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INFORMATION SYSTEMS EDUCATION JOURNAL

Effects of emergency online learning during COVID-19 pandemic on student performance and connectedness

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Abstract

This study took place at an undergraduate liberal arts college that switched to emergency online learning during the Spring 2020 semester due to the COVID-19 pandemic. All students were forced to leave campus and attend classes remotely. The participants were 109 undergraduate students ranging from 18 to 22 years of age. An online survey was conducted to better understand the effects of the sudden switch to emergency online learning on the students. Overall, participants felt less connected to their peers, but felt more connected to their professors when compared to pre-pandemic learning. Participants also felt less motivated to work and procrastinated noticeably more after the switch to emergency online learning. However, participants that felt connected to others reported the importance of using Zoom video conferencing and face-to-face interaction. Many participants reported the importance of having normal conversations with their professors instead of focusing on classes to feel more connected to the community. The COVID-19 pandemic greatly affected this college and its students during the Spring 2020 semester.

Keywords: COVID-19, Emergency Online Learning, Connectedness, Performance, Motivation, Engagement

1. INTRODUCTION

The pandemic virus known as COVID-19, the Human Coronavirus, was first introduced to the World Health Organization (WHO) as a type of pneumonia of unknown cause in Wuhan, China in December of 2019. On January 23, 2020 the WHO Director General, Dr. Tedros Adhanom Ghebreyesus, convened the Emergency Committee to consider the novel coronavirus outbreak. The outbreak spread throughout the globe and by March of 2020, WHO had declared that the COVID-19 outbreak characterized as a pandemic. Soon after this declaration, the

hashtag #TogetherAtHome started to become popular as more organizations started to establish procedures for employees to work from home to promote social distancing. Many different businesses and schools suspended any activities that required people to be in close quarters with each other. Many of these organizations opted to switch to remote activities. Colleges and Universities, especially, decided to finish the Spring 2020 semester remotely with online classes.

The undergraduate liberal arts college where this study took place was one of the colleges that switched to emergency remote learning to ensure the continued health of the students, professors, and staff. The transition was not an easy one, but went as smoothly as possible due to the institutional community working together. The college decided to prolong the spring break vacation for an extra week to allow professors to create lesson plans for emergency online learning. Spring Break vacation became a blessing in disguise since most of the students were home when it became obvious that all courses would be switched to an online format so that students could remain home and continue learning remotely. This ensured that all students could remain safe and healthy during such an unprecedented and challenging time, whilst simultaneously giving the students stability during the COVID-19 pandemic panic. This sense of stability was important in giving the students a purpose and a distraction during their quarantine (Benson, 2020).

In person classes create an atmosphere of connectedness among students and professors. Connection is "feeling that you belong to a group and generally feel close to other people" (Social Connection Definition: What Is Social Connection, 2020). Feeling connected to other people is an exceedingly important part of learning and being social in an academic setting. Feeling connected to other students and to one's professors will affect student performance and motivation in and out of class (Diep et al., 2019). It is important that this feeling of connectedness still exists when classes cannot be held face-to-face.

This undergraduate liberal arts college prides itself on creating a tight knit community where students feel connected to each other and their professors. So, we ask, is it possible to maintain this feeling of connectedness through online learning? And does this feeling of connectedness influence a student's engagement, performance, and motivation in class?

2. LITERATURE REVIEW

During the Spring 2020 semester, many institutions chose to switch to an online learning environment. There are three types of online classes that can be offered to ensure that students receive the education they were promised. The three types of online courses are hybrid courses, asynchronous online courses, and synchronous online courses. Since hybrid courses require students to attend some classes in-person and on campus, they were not offered during the latter half of the Spring 2020 semester when the COVID-19 pandemic forced the campus to close for the second half of the semester. Both asynchronous and synchronous online courses were offered during the COVID-19 pandemic.

Online classes

There has been much conversation about whether or not online classes are effective for students. Online classes can cause a feeling of disconnect between students and their peers, as well as between students and their professors (Otter et al., 2013). This feeling of disconnect can often cause problems with motivation and engagement in class. Otter et al. (2013) found that students in online-classes felt more disconnected from their peers and lecturers, were more autonomous in their studies, and were helped less by their professor than their professor believed them to be. Some students may feel that their professors do not care about them or how well they do in their classes when they are unable to meet with them face-to-face or when it takes a long time for the student to get a response from the professor. "Most students feel that face-to-face contact is essential for building a sense of community" (Conole et al., 2008). This sense of community could be what causes some students to prosper in their courses. Some students may be unable to focus on their work or may feel that a course is less important than others because they do not feel like they are a part of a community that is meant to be learning together.

