (68%) that they liked receiving messages from their teacher in GC ($M=3.82$) and somewhat fewer (59%) indicated that they liked receiving messages in GC about school-related issues ($M=3.70$). Students were less enthusiastic about receiving more messages (43%). The response to this question suggests that students may equate more messages with more work for themselves. Hayes et al. (2013) reports a very similar difference (31% compared to 25%) between liking to receive text messages (86%) and wanting to receive more text messages (55%). Question 5 does not have a clear equivalent in Hayes et al. (2013), but 59% of students indicated that they liked receiving messages in GC about school-related issues. Students did not agree that GC messaging with their teacher during ERL was intrusive ($M=2.43$), supporting the strong agreement ($M=4.23$) of the first question. Over all, very few students perceived messaging as intrusive (18%), similar to the results in Hayes et al. (2013) at 16%.

This leaves three questions (4, 6, and 8), two of which raise similar issues to previous questions. The means and the degree of agreement are very similar for questions 4 and 6. Students appear to make a distinction between liking to receive messages from their teacher (question 2, with agreement at 68%) and enjoying messaging with their teacher (question 4, with agreement at only 48%). In other words, the students may enjoy being recipients of communication more than senders of communication; this may also be related to their reluctance to receive more messages, as from their point of view receiving more messages may equate to having to send more messages. The result for question 4 cannot be directly compared to Hayes et al. (2013) because it is a more general question about messaging. Question 6, however, is directly comparable, and the results for the university students indicate significantly greater agreement (80% compared to 51%) when asked about messaging increasing the approachability of their instructor or teacher. This result is surprising given that during ERL the primary method of communication with the teacher was through messaging in GC and they had a pre-existing relationship formed throughout the year, prior to ERL. The results for question 8 indicate that the students used GC for utility during ERL, messaging their teacher when it suited them and this communication may have helped them to break a

social barrier. It is also possible that the results for this question may have been skewed as the students were aware that their teacher would be evaluating the survey responses and they may not have wanted to be seen in a negative light. If this is true, it could mean that the results may have been even less positive. When asked the same question, the university students in the Hayes et al. (2013) study also responded unenthusiastically, similar to the questions regarding motivation, engagement and participation.

Since it was assumed that using GC prior to ERL would have made it easier for students to use GC during ERL, the purpose of the first question in the Study B survey (In what ways did using Google Classroom prior to Emergency Remote Learning (September 2019 - March 2020) make the transition to Emergency Remote Learning easier?) was to have students identify which features of GC made the transition easier. Of the 119 students responding to the survey, 102 provided responses to this question, for a participation rate of 86%. The general response was positive and students agreed with the unstated but implied assumption that having familiarity with GC from the start of the year in September made the transition to ERL in April easier. Although the general response was positive, this was indirectly implied by the question and students did not clearly articulate how it was easier, making the question less productive than hoped for. The 10 responses that came closest to answering the question are shown in Table 9.

After reviewing the responses, the outcome turned out to be more of a secondary evaluation of GC reflecting similar themes as the second open response question discussed below. Another issue arising from this question is that English language learners may not have had a clear understanding of the question, leading to less informative responses. Appendix 3 lists the full set of responses excluding those found in Table 9.

Table 9. Subset of student responses to the open response question “In what ways did using Google Classroom prior to Emergency Remote Learning (September 2019 - March 2020) make the transition to Emergency Remote Learning easier?”.

Response
1. “Google classroom makes the remote learning easier is because teacher can post anything that we have to learn or finish as form of doc or PDF, if there are any problems, teachers can contact students immediately, and students can contact teacher if they have any problem.”
2. “I think that it is not make learning easier at all. If anything, it makes it much harder because we cannot really learn anything other than learning by our selves in text books and other different resources. I would very much want to go back to school”
3. “You can communicate with teachers, easy to use, and a good way of learning”
4. “It was better and we could contact our teachers easier; being able to contact teachers anytime”
5. “It became more easier to communicate with teachers”
6. “I was able to connect with some of my teachers to find out about some questions that I didn’t understand and it also made the completing assignments less complicated.”
7. “Google classroom made it easier for students and teachers to stay in touch, keep doing assigned work and means of communication.”
8. “I already new how GC worked and we had been using it all year so it was easy and not much changed. For my friends at other schools they are using Microsoft teams and they are very confused and missing some work sometimes.”
9. “This emergency learning is a little bit harder for learning. for me its hard because, when i ask a question that i’m unsure, I would have to wait for my teacher to respond. if i wait for 10 minutes and there isn’t a respond, i would probably go into my free time and forget about the question, and check back on it tomorrow to see if my teacher responded.”
10. “by being able to be guided through the course/assignments.”

