

Social media mining to understand the impact of cooperative education on mental health

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Cooperative education is a form of work-integrated learning that includes both classroom study terms and paid work experience. Prior work has studied the benefits of cooperative education for students, employers, and academic institutions. In contrast, this article studies the impact of co-operative education on students' mental well-being. This is done by mining the Reddit social media platform, which includes, among many other topics, discussion communities for major U.S. and Canadian colleges. This analysis reveals that students report feelings of self-doubt resulting from a competitive co-op job market, especially when placed in entry-level jobs that are not related to their academic programs, and anxiety due to job interviews, especially when they coincide with exams and other academic deadlines. Additionally, recent discussions frequently point out cancelled work terms due to the COVID-19 pandemic, creating even more competition, financial hardship, and pressure to make alternate academic or employment arrangements.

Keywords: Cooperative education, mental health, social media, topic modelling

Cooperative education (co-op) programs combine academic courses with paid work experience. For example, students may alternate between classroom study terms and work terms, also referred to as internships. Cooperative education programs, both at the undergraduate and graduate levels, have become popular as they offer practical work experience for students and a talent pipeline for employers (Braunstein & Stull, 2001; Van Gyn, 1997).

Prior work has examined the benefits of cooperative education for students and employers. From a student point of view, studies have illustrated the impact of co-op on skill and career growth (Gault et al., 2000; Ralph et al., 2009). From an employer point of view, there has been work on understanding employers' expectations of successful internships (Chopra et al., 2018; Hodges & Burchell, 2003; Nevison et al., 2018). However, cooperative education also includes new work-related tasks and responsibilities that may impact students' well-being. Yet, there is less work on the effect of co-op on students' mental health, aside from small-scale studies of specific issues such as failing to obtain co-op employment

To fill this gap, this article analyzes social media to discover what students say about the impact of cooperative education on their well-being, with a focus on the following two research questions:

1. How are students affected by the additional tasks and responsibilities associated with cooperative education, including job interviews?
2. How is co-op students' well-being affected by the economic shutdowns resulting from the COVID-19 pandemic?

This is done by analyzing U.S. and Canadian university discussion communities hosted on Reddit (www.reddit.com). Reddit is a popular online social media platform divided into over 100,000 user-created discussion communities called subreddits. A subreddit contains a number of posts that initiate discussions, and a post is followed by (zero or more) comments. Subreddit names begin with "r/" and

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are indicative of the content. For example, r/Fitness contains discussions of fitness and physical exercise, r/StarWars is a forum for fans of Star Wars movies, etc. As of 2020, there are over 400 million users on Reddit, most of whom come from the U.S., followed by the U.K. and Canada. Each user has a Reddit ID, but is not required to reveal any personal information.

In contrast to prior work based on surveys of small groups of students from a single institution, this study is based on a large dataset containing student-generated social media content from over 50 institutions, and is not limited to a specific issue to or students in specific circumstances. Furthermore, it has been recognized that the anonymity of social media makes it suitable for discussing sensitive issues. However, while there has been prior work on using social media such as Reddit and Twitter to understand mental health issues (Coppersmith et al., 2014; De Choudhury et al., 2017; De Choudhury & De, 2014; Gkotsis et al., 2016; Guntuku et al., 2017; McClellan et al., 2017; Pavalanathan & De Choudhury, 2015), including issues experienced specifically by students (Bagroy et al., 2017), these studies have not reported any issues related to cooperative education.

The remainder of this paper is organized as follows. The Related Work section presents prior work on social media mining to understand students' mental health and work on understanding and overcoming issues that students face in cooperative education programs. The Data and Methodology section explains how data were analyzed. The Results section presents the findings, and the Discussion section places the results in the context of prior work and explains their significance. Finally, the Conclusions section suggests direction for future research.

RELATED WORK

Two research directions are closely related to this study: social media mining to understand students' mental health and survey-driven studies of the effect of cooperative education on students' mental health.

In the context of social media mining, the closest work is that of Bagroy et al. (2017), which proposed a mental well-being index for college campuses. The index was computed by measuring the fraction of a given college's Reddit discussions that were related to mental health issues, as determined by a text classifier. In a related study, Saha et al. (2019) computed the fraction of these discussions that were classified as hate speech, and identified expressions of stress linked to exposure to hate speech. However, these studies did not report any issues related to co-op.