Online courses rely heavily on student self-motivation. When students are unsupervised, they must still be able to complete their assignments promptly. Students need to motivate themselves to complete activities online. Some students might find it hard to motivate themselves or may even procrastinate more often. While in face-to-face classes, the role of the motivator is taken on by the professor (Upton, 2006). A lack of motivation on the part of the students may ensure that they do not learn the material, thoroughly or at all. It is especially true that student learning may be affected

negatively by motivation for courses that are not typically stimulating or are basic courses that will not be built upon in the future. Motivation, however, is not the only possible disadvantage. Students can also feel daunted by the technological expectations of taking an online course, especially if they don't have previous knowledge or experience using online tools (Holley and Oliver, 2010). It is important that professors ensure that their students know how to use the technology necessary for their courses at the beginning of their course. For instance, Evans et al. (2004) showed that students performed better when their online course material was accessible via interactive, navigable format than via a series of scrollable web-pages. This may also help to foster a sense of community or camaraderie with a professor. Research suggests that participation in learning technology can itself increase engagement and learning (Chen et al., 2010).

Neither online courses nor face-to-face courses are guaranteed to be beneficial to or hinder the learning of all students, however. In General, student engagement in traditional classes is positively associated with student engagement and academic performance, although the magnitude of those effects might be small (Carini et al., 2006). There is no guarantee that students will perform better in a face-to-face class or in an online course (Magalhães et al., 2020). Davies and Graff (2005) found that students who interacted and participated more in online discussion did not show significantly better academic performance than students who were less involved in that discussion. Phillips (2015) found that most students liked online learning, but felt that it would work better as supplementary learning instead of full-time classes. Similarly, Nenagh and Rachel (2014) found that students had a strong preference for discussion face to face because they felt more engaged and liked the immediate feedback. However, these same students preferred online assignments, especially written assignments, to be available online which allowed them to complete their assignments on their own time (Nenagh & Rachel, 2014).

Students have benefitted from taking online courses though. Professors often post all work and assignments, along with their syllabus at the beginning of the year. This gives students ample time to complete assignments when they have the time to dedicate to them. The extra time available for online activities might allow students to think about course material more critically and reflectively, leading to a deeper understanding of the course content (Ramsden, 1992; Robinson and Hullinger, 2008). Students will benefit from an online class with a format that allows them to take their time to explore the material and make connections of their own. Face-to-face classes often require students to take notes while the professor is teaching, so asking questions could be impossible for those students that need to ruminate before asking questions or need more time to understand the material.

Feelings of Connection

One benefit of participating in online courses is that there is no peer pressure. The less confrontational or personal nature of e-learning might encourage shyer students to engage more, or to feel less pressure in comparison to face-to-face interactions (Warschauer, 1997; Hobbs, 2002). According to Anna Yi Ni (2013), participation in an online class is less intimidating so the quality and number of interactions may be increased in an online classroom. This means that students may find themselves more open to asking questions and interacting with their professors and with other students, resulting in an increase in connectedness in the classroom.

Humans seek out connections with one another every day of their lives. Humans want to have a feeling of connectedness with each other. Connectedness is the desire to interact with others in a meaningful way and to create safe and satisfying relationships with others (Adams et al., 2017). This feeling of connectedness can affect a students' motivation and, in turn, their performance in their academics. The feeling of connectedness is one aspect that is necessary for a person to experience self-determination. Self-determination is an important thing for everyone to experience because it promotes optimal health and is essential for social development and wellbeing (Siti et al., 2020). "Self-determination also has an impact on motivation—people feel more motivated to take actions when they feel that what they do will have an effect on the outcome" (Siti et al., 2020, p. 3). In order for students to intrinsically feel motivated in their classes, it is important that they feel self-determination. This would be impossible, unless they felt connected to their peers and their teachers.

Previous research has indicated that students prefer to receive more personalized feedback from their professors when attending online courses. These students reported that they were more satisfied with the class and their own work, but did not report that they felt more connected

to their professors because of the personalized feedback (Gallien & Oomen-Early, 2008).

3. PARTICIPANTS

Students were recruited to participate in this study through social media platforms and the undergraduate college's digital newsletter/digest. All social media postings were done via Facebook groups that were dedicated to each of the classes that attended the college during the Spring 2020 semester. The social media postings remained in the Facebook groups for seven days before being removed. The same message was posted in the newsletter/digest for four days before being discontinued to ensure that more students would be able to view the survey. All students that chose to participate did so without incentive or reward. All information was kept confidential and no personal identifiers were collected at any point during the project.

Participant Demographics

The participants of this study included 109 undergraduate students and 1 graduate student that attended the liberal arts college during the Spring 2020 semester. 45% of the participants identified as female, 17% identified as male, 1% identified as gender variant or nonconforming and 37% preferred not to disclose their gender. 15% of participants were freshman students, 9% were sophomore students, 29% were junior students, 9% were senior students, 1% were graduate students, and 37% of participants preferred not to share their class year. Participants ranged from 18 to 22 years old.

4. METHODS

All data for this research was collected through a voluntary, anonymous survey. This survey was created using Qualtrics. The survey contained one qualifier type question to ensure that only students of this college who attended the Spring 2020 semester for the switch to emergency online learning took the survey. The survey included 24 multiple choice questions, 7 short responses, and an open text box so participants could share information about their experience during the COVID-19 pandemic with the authors of this paper.

The survey questions can be viewed in their entirety in appendix A.