The second open response question of the Study B survey (What is the best thing about Google Classroom?) asked the students to express their opinions about the best aspects of GC. This question was also optional, with 105 students choosing to respond, for a participation rate of 88%. As with the first open response question, most students were very satisfied with GC. The length of student responses varied from a single word to clearly written comments in which some students provided genuine responses with a critical outlook on how GC was an effective tool in their learning and how it helped them to be more academically successful. The main underlying themes noted in the student responses are ease and simplicity of use, organization and management, and communication. Table 10 displays a 20 response subset of the 105 student responses to the second open response question.

Table 10. Select student responses to the open response question “What is the best thing about Google Classroom?”.

Response
1. “The easy accessibility as it can be accessed across different devices.”
2. “I love how you can use it very easily and it’s very accessible, also it notifies you when a assignment is about to be due.”
3. “Being able to see and manage assignments from classroom to google drive.”
4. “By turning on notifications, I have not missed a single beat. I am always updated on everything that happens and I am becoming more successful and having less errors.”
5. “It is easy to access and convenient for me to organize my classworks.”
6. “More organized and convenient to keep track of work and to get hold of teacher etc.”
7. “The To-Do List because it shows all of my classroom assignments that are late, that I've done and that I need to do, efficiently organizing my workload.”
8. “Submit a lot of assignments makes me feel well”
9. “I can spend my time on homework whenever I want”
10. “I can do assignment online and I can ask for help.”
11. “the best thing about google classroom is when is shows the due date and sends notifications to you so you never hand in an assignment late.”
12. “knowing the due dates of my works, so I can manage my time better”
13. “It sends you emails when new work is assigned and the best part is it tells you when upcoming work is due which is very helpful.”
14. “clear schedules, time frames for assignments, and ability to contact teachers/peers.”
15. “The best thing about google classroom is probably the ability to see all your assignments and when they are due and also the ability to communicate with your teacher through private comments.”
16. “the best thing in Google Classroom in my opinion, is the private comments. the reason i like this part is because i sometimes ask a lot of questions. Sometimes i barely know the answer to the question, but i would like to make sure by asking my teacher about it privately.”
17. “Even if student can't go to school, it seems to be good for Google Classroom to be able to communicate with the teacher.”
18. “instead of emailing you can private comment”
19. “The best thing about google classroom is that we can all communicate, just like in a classroom. Although it's different from face to face communication, we still can talk to our teachers and classmates through the comments on google classroom.”
20. “Nothing is good abt it”

In the full set of 105 responses, there were 29 statements recognizing the ease and simplicity of use of GC. Examples from Table 10, include responses 1 and 2, the former of which mentions the fact that GC “can be accessed across different devices”. By accessing their work seamlessly across devices, students have fewer limitations. They can connect and work from their PC, tablet or handheld smart device from anywhere, so long as they have battery life or a power supply.

The second major theme recognized in the full comment list was organization and management, with 28 references. Responses 2-15 in Table 10 illustrate this theme. Student responses included indirect appreciation for GC integration with Google Calendar as they receive notifications for upcoming due dates. GC also creates a student specific to-do list to help them stay on track and help with time management. The students that wrote responses 11-15 specifically mentioned due dates and time frames, indicating their concern for getting work submitted on time.

The third major theme was communication in GC, with 16 references. Responses 14-19 in Table 10 illustrate this theme. Students recognized that GC was an effective communication tool in the classroom, both real and digital, allowing them to connect with classmates, as well as providing them a direct line to their teacher, whether publicly or privately. The student that wrote comment 16 illustrated that they valued the ability to connect with the teacher privately in GC as they recognized that they ask a lot of questions and wanted to be able to confirm the answers.

Only 3 students responded very negatively, stating that nothing about GC is good (eg. Table 10, response 20). Appendix 4 lists the full set of responses excluding those found in Table 10.

Study C - Teacher perceptions about communication using GC during ERL

The third study looks at teacher perceptions about communication using GC during ERL using a survey that was divided into sections, including informed consent (Appendix 2). The first section consists of three questions identifying subjects taught by teachers, if GC was used prior to ERL and the frequency with which GC was used for communication during ERL using a Likert scale. The second section consists of 10 questions regarding perceptions of

using GC for communication with students and an open response question asking what was liked about GC.

Participation was voluntary and the rate of teacher participation was 12 out of 14, or 86%. Of the 12 teachers that responded, 10 indicated that they used GC to communicate with their students prior to ERL. The exceptions were teachers of English and Math (Table 11).

Table 11. Number of teachers using GC prior to ERL

Subject	Yes	No
English	3	1
French	1	0
Math	1	1
Science	3	0
Social Studies	2	0

The French teacher indicated that GC was used for OCC; however, 38% of students from Study B reported not using it in that class. This indicates that although the teacher may have been using GC for OCC, students did not necessarily use it the same way.