In terms of survey-driven studies, previous work investigated the effects of co-op on students' well-being. Drysdale and McBeath (2014) surveyed 1970 students about psychological attributes such as hope, procrastination, self-efficacy, and study skills. They found that co-op students had lower anxiety, a better attitude, better use of study aids, and better time management. Drewery et al. (2016) surveyed 1989 co-op students and found that students who see a strong connection between the work term and their academic program are more likely to feel satisfied and perform well. Deziel et al. (2013) surveyed 312 students and found that factors such as academic program, year of study and gender affect students' mental wellness.

In contrast to the positive implications of work integrated learning (WIL), such as improving self-confidence (Leong & Kavanagh, 2013), self-efficiency (Freudenberg et al., 2013), and engaging in networking opportunities (Jackson & Wilton, 2016; Pretti et al., 2020), negative aspects have also been discussed in previous work. Some of the reported issues were related to mental health: depression of students unable to find co-op jobs or placed in jobs that are unrelated to their academic programs,

disconnect from campus life caused by alternating work and study terms, unpaid or low-paid nature of many co-op placements (Cormier & Drewery, 2017; Drewery et al., 2016; Drewery et al., 2019; Gillett-Swan, 2018; Rowe, 2015), financial stress, family responsibilities, cultural differences, travel requirements and transport issues (Andrews & Chong, 2011; Crebert et al., 2004; Drysdale et al., 2016; Forbus et al., 2011; Gardner, 2010; Jackson, 2017; Johnstone et al., 2016), and feelings of anxiety, worry, and helplessness caused by doing poorly in WIL programs (Brockner & Guare, 1983; Coetzee & Bergh, 2009; Kerka, 1998).

Additionally, the COVID-19 pandemic has created new challenges, as noted by previous work (Wang et al., 2020; Zhang et al., 2020). Some of these challenges include co-op placement cancellations, technical issues such as unstable internet connection during online work (Hodges & Martin, 2020), missing in-office atmosphere, and a decrease in students' motivation (Pretti et al., 2020).

In response to the negative impacts of WIL, previous work provides recommendations to alleviate these impacts. A recent study suggests minimizing gender differences in WIL programs to help students who feel inferior or have a low self-esteem (Jaaffar et al., 2019). Moreover, it is necessary to effectively prepare students before engaging in co-op opportunities (Billett, 2015; Smith, 2016; Smith et al., 2019). To this end, previous work suggests incorporating and promoting networking and career events in universities (Paull et al., 2019); providing simulations and virtual WIL to develop students' skills (Sachs et al., 2017; Male et al., 2017; Paull et al., 2019); incorporating students' experiences to enrich program design (Jackson, 2015; Kaider & Bussey, 2018; Paull et al., 2019); and appointing academics with industry experience (Male & King, 2014; Male & King, 2019; Paull et al., 2019). Furthermore, previous work noted the role of a facilitator in debriefing and reflecting on WIL placements to be beneficial for students' WIL experience (Antoniou et al., 2013; Bates, 2003; Crebert et al., 2004; Klassen & Durksen, 2014; McBeath et al., 2018; Pretti et al., 2020; Winchester-Seeto & Rowe, 2019; Zegwaard & Rowe, 2019).

Previous work also observed feelings of loneliness and low self-esteem (Paul & Brier, 2001) in students who were away from friends during work placements (Jones, 2007). To prevent students from becoming friend sick, prior work suggests increasing students' sense of belonging to the university (McBeath et al., 2018).

Finally, prior work recommends clear communication between supervisors and students (Hodges & Martin, 2020; Richardson et al., 2009; Staples, 2001) and increasing student awareness of mental health counseling services (Hunt & Eisenberg, 2010).

In contrast to the studies above that typically survey students from one institution about a specific issue, this study analyzes social media discussions generated by students from over 50 academic institutions in the U.S. and Canada. In addition to confirming previously reported issues, such as stress due to co-op unemployment, new issues affecting co-op students are identified, such as competition and interview anxiety and timing. Additionally, new insights are provided into issues affecting co-op students during the COVID-19 pandemic.