5. RESULTS

The analysis of the survey responses began by comparing the answers in the report given by Qualtrics. Out of the 173 responses we received, we had to eliminate 64 surveys because they were incomplete. From the 109 responses, 72.06% of participants said that they had not taken an asynchronous class and the other 27.94% had taken an asynchronous class previous to the Spring 2020 semester. The maximum number of asynchronous classes taken by a participant before the Spring 2020 semester was 4. 85.07% of participants had not taken a synchronous online class prior to the switch to emergency online learning in the Spring 2020 semester while only 14.93% of participants had taken a synchronous class. The maximum number of synchronous classes taken by a participant before the Spring 2020 semester was 7. The students were also asked if they had taken a hybrid online class, 82.35% of participants answered no while 17.65% said yes. The maximum number of hybrid classes taken by a single participant before the Spring 2020 semester was 6.

To better understand how the switch affected participants' perceptions of their connection to classmates and professors, the participants were asked about how connected they felt to each other and to their professors before and after the switch to online learning. A paired-samples t-test was conducted to compare how connected students felt to each other before and after the switch to online learning. There was a significant difference in the scores for the pre-switch (M=3.78, SD=0.96) and post-switch (M=1.94, SD=0.90) conditions; $t(80)=12.56$, $p<0.01$. Students felt significantly less connected to each other after the switch to online learning. When asked how connected they felt to other students before switching to online learning the majority of students, 67.65%, felt either very or extremely connected to their fellow students. However, after the switch to online learning only 5.88% of students felt very connected and 0% of students felt extremely connected to others. There was a dramatic increase in students that felt not at all or only somewhat connected to other students, a jump from 11.76% to 72.06% of students. The participants' feelings of connectedness to other students decreased heavily after having to switch to online learning.

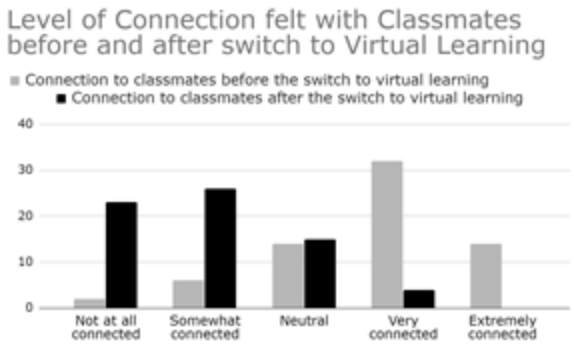

Figure 1: A comparison of the levels of connection between students before and after the switch to online learning.

When participants were asked how connected they felt to professors before switching, 25.00% felt extremely connected, 55.88% felt very connected, 10.29% were neutral on the topic, 7.35% felt somewhat connected, and 1.47% felt not at all connected. A paired-samples t-test was conducted to compare how connected students felt to their professors before and after the switch to online learning. There was a significant difference in scores between pre-switch (M=2.23, SD=0.95) and post-switch (M=3.96, SD=0.87) conditions; $t(80)$=-11.84, p<0.01. Students, overall, felt more connected to professors after the switch to online learning. When participants were asked what tools helped them to feel more connected to their peers and their professors, the most helpful tool reported was Zoom.

The participants were also asked about the availability of their professors after switching to online learning. The results showed 10.61% much more available, 18.18 somewhat more available, 36.36% available the same amount as before the switch, 28.79% somewhat less available and 6.06% much less available.

The tools that reportedly helped participants to feel connected with their professors were Zoom and email. The participants were asked if there was anytime they felt particularly connected to classmates or professors. While most said no, a handful said Zoom calls helped them feel connected. Participants were also asked how often they used their webcam during class. The responses showed 9.09% never used their webcam, 24.24% sometimes did, 24.24% used it about half of the time and 18.18% always used their webcam. They were also asked about the use of microphone; 3.08% never used a microphone, 43.08% sometimes did, 26.15% used it about half the time, 15.38% did most of the time and 12.31% always used their microphone. The participants were asked how often they had access to tools they needed for their online class. All participants were able to access tools they needed, but how often varied. 10.61% of participants had access sometimes, 13.64% had access about half of the time, 40.91% did most of the time, and 34.85% always had access to the necessary materials.

The participants were asked about how often they spent time with their classmates on class related activities and non-class related activities after the switch to online learning. For class related activities, 19.40% spent no time with classmates, 28.36% did one to two times during the six weeks, 23.88% did three to four times during the six weeks, 17.91% spent time with classmates one to two times per week and 10.45% spent time with classmates more than two times per week. For non-class related activities, 41.79% never spent time with other students, 34.33% did once or twice during the six weeks, 8.96% did three to four times during the six weeks, 8.96% did one or two times every week and 5.97% did more than two times per week. Students did not interact very often outside of class. Students seem to have sought classmates out for homework, group projects and other in class related activities. Participants were also asked how many college events they attended online. 50.00% of participants attended 0, 39.71% participants attended 1-2 events, 4.41% participants attended 3-4, and 5.88% attended 5 or more events. As shown in Figure 2, participants met very few times after the switch to online learning and mostly interacted with each other for class related activities.