Most teachers indicated that they chose to use GC as a regular method of communication during ERL, with a mean score of 4.67 (SD=0.65). The options “very often” and “often” were chosen by 11 out of 12 teachers (92%), indicating a very high frequency of use. This is expected due to the convenience with which teachers can communicate with students in GC and that most teachers had used GC prior to ERL. Alternative methods of communication included Google Meets, telephone calls and individual emails.

As in Study B, the most general question of the survey (1) had the highest mean (M=4.75) and in this case 100% agreement (Table 12). This could be attributed to the convenience with which teachers were able to use GC for communication with their students. During ERL all of the teachers used GC and 10 of them reported using it prior to ERL.

Table 12. Teacher survey results for communication in GC during ERL

Statement	Mean	SD	% ≥ 4
1. Being in touch with my students in GC is a good idea.	4.75	0.45	100%
2. I like receiving messages from my students in GC.	4.00	1.04	83%
3. I would like to receive more messages from my students in GC.	3.08	1.16	42%
4. My students are more approachable as a result of using GC.	3.33	0.78	33%
5. GC messaging with my students has increased their motivation to learn.	2.92	0.90	25%
6. GC messaging with my students has increased their engagement in my class.	2.92	0.79	17%
7. GC messaging with my students has increased my participation in my class.	2.67	1.07	25%
8. GC messaging with my students has helped me to adapt lessons in my daily learning environment.	3.17	1.27	42%
9. GC messaging with my students has improved my relationship with them.	3.08	1.44	50%
10. Receiving GC messages from my students outside of class is intrusive. ^a	2.17	0.94	8%

Note. 5 = Strongly Agree; 4 = Agree; 3 = Neutral; 2 = Disagree; 1 = Strongly Disagree.

^a reverse coded question

The responses to the questions related to receiving messages again showed even greater agreement than in Study B. Teachers indicated that they liked receiving messages from their students during ERL (M=4.00), with an agreement of 83%, but, similar to students in Study B, they were less enthusiastic regarding receiving more messages (M=3.08), with only 42% agreement. This suggests that teachers perceived that an appropriate amount of OCC was taking place and they probably had a lower interest in receiving more messages as it could have meant more work to do in an already strained teaching environment. In question 10, which was reverse coded, teachers generally disagreed that receiving GC messages from their students outside of class was intrusive (M=2.17), which supported their very strong agreement

($M=4.75$) for the first question about being in touch with their students in GC being a good idea. Only one teacher perceived messaging as intrusive.

Only one third of teachers agreed (33%) that their students were more approachable as a result of using GC. The neutral mean ($M=3.33$) may suggest that the neutral response was being chosen as a default value. It is interesting that more students (51%) agreed that their teachers were more approachable, but perhaps teachers do not consider whether their students are more approachable or not, as it is their job to connect with them when required.

The majority of teachers chose the “neutral” response or “disagree” when asked if GC messaging during ERL increased their students' motivation to learn or their engagement in class. Although the means for questions 5 and 6 were identical ($M=2.92$), fewer teachers chose “strongly agree” or “agree” when it came to engagement (17%) than for motivation (25%). This leads to the question of how teachers measure motivation and engagement during a time when students are trying to keep up with their assigned workload during the pandemic. It is also possible that some teachers may have interpreted “in my class” as literally being in the classroom.

In answering question 7, the teachers disagreed when asked whether GC messaging with their students during ERL increased the teacher's participation in class ($M=2.67$). The particular wording of the question may have been misinterpreted to read “increased student participation in my class” which would have yielded a different result. Possibly inserting “own” after “my” could have solved the problem.

When asked in question 8 about GC messaging and adapting lessons “on-the-fly” to suit the needs of their students, most of the teachers chose “neutral” ($M=3.17$), or perhaps disagreed with the statement. This may be explained by a more formulaic approach while following a specific schedule during ERL. It should be noted that 42% of teachers chose “agree” or “strongly agree”, indicating that they are trying to adapt lessons. In this case, due to the small sample size, the mean is less revealing than proportion of agreement. The relatively large SD (1.27) may also indicate that there is considerable polarization in the responses.

In question 9, half of the teachers chose “strongly agree” or “agree” when responding to the question asking if GC messaging has improved their relationship with their students. Again, however, the mean at 3.08, with the highest SD (1.44), suggests a polarization of responses and a greater disparity among teachers in the small population.

It should be noted that the teacher population in Study C was only 10% of the student population in Study B, and that each respondent had a significantly greater impact on the resulting means. Perceptions were communicated from the perspective of the courses that the teachers taught. They were unaware of the degree of engagement students had in other classes during ERL and had to gauge participation and engagement as a function of assigned work submitted through GC. Also, students may have behaved differently in their Science class when compared to other classes.