DATA AND METHODOLOGY

Data

The organization of Reddit into communities with descriptive names makes it possible to perform focused data mining studies on specific topics or user groups. In particular, previous work (Bagroy et al., 2017) has identified the subreddits corresponding to large U.S. colleges according to U.S. News

(<https://www.usnews.com/best-colleges/rankings/national-universities>). These subreddits are also used in this analysis and are listed in Table 1 (first column). Additionally, subreddits were identified for large Canadian universities, according to McLean's Magazine (<https://www.macleans.ca/education/university-rankings-2020-canadas-top-comprehensive-schools>) and are listed in Table 2 (first column). The numbers reported in Table 1 and in Table 2 will be explained shortly. In the remainder of this paper, the above subreddits are referred to as academic subreddits.

The following publicly available datasets are used in this study.

1. Dataset 1 consists of all posts and comments on the academic subreddits made between September 1, 2015, and August 30, 2019. This dataset was obtained from the Google Big Query database (<https://cloud.google.com/bigquery>), which stores a copy of all Reddit content from the above time frame. This dataset is used to analyze the impact of co-op on students' well-being.
2. Dataset 2 consists of posts and comments on the academic subreddits made between January 1, 2020, and May 15, 2020, that are related to the COVID-19 pandemic. This dataset was downloaded from Pushshift (<https://pushshift.io>) which provides keyword search of Reddit content. Specifically, this dataset contains all posts and comments on the academic subreddits that include at least one occurrence of the following keywords: corona, covid, pandemic, and quarantine. Reddit keyword search is case insensitive and produces substring matches. That is, the term covid matches posts and comments that include covid, Covid, covid-19, COVID19, etc. This dataset is used for a focused study of the effect of the pandemic on co-op students' well-being.

Reddit places a limit on the number of posts and comments that can be downloaded from Pushshift. As a result, it was not possible to download all the content from academic subreddits from September 2019 onwards and append this new content to Dataset 1. Instead, only COVID-19 related content was downloaded into Dataset 2 for a focused analysis of the effect of the pandemic on co-op students.

TABLE 1: U.S. academic subreddits: number of posts and comments in Dataset 1 and Dataset 2 before and after processing.

Subreddits	Dataset 1: Posts		Dataset 1: Comments		Dataset 2: Posts		Dataset 2: Comments	
	before	after	before	after	before	after	before	after
r/gatech	18623	305	14605	1386	88	5	2267	39
r/UIUC	5893	423	27258	1864	34	10	1923	195
r/rutgers	4062	263	12858	913	22	2	1587	135
r/UMD	2861	198	10748	916	24	15	1239	139
r/UCSD	2638	163	10991	771	12	2	993	98
r/Purdue	2408	183	10540	883	13	1	883	108
r/berkeley	2254	170	15946	970	40	11	1761	142
r/UTAustin	2134	133	8744	507	8	2	506	66
r/utdallas	1974	146	6476	524	29	1	525	53
r/Cornell	1718	75	5865	453	24	8	1485	146
r/udub	1571	97	7422	456	14	10	845	85
r/uofm	1550	99	6254	546	22	5	723	58

r/SBU	1450	90	4367	246	8	0	789	91
r/rit	1363	96	7080	684	23	3	653	38
r/UWMadison	1322	93	5040	343	1	1	462	43
r/RPI	1207	91	7119	571	12	5	827	68
r/SJSU	1187	51	3955	306	1	1	146	27
r/nyu	1146	82	2975	169	2	4	226	44
r/PennStateUniversity	1134	85	5255	369	0	1	554	36
r/NCSU	1110	58	3679	293	1	4	330	46
r/msu	1074	52	4191	316	5	2	617	55
r/UGA	1026	69	3511	278	0	0	57	17
r/USC	931	51	2851	197	2	2	313	92
r/UVA	616	49	2273	116	7	2	527	30
r/uichicago	532	37	1178	93	3	1	115	13
r/UNCCCharlotte	512	32	1635	94	5	3	325	37
r/stanford	510	42	1416	112	0	0	79	25
r/UPenn	491	35	1276	68	8	1	212	26
r/columbia	411	30	1428	55	13	3	252	29
r/cmu	333	25	1320	118	4	0	47	9
r/Baruch	324	19	796	57	1	0	124	28
r/IndianaUniversity	320	25	1311	79	0	0	5	4
r/mit	316	25	1487	121	2	0	134	26
r/UMBC	286	11	822	59	0	0	71	12
r/Harvard	241	18	1081	73	1	1	45	21
r/BrownU	219	14	603	28	0	0	21	9
r/byu	198	20	1404	75	1	0	113	10
r/duke	187	10	502	19	0	1	78	16
r/UNC	184	9	416	21	0	0	227	37
r/washu	179	15	622	30	2	1	47	8
r/Vanderbilt	156	9	334	16	1	1	29	6
r/bostoncollege	96	3	315	9	0	0	13	6
r/Caltech	77	11	232	20	0	0	9	15
Total	50063	3512	208181	15224	433	109	22184	2188