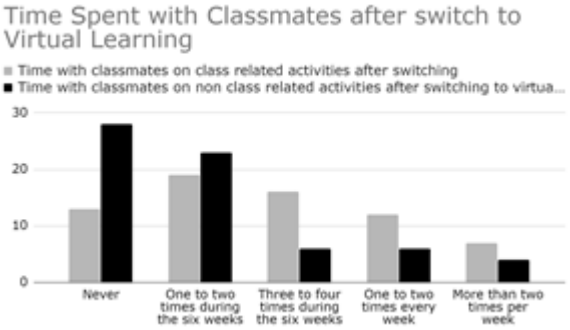

Figure 2: Participants spent very little time connecting with other students after the switch to online learning.

A paired-samples t-test was conducted to compare the levels of motivation felt by participants to complete their assignments before and after the switch to online learning. There was a significant difference in the scores for pre-

switch (*M*=4.25, *SD*=0.95) and post-switch (*M*=2.84, *SD*=1.16) conditions; *t*(67)=8.68, *p*<0.01. Students felt much less motivated to complete assignments after the switch to online learning. Motivation among participants decreased from 95.46% having moderate to a great deal of it to only 59.09% of participants feeling a moderate amount to a great deal of motivation.

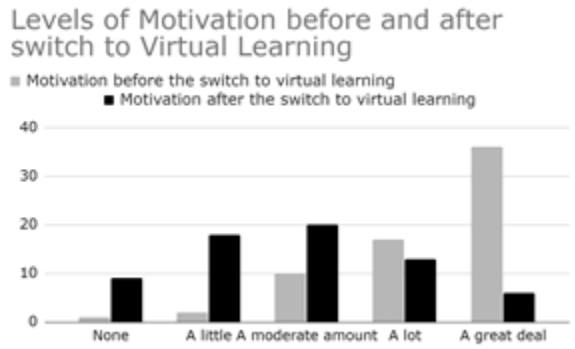

Figure 3: Participant motivation decreased noticeably after the switch to online learning.

Participants were asked about how much effort they put into their classes both before and after the switch to online classes. A paired-samples t-test was conducted to compare the amount of effort students put into classwork before and after the switch to online learning. There was a significant difference between pre-switch (*M*=4.35, *SD*=0.77) and post-switch (*M*=3.72, *SD*=1.06) conditions; *t*(67)=4.36, *p*<0.01. Overall, there was a decrease in effort devoted to classes after the switch. Previously, 53.03% of the participants put in a great deal of effort, but after the switch only 28.79% put in the same amount of effort.

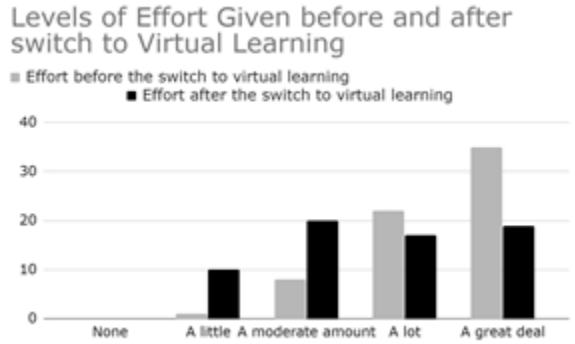

Figure 4: The amount of effort devoted to classes before and after the switch to online learning by participants.

The participants were also asked about the time they devoted to their assignments. Before the switch 16.67% of participants devoted more than 20 hours per week, 31.82% devoted 15-20 hours, 25.76% devoted 10-15 hours, 16.67% devoted 5-10 hours and 9.09% devoted 0-5 hours. After the switch, 12.12% of participants devoted more than 20 hours per week, 22.73% devoted 15-20 hours, 16.67% devoted 10-15 hours, 27.27% devoted 5-10 hours and 21.21% devoted 0-6 hours. As shown in Figure 5, there was an overall decrease in time spent on assignments per week after the switch to online learning.

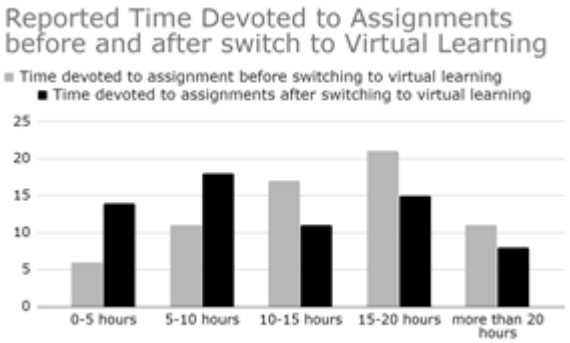

Figure 5: Overall decrease in the amount of hours spent on assignments per week after the switch.

The participants were also asked how much time they spend procrastinating per week. Before the switch 3.03% of participants procrastinated more than 20 hours per week, 6.06% procrastinated 15-20 hours, 15.15% procrastinated 10-15 hours, 34.85% procrastinated 5-10 hours, and 40.91% procrastinated 0-5 hours. The overall time that participants spent procrastinating increased after the switching to online learning. 16.67% procrastinated more than 20 hours per week, 15.15% procrastinated 15-20 hours, 19.70% procrastinated 10-15 hours, 28.79% procrastinated 5-10 hours, and 19.70% procrastinated 0-5 hours.