The open response question in the Study C survey (What is the best thing about Google Classroom?) asked the teachers to articulate what they felt were the best aspects of GC (Table 13). This question was optional and had a 100% response rate, with teachers generally indicating that GC is an asset to their teaching, but it does not replace what they do in the classroom. The main themes brought up were convenience, organization, and communication. Teachers commented that GC was easy and convenient to use, was accessible across devices and came with the ability to share information quickly and simultaneously across their classrooms. As an organizational tool, GC was noted as being a repository for files, keeping them in one central place, on a single platform. In terms of communication, teachers commented on the ability to actively and directly engage with students and were able to keep in “constant contact” with them, which was critical during ERL.

Table 13. Teacher responses to the open response question “What is the best thing about Google Classroom?”.

Response
1. “It is user friendly and it is a way to connect during COVID.”
2. “The ability to quickly share information. Also, the ability to document correspondence and student work.”
3. “You have the ability to be in constant communication with the students so if they don't submit something, you can contact them. They can also write for clarification on an assignment rather than having to track me down in a building. However, this can be very intrusive since a lot of messages are coming in at all hours (even in the middle of the night) from the students.”
4. “I do like the additional method of staying in touch, sending out announcements, sharing articles, etc. I tend not to use it for marking or extensive comments. It is a very handy platform but it aids, not alters, my practice.”
5. “Just a quick note on the last question, you don't have to check messages outside of class time so it shouldn't be intrusive.... anyways, I like the fact I can post a message or assignment to multiple classes at once so I can communicate with all of my students in various blocks simultaneously. I also like the fact I can schedule things to post at a future time and date.”
6. “If multiple teachers across different subject areas all use GC, then GC is an excellent learning management system that keeps all student work, and communication organized around a singular platform. The integration of Google Meet to allow for live sessions is a game changer that allows for remote, live teaching. I am hopeful that Google integrates chat into GC, which would improve communication further by allowing better asynchronous communication with kids. (I don't think kids like emails)”
7. “I like that I can use it as a repository for their homework. When we go back to in-class teaching, I will at least continue with that aspect. I don't normally collect homework, but this is a good way of doing so and keeping it organized.”
8. “It's easily accessible for students and teachers from everywhere”
9. “The organization. It helps me keep my course organized and transparent. The students always know where they are at, how they are doing, and what they have done/not done. It also helps keep me motivated to return assessments in a timely manner so that the platform reflects their progress.
10. “GC provides an open and direct line of communication between teacher and student.”
11. “I would like to note that my response of 3 to many of the questions above is based on my taking 3 as 'neutral' or 'neither agree nor disagree'. The biggest thing I have observed with my Socials 8 class since we have been socially isolating is that the students who struggled with handing work in on time have been the ones most likely to struggle with submitting work on GC too. Students who were actively engaged in class are often the first ones to ask questions, hand assignments in etc on GC during this time as well.”
12. “Offers a central location for material to be placed.”

General Discussion

Both students and teachers responded very positively to GC. They specifically commented on its use as a tool for organization and management, as well as for communication. They both reported that GC was easy to use and the students noted that it was effective in helping them to keep track of their school work, course files and to get their assignments completed on time. Communication through comments can be used to enhance the connection between students and teachers, especially when contact time is limited. The ability to communicate directly in GC mimics the communication that takes place in person and allows for connections to extend beyond the classroom. This OCC benefits students as it allows them to build knowledge and skill at their own pace, and to ask specific questions when they need support. Teachers can provide different levels of support for their students specifically when it is requested, and by focussing their efforts, teachers can become more efficient with their time. While students and teachers were very positive about using GC, they were not enthusiastic about receiving more messages.

It is important to note that the increase of OCC during ERL was associated with a perceived benefit for the student. Teachers that deliberately choose to initiate more communication by commenting in GC elicit a higher response rate from their students, and by extension increase engagement and immediacy. This increase in OCC does not need to be limited to ERL as the future landscape of classroom learning is unknown, especially with the threat of future lockdowns and the prospect of blended learning models in the coming years.

The degree to which the results of Study B were similar to the results in Hayes et al. (2013) was somewhat surprising. Not only is there a considerable difference in age between grade 8 and third year university students, but there are also considerable cultural differences between Ireland and Canada. This suggests that there may be less difference among different student populations than one might have assumed.

The instrument used in Study C is a new instrument targeting teachers and their perceptions in the courses they teach. Clearly, the sample of 12 teachers is very small, but since it did yield some interesting results, it would be interesting to increase the size of the sample for future studies so that the validity of the results could be increased and so that possible differences among teachers of different subjects could be revealed.