TABLE 2: Canadian academic subreddits: number of posts and comments in Dataset 1 and Dataset 2 before and after processing.

Subreddits	Dataset 1: Posts		Dataset 1: Comments		Dataset 2: Posts		Dataset 2: Comments	
	before	after	before	after	before	after	before	after
r/uwaterloo	8912	1836	43382	5215	126	29	3707	257
r/UofT	7895	588	32929	2490	15	3	1271	156
r/UBC	3577	406	20504	1485	31	5	2053	136
r/uAlberta	2766	146	8968	576	9	5	2032	223
r/yorku	2612	182	9877	531	5	2	700	88
r/mcgill	2603	171	10517	635	67	5	3774	63
r/Concordia	1643	129	4042	286	12	3	725	57
r/uwo	1599	112	6167	401	10	2	400	41
r/ryerson	1383	82	4018	374	22	5	365	54
r/CarletonU	1320	134	4988	473	0	0	350	42
r/McMaster	928	63	2354	218	30	2	565	65
r/queens								
university	763	35	2452	163	17	2	294	27
r/uvic	665	41	2400	181	11	3	204	26
r/wlu	458	38	1159	114	13	2	209	30
r/uoguelph	399	29	960	99	4	3	229	24
r/Dalhousie	293	24	667	39	3	0	117	15
r/umanitoba	165	23	354	18	1	1	78	15
r/brocku	103	11	220	22	5	2	45	10
r/memorial								
university	86	5	116	15	0	0	30	3
r/usask	74	4	157	11	1	1	14	4
r/uottawa	35	5	27	2	0	0	0	0
r/UdeM	22	2	101	4	0	0	0	0
r/University_								
Of_Regina	21	3	30	3	0	0	0	1
r/lakeheadu	20	0	47	4	0	0	10	4
r/uleth	17	0	18	3	0	0	0	0
r/laurentian	14	0	21	0	0	0	0	1
r/AcadiaU	14	1	44	1	0	0	0	0
Total	38387	4070	156519	13363	382	75	17172	1342

Methodology

The methodology used in this paper, consisting of three steps, is summarized in Figure 1 and explained below.

FIGURE 1: Reddit mining methodology to understand the impact of cooperative education on students' mental health.



Step 1: Data Pre-Processing

For both Dataset 1 and Dataset 2, standard text pre-processing was done using the Python NLTK parser (Bird et al., 2009). Following previous work on Reddit data mining (Khan & Golab, 2020), posts and comments with fewer than 256 or more than 4096 characters were removed: short ones are unlikely to be meaningful (and may instead correspond to URLs), while long ones may mention more than one topic and therefore cannot be handled well by topic modelling algorithms. Stopwords were also removed (which are words that serve a grammatical purpose but do not convey any semantic meaning, such as and, the, etc.). Finally, the remaining words were lemmatized. Lemmatization is the process of grouping together the inflected forms of a word. For example, words such as “works”, “worked”, and “working” are all lemmatized to “work”.

Step 2: Content Filtering

Academic subreddits discuss a variety of topics related to the corresponding institution, such as admissions, academics and campus events. Thus, the next step is to filter the data and identify discussions that are relevant to this study, namely those which 1) are related to mental health, and 2) are related to co-operative education.

First, a machine learning classifier was applied to predict whether a post or a comment is likely to be related to mental health. This study used the logistic regression classifier from Bagroy et al. (2017), which was originally used to compute the percentage of discussions on academic subreddits that are related to mental health. The classifier was trained by considering all posts on the subreddit r/mentalhealth to be mental-health-related and all posts on control subreddits (among them r/food, r/technology, and the FAQ forum r/AskReddit) to be unrelated.