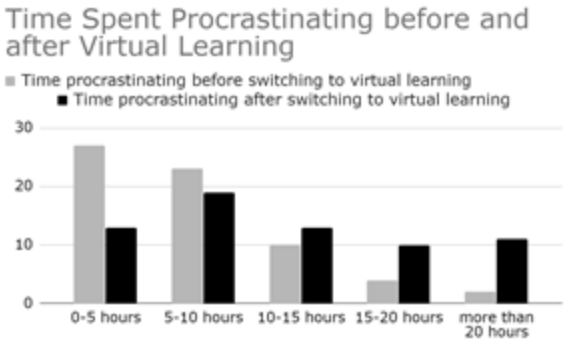

Figure 6: Overall, time spent procrastinating increased after switching to online learning.

Participants' GPA did not fluctuate greatly after the switch to online learning as shown in Figure 7. The minimum GPA dropped from 2.43 to 2.0. The maximum GPA stayed at a 4.0. The average GPA rose from 3.57 to 3.71.

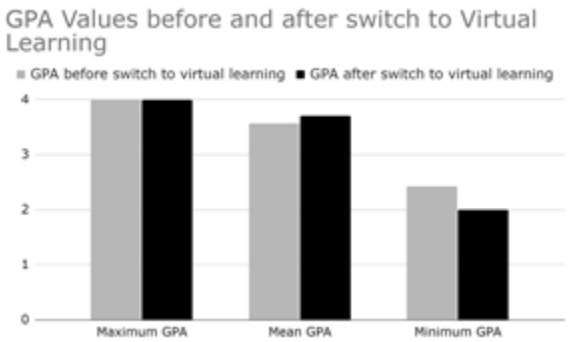

Figure 7: Participant GPA before and after the switch to online learning.

Participants were asked about how often they participated in class before and after the switch to online learning. A paired-samples t-test was conducted to compare how often students actively participated in classes before and after the switch to online learning. A significant difference was found between pre-switch (M=3.70, SD=1.05) and post-switch (M=2.54, SD=1.15) conditions; $t(66)=7.28$, $p<0.01$. The majority of students participated less in their classes after switching to online learning. Before the switch to online learning, 53.03% of participants spent at least a lot of time participating in class. After the switch, this decreased to 15.16% spending that same amount of time participating in class.

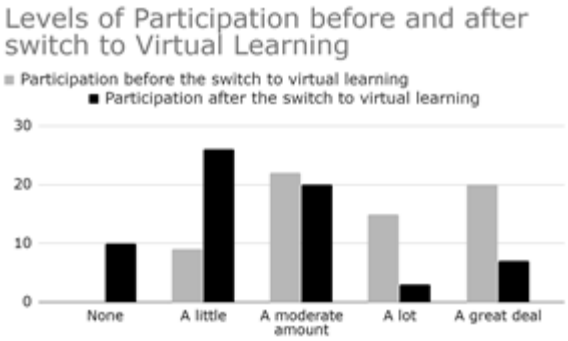

Figure 8: Most participants spent almost no time participating in class after the switch to online learning.

Participants were also asked to report about their class attendance before and after the switch to online learning. Another paired-samples t-test was conducted to compare the participant's attendance to class before and after the switch to online learning. There was a significant difference found between the pre-switch (M=4.81, SD=0.56) and post-switch (M=4.10, SD=0.99) conditions; $t(66)=5.66$, $p<0.01$. Students attended fewer classes after the switch to online learning than they did before the switch occurred. Before the switch, 86.36% of participants attended a great deal of their classes. However, after the switch only 46.97% attended their classes a great deal of the time.

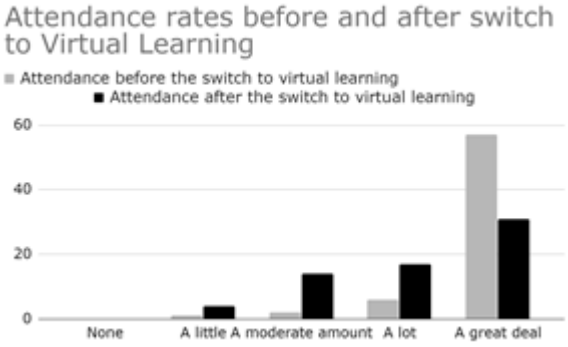

Figure 9: Attendance decreased dramatically after the switch to online learning.

6. DISCUSSION

The results showed that the feeling of connectedness from participants towards classmates had decreased after switching to emergency online learning. However, they felt more connected to their professors after the switch occurred. Also, the students felt that the availability of the professors had decreased after the switch. The majority of participants indicated

that they connected with other students, at most, four times in a six-week period for their classes. Outside of classes, they connected with students at most twice during a six-week period. One factor for the decrease in connection between classmates is the low interaction rate between students both for class related and non-class related activities. The authors believe that the decrease in connectedness is the lack of face-to-face interaction. Creating a presence whether online or in person is important. This might explain why the tool that made the students feel the most connected was Zoom, which allowed face-to-face interactions on the computer. The authors suggest that an increase of using the webcam and mic could foster more of a sense of connection. The participants also felt disconnected from the college community possibly due to the lack of involvement in the college's online events.