An important finding was that respondents seem to be sensitive to the specific wording of questions. This was displayed in the problems with the wording of the first open question in Study B, and in questions about motivation and participation in Study B and Study C. The question of how individuals assess their own levels of motivation, engagement and participation was probably a challenge for them. In future studies, it might be advisable to test the wording of all questions with a small pilot group before using them with a larger sample.

In this survey, a central design decision was to focus on students in science classes. While this did provide a clear framework, it could have skewed some of the results. Students have favorite teachers and subjects and these preferences could affect how motivated and engaged they are in various subjects. This could have been reflected in their survey results. The studies were also carried out in a single school with a single age population. With some modification, the tools and methods used in the studies could be used across the school district with students of different ages and teachers of different subject areas to provide a rich view of student-teacher OCC practices and perceptions. An alternative approach would be to follow this specific group of students as they mature and track their changing communication practices and views over time. By taking these studies outside of their particular context, further insight would be gained. Further consideration could also be given to variables such as different LMS, different age groups, schools in different countries and across different cultures. Students and teachers each have a role to play in education and communication is central to the process. By continuing to gain insight in this area, teachers will be better equipped to focus their energies more efficiently in support of their students.

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Author's Declaration

I hereby declare that I have written this thesis independently and that all contributions of other authors and supporters have been referenced. The thesis has been written in accordance with the requirements for graduation theses of the Institute of Education of the University of Tartu and is in compliance with good academic practices.

Signature:

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Appendices

Appendix 1. Student Perception Survey: Use of GC during ERL

The purpose of this survey is to collect information about student use and perception of Google Classroom.

Informed Consent

My participation in this survey is voluntary. I may discontinue participation at any time without penalty. I understand that all information collected will be anonymized and that my name will not appear in any reports generated from the data collected.

Do you agree to participate in the data collection for research purposes? (yes/no)

Do you agree that your collected data will be used for research purposes? (yes/no)

General student information (checkboxes)

- Male
- Female
- International
- English Language Learner

Prior to Emergency Remote Learning (from September 2019 - March 2020), did you use Google Classroom to communicate with your teacher in the subject areas listed below? (yes, no)

- English
- French
- Math
- Science
- Social Studies

During Emergency Remote Learning (since March 2020), how often do you use Google Classroom to communicate with your teacher in the subject areas listed below? (Very often, often, sometimes, rarely, very rarely)

- English
 - French
 - Math
 - Science
 - Social Studies
-

Please respond to the next questions based on your communication in Google Classroom (GC) in Science class during Emergency Remote Learning (March 2020 - present). (Strongly agree, agree, neutral, disagree, strongly disagree)

1. Being in touch with my teacher in GC is a good idea.
2. I like receiving messages from my teacher in GC.
3. I would like to receive more messages from my teacher in GC.
4. I enjoy GC messaging with my teacher.
5. I like receiving messages in GC about school-related issues.
6. My teacher is more approachable as a result of using GC.

7. GC messaging with my teacher is beneficial to me.
8. I like Science more as a result of communicating with my teacher in GC.
9. GC messaging with my teacher has increased my motivation to learn.
10. GC messaging with my teacher has increased my engagement with the subject.
11. GC messaging with my teacher has increased my participation in the class.
12. GC messaging with my teacher has helped me in the learning process.
13. Receiving GC messages from my teacher is intrusive.
14. Open response question: In what ways did using Google Classroom prior to Emergency Remote Learning (September 2019 - March 2020) make the transition to Emergency Remote Learning easier?
15. Open response question: What is the best thing about Google Classroom?

Appendix 2. Teacher Perception Survey: Use of GC during ERL

The purpose of this survey is to collect information about teacher use and perception of Google Classroom.

Informed Consent

My participation in this survey is voluntary. I may discontinue participation at any time without penalty. I understand that all information collected will be anonymized and that my name will not appear in any reports generated from the data collected.

Do you agree to participate in the data collection for research purposes? (yes/no)

Do you agree that your collected data will be used for research purposes? (yes/no)

General teacher information (checkboxes)

- Male
- Female
- Subject taught: _____

Prior to Emergency Remote Learning (from September 2019 - March 2020), did you use Google Classroom to communicate with your students? (yes/no)

During Emergency Remote Learning (since March 2020), how often do you use Google Classroom to communicate with your students? (Very often, often, sometimes, not often, rarely)

Please respond to the next questions based on your communication in Google Classroom (GC) during Emergency Remote Learning (March 2020 - present). (Strongly agree, agree, neutral, disagree, strongly disagree)

1. Being in touch with my students in GC is a good idea.
2. I like receiving messages from my students in GC.
3. I would like to receive more messages from my students in GC.
4. My students are more approachable as a result of using GC.
5. GC messaging with my students has increased their motivation to learn.
6. GC messaging with my students has increased their engagement in my class.
7. GC messaging with my students has increased their participation in the class.
8. GC messaging with my students has helped me to adapt lessons in my daily learning environment.
9. GC messaging with my students has improved my relationship with them.
10. Receiving GC messages from my students outside of class is intrusive.
11. Open response question: What is the best thing about Google Classroom?