Next, posts and comments related to co-op were identified. This was done by selecting posts and comments that contain at least one of the following co-op related terms: “coop”, “interview”, “resume”, “work term”, and “intern”. Recall that words were lemmatized during pre-processing, so “interview” also captures similar words such as “interviewer” and “interviewing”.

Step 3: Topic Modelling

For both Dataset 1 and 2, the final step is to apply a topic modelling algorithm to the posts and comments that passed the above mental health and co-op filters. First, the posts and comments were vectorized in a standard way. For each post or comment, the i th entry of its vector corresponds to the Term Frequency - Inverse Document Frequency (TF-IDF) of the i th word. The TF-IDF score of a given word for a given post or comment was computed as follows: the number of times the word appears in the given post or comment (TF) was divided by the fraction of total posts and comments that contain at least one occurrence of this word (DF). TF-IDF is frequently used when vectorizing text as it takes into account both the uniqueness of a word in the entire dataset and the importance of the word to the specific document (in this case, the specific post or comment).

Next, the Non-negative Matrix Factorization (NMF) topic modelling algorithm (Xu et al., 2003) was applied to the vectorized posts and comments. NMF clusters the data into topics and produces a list of representative terms called topic descriptors for each topic. Each such term has a “representativeness” score, and the top-10 highest-scoring terms were selected for each topic. Additionally, for each topic, the top-10 most frequent word n -grams were reported for n up to three, i.e., sequences of up to three consecutive words within the posts or comments belonging to the given topic. NMF requires the number of topics as input. To select an appropriate number of topics, NMF was applied to produce between 2 and 100 topics, and the coherence (O’Callaghan et al., 2015) of each output was computed (higher is better). The highest coherence was obtained at ten topics for Dataset 1 and 15 topics for Dataset 2, as shown in Figure 2 and Figure 3, respectively.

FIGURE 2: Coherence plot for Dataset 1, with the number of topics on the x axis and the corresponding coherence on the y axis.

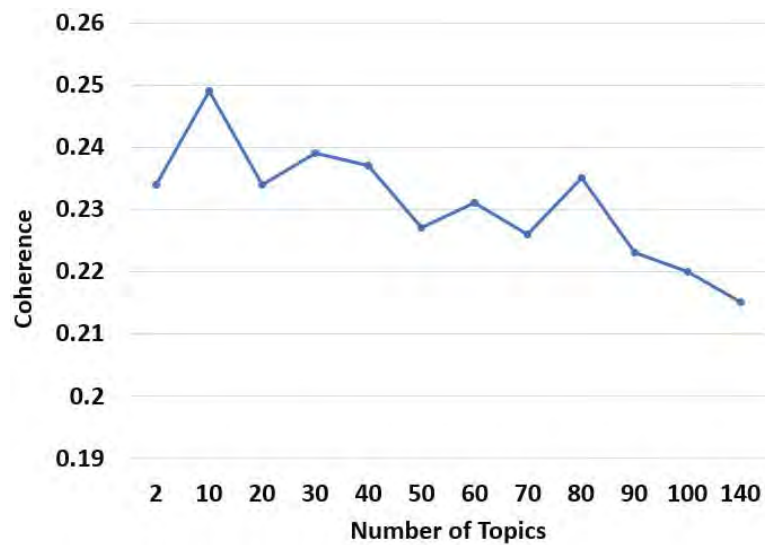
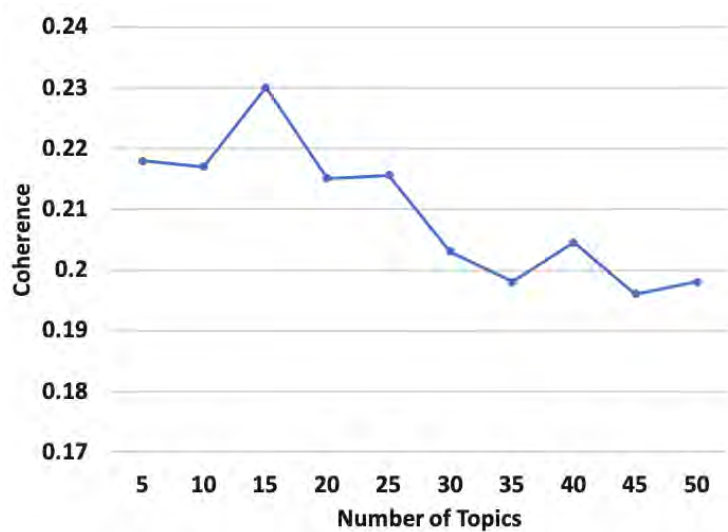


FIGURE 3: Coherence plot for Dataset 2, with the number of topics on the x axis and the corresponding coherence on the y axis.