The amount of effort the participants reported to complete their course work decreased after the switch to emergency online learning. The students' motivation to complete the course work also decreased after the switch. Their attendance to and participation in class also decreased. This demonstrates that overall, engagement in classes decreased. The time that the students devoted to assignments decreased while the amount of procrastination increased. The overall GPA maximum stayed the same throughout the Spring 2020 semester. The average GPA minimum, 2.43, was higher than the average minimum during the Spring 2020 semester, which was 2.00. The overall GPA mean was lower than the spring 2020 semester mean (Figure 7).

When asked to recount a time when participants felt particularly connected to other students or their professors, the majority of students responded that Zoom calls and discussion boards helped them stay connected to classmates and professors. Some professors reached out to the students to find out how they were doing. Some of the participants mentioned that participating in Bingo online and other campus activities made them feel more connected to others. The online learning tools that the students enjoyed the most were Zoom, email, quizlet and canvas.

The participants were to report what they found to be the most motivating, to which some reported feeling motivation when the online learning environment simulated the classroom experience by being able to see and hear their classmates and professor. Furthermore, when the professor was motivated and put in effort this in turn motivated students. Another way participants felt motivated was when they had opportunities to work on group projects and had discussions with their classmates. It was also mentioned that a motivating situation was when the assignment was graded thoroughly, not only checked for completion. Another motivating situation was when the professors allowed the students the freedom to do their work at their own pace, while also giving them feedback and support. Similarly to when the pandemic was not an issue, students expressed that a motivating force was earning desired grades and achieving a high GPA. Commuters reported that not having to commute gave them extra time to complete their work.

7. CONCLUSIONS

Previous literature supports the importance of connection between students to promote personal motivation and academic success. This undergraduate liberal arts college also supports a close knit, connected community. The COVID-19 pandemic halted connection between students and professors physically on campus, but students were still able to connect to each other with just a little more effort than they may be used to. In a socially distanced community, using technology such as Zoom calls and emails to stay connected to others is vitally important. Those participants that did not stay connected with their peers or with their professors, felt their lack of connection over the Spring 2020 semester through lowered motivation and possibly with lowered academic success. Overall, students had trouble staying connected and motivated after the emergency switch to online learning.

In the future, utilizing webcam and microphone technology may help students to feel more connected to their peers and their professors. Participants reported feeling more connected to their peers when these technologies were utilized. Students may also feel more connected to their professors when they reach out to talk to them outside of class. Limiting interactions to only lesson plans may make students feel disconnected and unimportant to their professors. This disconnect may be one of the reasons for lowered motivation and communication in students. More genuine interactions may persuade students to be more present in classes and give them the confidence to participate more openly.

Future research may include recording a more detailed report of the best and the worst interactions that occurred during the switch to online learning during an emergency. Overall,

participants reported feeling higher levels of connectedness when face-to-face interactions occurred, even if they only happen through webcams and Zoom meetings. Extended office hours utilizing this technology may allow students to seek out connections with professors. These connections may allow students to ask questions privately so they can better understand their classes and succeed academically, even online.

Key learnings and recommendations based on this research:

- Have opportunities for students to work together in discussion and group projects.
- Create a presence for your students by using tools such as Zoom that allow for an increased use of video and audio exchange.
- Create opportunities for casual discussions between students, simulating conversations they would normally have at the beginning and end of an in-person class.
- Reach out individually to students to check in.
- Extend office hours utilizing web-based technology such as Zoom to allow students to seek out connections with professors and ask questions privately.

However, there were three main limitations to this study that are discussed below.

Limited Time
Timing was a major factor for this project. The COVID-19 pandemic occurred during the last half of the Spring 2020 academic semester. The best results for this survey would have occurred if students had been able to take the survey directly after the Spring 2020 semester had completed. However, this survey was administered to the student population in the middle of July 2020. The survey was administered approximately two months after the completion of the spring semester. This time lapse could have resulted in a change in perception of peer connectedness and personal engagement in the students' studies.

Survey Population
The population for this survey was limited to the students that attended the undergraduate liberal arts college during the Spring 2020 semester. A limited population ensures that all data collected is non generalizable. This data may be useful for creating future studies, but the authors suggest taking caution when using these results to influence decisions made about online learning at other institutions.

Remote Correspondence
Since this study occurred during the COVID-19 pandemic, all interactions between authors and participants were handled remotely. All recruitment procedures took place through an online newsletter and social media postings. The interactions between authors took place through emails and video chats. It was difficult to find times when all authors were available for meetings or to work together.

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9. REFERENCES

Adams, N., Little, T. D., & Ryan, R. M. (2017). Self-Determination Theory. Development of Self-Determination Through the Life-Course, 47-54.

Anna Ya Ni. (2013). Comparing the Effectiveness of Classroom and Online Learning: Teaching Research Methods. *Journal of Public Affairs Education*, *19*(2), 199.

Benson, J. (2020, April 3). Online training program helps Bloomington martial arts academy connect with students during coronavirus pandemic. *Pantagraph, The (Bloomington, IL)*.