Appendix 3. Study B student responses to the open response question “In what ways did using Google Classroom prior to Emergency Remote Learning (September 2019 - March 2020) make the transition to Emergency Remote Learning easier?”.

Note. Responses quoted in the body of the thesis are not included in this appendix.

1. “Assignments”
2. “since we already had many assignments in the google classroom, switching over to complete online learning was not too bad.”
3. “It made it easier to ask questions.”
4. “I was already familiar with the user interface and had done assignment through google classroom before.”
5. “IT is a good online learning app.”
6. “I was more familiar with the software. I knew how to plan to complete all my work and I was ready to go from day one!”
7. “It was better and we could contact our teachers easier.”
8. “In grade 7 I never used GC so if I ever used it all year up until emergency remote learning it would be hard to understand what does what and how I attach stuff...”
9. “because we know hoot used was easier”
10. “Being used to using GC makes it an easier transition”
11. “It made me more familiar with how to use it.”
12. “because everything was more organised and I knew what to do”
13. “I already had a good understanding of how it worked which made the transition to using it constantly, everyday far smoother and easier than it would have been without the prior knowledge and understanding.”
14. “I could still learn from my teacher and complete assignments.”
15. “it is less stressful...”
16. “The communication with teachers helped a lot”
17. “It made it easier being able to still communicate to my teachers if help is needed
18. “a lot of the content was already posted”
19. “Somewhat”
20. “We use GC before to submit homeworks and now we receive and submit homeworks both digitaly on GC”
21. “We had everything set up already, and we knew where to go if we needed help”
22. “For school”
23. “I knew where to find new posts and information, and what kinda of assignments were probably going to be posted.”
24. “we already used it a lot so it wasn't very different”
25. “Knowing how to use it and what features work for me.”
26. “we already had a full system set up for most of my classes”
27. “I knew how GC worked and how to to my work that is on GC.”
28. “I already new how GC worked and we had been using it all year so it was easy and not much changed. For my friends at other schools they are using Microsoft teams and they are very confused and missing some work sometimes.”

29. "I already knew how my teacher used google classroom and could expect what assignment will happen next."
30. "It made it easy to transition because Google Classroom was there in the beginning and was always there as a tool to use when doing school work."
31. "Google doc"
32. "Becuase we became familiar with the website/app"
33. "I already knew how to use a lot of the features and in most of my classes we already had a classroom. Especially in science we were already using GC for lots of things including quizzes and tests with google forms."
34. "It helped me to be accustomed to the site and understand how to use it first in case I would need to use it on my own without help."
35. "I know alot of how to use google classroom, google docs, videos, and many of my old assignments were online so it wasn't very different for me."
36. "Because we had already been using google classroom in our school, it made the transition to online learning easier. Although it's quite a bit different from how we usually learn, this method is still effective for our learning."
37. "It helped me in my learning process."
38. "google classroom is a great format for learning. It makes learning a lot easier and more understandable."
39. "a"
40. "Yes it did"
41. "Easier to access work"
42. "Since Google Classroom is online, communication is easy without going to school, so it was easy to make the transition to Emergency Remote Learning."
43. "You know what to do, and where to look."
44. "better understanding in my homework."
45. "some teacher are using gmail and email."
46. "It made it easier to transition to Emergency Remote Learning because I was familiar with how to use google classroom and it's systems."
47. "We all learned how google classroom works and how each of our teachers like to format different assignments. We learn how to upload our homework to the classroom and see when things are due."
48. "Because it is a major part of my education program for the past 3 years."
49. "To complete my assignments"
50. "it made things easier to do and finish"
51. "We can complete homework as usual or study as usual, and sometimes this way is more convenient than studying in school."
52. "I knew how it worked prior to online learning."
53. "Using GC prior to remote learning made the transition easier because since we already knew how to use the website, there wasn't much extra we had to learn."
54. "I was already used used to using it and did not have a hard time trying to figure it out."
55. "There are many teachers who already used Google Classroom to hand out homework and reminding students about tests and assignments. This made me really used to the idea of online homework and also made me always check my Google Classrooms regularly to see if there was any new work or tests. Of course, because many of the student's essay, charts and homework are