Another issue with NMF was that some topic descriptors were uninformative, as shown in Figure 4: “thanks,” “day,” and “stuff,” misspelled words such as “havent” and “thats”, and words such as “Monday” and “lot.”

Following prior work on topic modelling (Blanchard, 2007; Khan & Golab, 2020), uninformative terms were repeatedly removed from the posts and comments, and NMF was re-applied, until the topic descriptors no longer contained any uninformative terms. After two iterations, all the top-10 descriptors became informative.

FIGURE 4: Sample topic descriptors produced by NMF. Uninformative words are circled.

Topic 3: people, thing think, better, make, best, way, lot, say, try
 Topic 4: day, class, exam, today, outside, getting, going, didnt assignment, havent
 Topic 5: term, coop, course, study, exam, job, wish, winter, summer, failed
 ...

Finally, issues affecting students were extracted from the NMF topic descriptors, the frequent n -grams, and a manual inspection of a 5% sample of posts and comments assigned to each topic.

RESULTS

Topic Modelling of Dataset 1

Table 3 shows the topic modeling results for posts and comments in Dataset 1 that are related to both mental health and co-op, including topic descriptors, a sample of frequent n -grams, and the percentage of content assigned to each topic. After inspecting these results, plus a sample of posts and comments assigned to each of the ten topics, the topics were manually grouped into issues, shown in Table 4 (which points out which topics from Table 3 describe which issue).

TABLE 3: Topic modeling output for posts and comments in Dataset 1.

	Topic descriptors	Frequent n-grams	%
1	work, time, people, like, make, want, hard, day, need, know	'work hard', 'people work', 'school work'	29.9
2	job, apply, degree, graduate, student, want, like, people, look, pay	'apply job', 'job market'	14.1
3	project, code, like, use, course, make, time, start, personal, create	'work project', 'start project', 'personal project'	12.2
4	experience, internship, year, co-op, school, summer, gpa, company, graduate, program	'work experience', 'grad school', 'work hard'	9.5
5	class, easy, semester, final, hard, pretty, time, exam, course, lecture	'class work', 'final project', 'work time'	7.8
6	resume, interview, look, company, ask, skill, apply, recruiter, employer, page	'work experience', 'career fair', 'cover letter'	7.0
7	lab, research, professor, prof, student, grad, undergrad, paper, ask, email	'research project', 'work lab', 'grad student'	5.6
8	group, member, people, meet, person, presentation, individual, make, facebook, fb	'group project', 'work group', 'class group'	5.3
9	team, game, member, join, play, club, engineer, player, people, design	'project team', 'work project', 'team work'	5.0
10	letter, cover, apply, write, application, position, make, generic, company, tailor	'cover letter', 'resume cover', 'resume cover letter'	3.6

TABLE 4: Issues extracted from posts and comments in Dataset 1.

Topics	Issue	Description	%
1,2,4,9,10	Competition	Not qualifying for a desired co-op job	62.1
3,5	Questions	About co-op programs (e.g., seeking clarification when instructions are not clear enough)	20
6	Interviews	E.g., not knowing what to expect or how to prepare	7
7	Research opportunities	Not directly related to co-op	5.6
8	Group projects	Not directly related to co-op	5.3

Topics 1, 2, 4, 9 and 10 cover over 60 percent of the content and appear related to competition, specifically the competitive nature of the co-op job market. Upon manual inspection of a sample of posts and comments, it was found that students express self-doubt and feelings of inadequacy when unable to secure a desirable co-op job, especially when one's classmates and friends are able to obtain such jobs. There were also some discussions about choosing a good co-op program that enables interesting and highly-paid co-op job opportunities, concerns over not having enough experience to qualify for these desirable jobs, and the stress of maintaining a high GPA to qualify for or remain in such programs.

Notably, many of the posts and comments related to competition referred to technology and software roles, as well as large technology employers such as Facebook and Google. This is likely due to the fact that co-operative programs are mainly in science and engineering.