Carini, R. M., Kuh, G. D., and Klein, S. P. (2006). Student engagement and student learning: testing the linkages. *Research in Higher Education Journal 47*, 1–29. doi: 10.1007/s11162-005-8150-9

Chen, P., Lambert, A., & Guidry, K. (2009, November 22). Engaging online learners: The impact of Web-based learning technology on college student engagement. Retrieved July 27, 2020, from https://www.sciencedirect.com/science/article/pii/S0360131509003285.

Conole, G., Laat, M., Dillon, T., & Darby, J. (2007, November 05). 'Disruptive technologies', 'pedagogical innovation': What's new? Findings from an in-depth study of students' use and perception of technology. Retrieved July 28, 2020, from https://www.sciencedirect.com/science/article/pii/S036013150700111X?casa_token=1Ebb8mOwaNsAAAAA%3ACv2M6NlIMZ63nRogFG5QGbmy7Xj91easTU6t5iN1RCPKkdbDU2q9vwuQKmVzqL-Q09nhjni0QA.

Davies, J., and Graff, M. (2005). Performance in e-learning: online participation and student grades. *British Journal of Educational Technology 36*, 657–663. doi: 10.1111/j.1467-8535.2005.00542.x

Diep, A. N., Zhu, C., Cocquyt, C., De Greef, M., & Vanwing, T. (2019). Adult Learners' Social Connectedness and Online Participation: The Importance of Online Interaction Quality. *Studies in Continuing Education, 41*(3), 326–346.

Evans, C., Gibbons, N. J., Shah, K., and Griffin, D. K. (2004). Virtual learning in the biological sciences: pitfalls of simply "putting notes on the web." *Computers & Education, 43*(1-2), 49–61. doi: 10.1016/j.compedu.2003.12.004

Gallien, T., & Oomen-Early, J. (2008). Personalized Versus Collective Instructor Feedback in the Online Course room: Does Type of Feedback Affect Student Satisfaction, Academic Performance and Perceived Connectedness With the Instructor?. *International Journal on E-Learning, 7*(3), 463-476.

Hobbs, D. (2002). Constructivist approach to web course design: a review of the literature. *International Journal on E-Learning, 1*(2), 60–65. Available online at: http://www.editlib.org/p/10821

Holley, D., and Oliver, M. (2010). Student engagement and blended learning: portraits of risk. *Computers & Education, 54*(3), 693–700.

Magalhães, P., Ferreira, D., Cunha, J., & Rosário, P. (2020). Online vs traditional homework: A systematic review on the benefits to students' performance. *Computers & Education*, *152*.

Nenagh eKemp, & Rachel eGrieve. (2014). Face-to-face or Face-to-screen? Undergraduates' opinions and test performance in classroom versus online learning. *Frontiers in Psychology*, *5*.

Otter, R. R., Seipel, S., Graeff, T., Alexander, B., Boraiko, C., Gray, J., Sadler, K., et al. (2013). Comparing student and faculty perceptions of online and traditional courses. *Internet High. Educ. 19*, 27–35.

Phillips, J. A. (2015). Replacing traditional live lectures with online learning modules: Effects on learning and student perceptions. *Currents in Pharmacy Teaching and Learning*, *7*(6), 738–744.

Ramsden, P. (1992). Learning to Teach in Higher Education. London: Routledge.

Robinson, C. C., and Hullinger, H. (2008). New benchmarks in higher education: Student engagement in online learning. *Journal of Education for Business, 84*(2), 101–109. doi: 10.3200/JOEB.84.2.101-109

Social Connection Definition: What Is Social Connection. (2020). Retrieved July 25, 2020, from https://greatergood.berkeley.edu/topic/social_connection/definition.

Siti Nur, D. M., Husnin, H., & Tuan Mastura, T. S. (2020). Teaching presence in online gamified education for sustainability learning. *Sustainability, 12*(9), 3801. doi:http://dx.doi.org.ezproxy.siena.edu:2048/10.3390/su12093801

Upton, D. (2006). Online learning in speech and language therapy: student performance and attitudes. *Education for Health, 19*(1), 22–31. doi: 10.1080/13576280500534735

Warschauer, M. (1997). Computer-mediated collaborative learning: theory and practice. *The Modern Language Journal, 81*(4), 470–481. doi: 10.2307/328890

Appendices and Annexures

Appendix A: Survey (Abbreviated Version)

Connection and Engagement after switching to virtual learning

We're inviting you to take a completely voluntary survey for research. There are no negative consequences if you don't want to take it. If you start the survey, you can always change your mind and stop at any time. This survey is completely anonymous, no personal information will be recorded. The information collected from this survey may be important to help your professors create a better class structure in the Fall 2020 semester. This survey should take 5-10 minutes to complete. Thank you very much!

Were you a student of (the undergraduate, liberal arts college) during the Spring 2020 semester? (Yes or No)

Skip To: End of Survey If Were you a student of Siena College during the Spring 2020 semester? = No

Please select your major at the end of the Spring 2020 semester (hold CTRL while clicking to select more than one option) (DROP DOWN MENU OF ALL MAJORS OFFERED)

Display This Question:

If Please select your major at the end of the Spring 2020 semester (hold CTRL while clicking to sele... = Other

Please type in your major

Please select your minor at the end of Spring 2020 semester (select all that apply).