- already able and needed to be and completed online, this made the use of Google Classroom to hand in work much easier.”
56. “It was easier because I was familiar with it and it was all very easy and accessible.”
 57. “I knew how to use the website first of all and the teachers basically told the students what we should expect what the Google Classroom for that specific class was going to be like.”
 58. “It made it easier because you know how to use google classroom and you have all the classes already.”
 59. “work was well organized; was only way of communication other than email; made it easier”
 60. “I already knew how the system worked and all the tools. It was an easy transition. Most of my school work was already on google classroom.”
 61. “Google classroom is really easy to use and you can find all your work easily.”
 62. “We understood how to use google classroom and how to contact are teachers.”
 63. “Weekly check ins from teachers”
 64. “Well before the quarantine thing I was already using google classroom in almost all of my classes. For some subjects including science and math etc, all things I would need were there for me, even if I was to miss a day and was unable to come to school. That made the transition a little easier because I was already used to it.”
 65. “Everything about Google Classroom. The ability to communicate with my teachers, to see different assignments posted, to ask questions, etc. All features of Google Classroom that I used in Remote Learning I utilised outside of Remote Learning.”
 66. “We all always used google classroom in regular school so the transition was easier.”
 67. “it allowed me to already know then basics of google classroom and other utilities such as docs and slides.”
 68. “it made it easier because everything was already set up for most of my classes and it makes it easier to communicate with people.”
 69. “I personally have been using Google Classroom since fourth grade, so I know how everything works and functions perfectly, so this transition was honestly not that much of a difference for me. I guess in terms of things becoming easier, I was able to best communicate with my teachers if I ever had any questions or concerns with an assignment, or if I wanted to reach out for help if I was ever confused through Google classroom private (or public) comments. Another thing that made my life a little easier was how in my Science class (and only Science- no other classes) my average for the subject was displayed. This helped me calculate the marks that I would like to receive on upcoming or future assignments to raise my grade even higher than it already was, and I think that this feature made everything so much simpler than emailing your teacher, waiting for an response to what your mark is, and calculating your average regarding the class. By far, my favourite feature of Google Classroom!”
 70. “I can do work whenever I like and I can see all the dates that they are due it just makes it more organized”
 71. “Online Learning”
 72. “During the time I wasn't doing remote learning I didn't have the time to meet with my teachers in person. Remote learning helps me contact my teacher with a quick response without me having to mess up my schedule.”
 73. “We were taught how to use Google Classroom and we always hand in projects and big assignments on the Google Classroom so I am very familiar with Google Classroom. This made remote learning easier.”
 74. “I don't have to walk to school I guess, I think the accessing of homework is much easier.”

75. "I felt that most of my teachers and I were already comfortable navigating the app, other than my math teacher as he was new to GC. But all my teachers use it great and are all fast responders :)"
76. "Because we already established a comfortable learning environment on there"
77. "everything on googleclassroom was very organised"
78. "being able to communicate with teachers, easy way of completing work, being able to do work at home."
79. "I think google classroom made and still makes remote learning so much easier. It is a very helpful platform and helped me tremendously to communicate my assignments and grades with my teachers. I think google classroom also really helps in school when we are in class with our teachers like the beginning of this school year."
80. "It made me easier to make the transition to Emergency Remote Learning because I already had some experience on learning from Google Classroom"
81. "i think the fact that you can do your homework any time of the day is really good."
82. "that it was all in one place"
83. "because we used it alot"
84. "Since I had some knowledge about google classroom it was easy for me to transition the remote learning."
85. "I already had a sense to where everything was and was really relaxed and not stressed about the switch"
86. "Only made it harder"
87. "communicate make it more easier"
88. "It was easier to hand stuff in and know when they were due. It was also easy because we have been using google classroom all year."
89. "I can receive the assignment and it helps me more."
90. Start online classes for school
91. i dont know
92. to do work
93. it was easier to understand and communicate with my teachers

Appendix 4. Study B student responses to the open response question “What is the best thing about Google Classroom?”.

Note. Responses quoted in the body of the thesis are not included in this appendix.

1. “understandability”
2. “the ability to access google classroom from anywhere.”
3. “That it reminds you when you have a deadline for a project.”
4. “The best thing about google classroom is that it is very educational and helps me stay engaged with school work.”
5. “The assignments.”
6. “Basically everything, It’s so organized to have everything in a push of a button, also how you can pick the background of your class, for example my science is like a planet, orange coloured thing”
7. “you can look at the marks you got in percent instead of adding up easier”
8. “Not needing to get on a bus and traveling to school, and GC makes it easier to organize assignments.”
9. “It is simple to use.”
10. “how easy it is to do things”
11. “The clarity and how direct it is with supplying assignments.”
12. “It makes the work more understanding”
13. “its easy to work with”
14. “can work at any time of day”
15. “The best thing about Google Classroom is that it's convenient.”
16. “Easy management of all classes on one platform.”
17. “We can submit our homework digitaly through GC”
18. “that the communication is simple and easy, and it's is very accessible anywhere.”
19. “It gives you another way to communicate with ur teachers and classmates. It also give you easier access to information about your assignments and other important information.”
20. “the ability to do assignments online”
21. “Best thing for me would be the accessibility.”
22. “it allows me to communicate and receive assignments from my teachers”
23. “The best thing about google classroom is how easy it is to upload work.”
24. “the easy communication between students and teachers”
25. “Simple to use. Unlike MC Teams.”
26. “Exchange”
27. “You can do stuff on your own time”
28. “Teachers can give us assignments.”
29. “The best thing about Google Classroom is that you can check it daily to see if there are assignments, materials and announcements.”
30. “I like how user friendly it is.”
31. “I love that it is easy to work on and make many assignments, as it is very organized and easy to communicate as well.”