(DROP DOWN MENU OF ALL MINORS OFFERED)

Display This Question:

If Please select your minor at the end of Spring 2020 semester (select all that apply). = Other

Please type in your minor

To which gender identity do you most identify? (Female, Male, Transgender Female, Transgender Male, Gender Variant/Non-Conforming, Not listed, Prefer Not to Answer)

Display This Question:

If To which gender identity do you most identify? = Not listed (type response in next question)

To which gender identity do you most identify?

What was your class year during Spring 2020? (Freshman, Sophomore, Junior, Senior, Graduate Program)

What was your age at the end of the Spring 2020 semester? (please input in decimal numeric form)

An asynchronous online class consists of a students that meet at the same place (i.e. Canvas) at different times.

Have you taken an asynchronous online class before Spring 2020? (Yes or No)

Display This Question:

If An asynchronous online class consists of a students that meet at the same place (i.e. Canvas) at... = Yes

How many asynchronous online classes did you take before Spring 2020? (please enter in decimal numeric form)

A synchronous online class consists of a students that meet at the same place (i.e. Zoom) at the same time.

Have you taken a synchronous online class before Spring 2020? (Yes or No)

Display This Question:

If A synchronous online class consists of a students that meet at the same place (i.e. Zoom) at the... = Yes

How many synchronous online classes did you take before Spring 2020? (please enter in decimal numeric form)

A hybrid online class consists of 50-75% online course work, the rest is face-to-face meetings.

Have you taken a hybrid online class before Spring 2020? (Yes or No)

Display This Question:

If A hybrid online class consists of 50-75% online course work, the rest is face-to-face meetings. H... = Yes

How many hybrid online classes did you take before Spring 2020? (please enter in decimal numeric form)

What is your overall GPA? (please type in numeric form with 2 decimal places)

Are you a commuter student? (Yes or No)

Connection is a feeling that you belong to a group and generally feel close to other people. Please select the choice that best represents your answer. (5-point Likert scale)

Overall, how connected to classmates did you feel before the switch to virtual learning?

Overall, how connected to classmates did you feel after switching to virtual learning?

Overall, how connected to professors did you feel before switching to virtual learning?

Overall, how connected to professors did you feel after switching to virtual learning?

How often were your professors available after switching to virtual learning compared to before switching to virtual learning? (5-point Likert scale)

Please select the choice that best represents your answer. (5-point Likert scale)

How often, on average, did you spend time with other students on class related activities after switching to virtual learning?

How often, on average, did you spend time with other students on non-class related activities after switching to virtual learning?

How many Siena events (i.e. club meetings, SEB events, Siena Fest, etc.) did you participate in after the switch to virtual learning? (0, 1-2, 3-4, 5+)

Were there any tools or activities that helped you feel connected to your classmates after the switch to virtual learning?

Please explain. (Short answer)

Were there any tools or activities that helped you feel connected with your Professors?

Please explain. (Short answer)

Was there any time that you felt particularly connected to other students or your professors?

If so, please describe the experience. (Short answer)

How often did you use your webcam during class time after the switch to virtual learning? (always, most of the time, about half the time, sometimes, never)

How often did you use your microphone during class time after the switch to virtual learning? (always, most of the time, about half the time, sometimes, never)

How often did you have access to tools you needed for your online classes after the switch to virtual learning? (always, most of the time, about half the time, sometimes, never)

What was your GPA for the Spring 2020 semester?

Please select the choice that best represents your answer. (5-point Likert scale)

How much effort did you put into taking classes before the switch to virtual learning?

How much effort did you put into taking classes after switching to virtual learning?

How much motivation did you feel to attempt and complete course work before the switch to virtual learning?

How much motivation did you feel to attempt and complete course work after switching to virtual learning?

Please select the choice that best represents your answer. (5-point Likert scale)

How much did you participate in class during class time before the switch to virtual learning?

How much did you participate in class during class time after the switch to virtual learning?

How many of your classes did you attend before the switch to virtual learning?

How many of your classes did you attend after the switch to virtual learning?

Please select the choice that best represents your answer. (5-point Likert scale)

How much time did you devote to your assignments per week before switching to virtual learning?

How much time did you devote to your assignments per week after switching to virtual learning?

How much time did you spend procrastinating per week before switching to virtual learning?

How much time did you spend procrastinating after per week switching to virtual learning?

Which online learning tools did you enjoy using the most after switching to virtual learning?

Please explain. (Short answer)

Did you notice any differences between your online and classroom learning experience? (Yes or No)

Display This Question:

If Did you notice any differences between your online and classroom learning experience? = Yes

Please explain the differences that you noticed. (Short answer)

Were there times when you felt motivated to do your best work? (Yes or No)

Display This Question:

If Were there times when you felt motivated to do your best work? = Yes

Please describe the situation and what you found most motivating. (Short answer)

If there is anything else you would like to add about your experience after the switch to virtual learning, please select yes. (Yes or No)

Display This Question:

If there is anything else you would like to add about your experience after the switch to virtual... = Yes

Please tell us about your experience. (Short answer)