32. "I like being always aware of the assignment due date and notifies me, and the fact I'm doing my homework online, I can listen to calming instrumental music while doing it and can easily search up some questions online."
33. "The best thing about google classroom is that there will be a lot of information posted about what we will need to study."
34. "It can post assignment"
35. "Very easy to use"
36. "Easy to communicate"
37. "Everything will be on there"
38. "remind me when is my homework is due."
39. "easier then gmail"
40. "Communication with the teacher."
41. "I think the best thing about google classroom is how organized it is. Many of my teachers keep our classrooms very organized. My favourite thing is the option to see your missing work In all your classrooms and the thing you've accomplished/done."
42. "How easy it is to participate fully with my subjects"
43. "it's very easy to use"
44. "Remote contract; Very convenient and simple; We just need to create a document on the assignment and submit it."
45. "Being able to talk to teachers and classmates"
46. "Being able to see all my grades in one place."
47. "Being able to ask questions whenever you want, and also being able to see your marks and having an easy access to learning materials."
48. "Every time I was late for seconds for handing in a work, it would turn from "assigned" to a red "Missing" with a capital "M". This really scared me and forced me to always hand in work on time so I don't need to see the word "Missing"."
49. "How you can see everything you're teacher posts, when it's due, grade, and how there are private comments"
50. "It tells you what assignments and their due dates are coming up."
51. "The best thing about google classroom is that you are organized and you know what homework you have and for what class you have the homework in."
52. "all of your work is right in front of you, organized in an easy and efficient way."
53. "The best thing about google classroom is the app on phone because it reminds me of all the homework I have to do."
54. "Going to school at home"
55. "How easy it is to receive and hand in work."
56. "easy to keep track of assignments and their due dates"
57. "It is easy to understand and I like how it has all the other google learning tools accessible through the app and it makes it simpler and easier to attach and submit assignments whether it is from your drive or creating new ones and checking calendar too. I think it has worked well during this time for students. I can imagine during this time Google Classroom is now a very well known app."
58. "It's a digital way to do assignments. No human contact required, just read the instructions and complete the assignment (as long as the teacher is clear with the instructions, that is)."
59. "Google classroom makes it easy to see all unfinished work and their due dates."
60. "its quick and easy access and the accessibility for handing in homework and viewing projects."

61. "The best thing is that teachers and students can add private comments on assignments instead of having to send a separate email or posting it in front of the entire class."
62. "I think that the best thing about Google Classroom is how (if your teachers chose to participate- if not- then no) our grades can be featured within the classroom. I am someone very obsessed with keeping their grades as high as they can be, spending more time studying, and trying to push my potential with every assignment I get, so knowing that I do not have to wait for weeks to hear about my mark honestly sounds amazing for me! I think it also makes it really convenient for teachers to have a already-laid-out platform to use for their grading, which makes this feature a win- win!"
63. "The organization and how you can look at everything."
64. "Everything"
65. "It shows the upcoming work I have to do when I'm in the classes overview. I never turn anything in late because of it."
66. "The best thing about google classroom is that it makes learning easier, handing in assignment easier, and handing in projects easier."
67. "You can use google Calendar with it to check my assignments."
68. "How fast questions can be answered. Also I like the To-Do list as it helps keep me on top of everything by letting me see all the assignments for the week :)"
69. "Easy to communicate"
70. "very easy to use and you can communicate with your teacher with no problems"
71. "I personally prefer google classroom because its much easier for me to be able to focus without being distracted by others."
72. "I think the best thing about google classroom is how easy it is to use and how easily you can find your needs and different classes."
73. "I can access files and complete assignments anywhere."
74. "the best thing is that it will remind you one day before the due date for your assignment."
75. "that no one could see what you were asking your teacher"
76. "it is easy to use"
77. "I like how you can keep everything organized and keep track of what is due soon."
78. "Being able to get work online and not have to always go into school to receive work also communication with my teachers"
79. "Nothing"
80. "I can communicate with my teacher."
81. "It is easy to get assignments done and know when there due."
82. "Nothing"
83. "it is easy to access"
84. "mostly typing instead of writing"
85. "communicating with my teachers"

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