Next, topics 3 and 5 are about questions students ask about co-op programs. This includes general questions related to admissions, and specific questions such as how to write a work report.

Topic 6 describes issues with interviews. Many posts and comments belonging to this topic referred to interviews for co-op jobs being stressful, especially because they often coincide with exams and other academic deadlines, and because interview processes for software positions may include lengthy programming tests. Students also reported feelings of uncertainty about how to prepare for interviews, how to acquire required skills, and what to expect. Additionally, some students reported anxiety after an interview while waiting to find out if they have been hired.

Finally, topics 7 and 8 are not directly related to the effect of co-op on students' well-being; they instead refer mainly to research opportunities and participation in group projects during internships.

Topic Modelling of Dataset 2

Table 5 shows the topic modelling results for posts and comments in Dataset 2, i.e., those related to mental health, co-op, and COVID-19. The table includes topic descriptors, a sample of frequent n -grams, and the percentage of posts plus comments assigned to each topic. These topics are then grouped into issues in Table 6.

TABLE 5: Topic modeling output for posts and comments in Dataset 2.

	Topic descriptors	Frequent n-grams	%
1	people, virus, case, flu, test, symptom, spread, quarantine, disease, death	'social distancing', 'mortality rate', 'global pandemic'	15.6
2	go, home, back, stay, quarantine, apartment, live, place, family, social	'stay home', 'international student'	10.8
3	like, get, feel, really, make, time, know, people, even, try	'feel like', 'mental health', 'every day'	9.8
4	pay, fee, money, tuition, financial, refund, rent, need, pandemic, support	'financial aid', 'tuition fee', 'pay rent'	8.3
5	grade, semester, gpa, school, would, pf, pandemic, grad, pa, admission	'admission committee', 'grading system', 'graduate school'	8.2
6	student, international, grant, benefit, many, government, provide, eligible, support, emergency	'international student', 'support student', 'student family'	8.2
7	class, online, take, semester, fall, still, would, know, lecture, inperson	'online class', 'fall semester', 'inperson class'	6.3
8	email, ask, send, professor, prof, office, need, say, department, tell	'financial aid', 'grading policy', 'email sent'	5.6
9	university, decision, mentor, look, u, make, plan, experience, guidance, campus	'faculty staff', 'make decision', 'student mentor'	5.5
10	year, school, last, next, first, fall, month, go, know, would	'next year', 'freshman year', 'gap year'	4.9
11	exam, final, cheat, question, take, average, u, make, professor, stress	'final exam', 'class average', 'feel like'	4.8
12	course, online, take, offer, prof, credit, drop, teach, pandemic, term	'summer course', 'community college', 'international student'	4.7
13	summer, job, work, internship, cancel, get, plan, apply, coop, due	'internship cancelled', 'summer internship', 'last summer'	4.6
14	department, graduation, celebration, specific, celebrate, would, grad, plaque, newgrads, commemorative	'department celebrate', 'zoom celebration', 'graduation would'	1.5
15	study, survey, participant, group, focus, national, fill, experience, participate, 1hour	'focus group', 'academic term', 'experience covid19'	1.2

TABLE 6: Issues extracted from posts and comments in Dataset 2.

Topics	Issue	Description	%
4, 5, 6, 9, 10, 11, 14, 15	Cancellation	<ul style="list-style-type: none"> Higher than usual competition Financial hardship Loss of relevant work experience 	42.6
3, 7, 8, 12, 13	Substitution	<ul style="list-style-type: none"> Courses are full Fear of being judged for making inadequate or unpopular alternate arrangements Working in an unrelated job e.g., as a cashier 	31.0
1, 2	Illness	Fear of getting the virus at work	26.4

The most commonly discussed consequences of COVID-19 are related to cancelled co-op work terms (topics 4, 5, 6, 9, 10, 11, 14, 15). This creates even more competition for the remaining positions, leaving students overwhelmed and disappointed after an unsuccessful job search. Cancelled work terms also cause financial hardship and may prevent some students from graduating if a certain number of completed work terms is required for graduation.

Furthermore, having to make alternate arrangements is a source of anxiety for some students (labelled “Substitution” in Table 6). One alternative is to take courses in place of a cancelled work term. However, some students reported that many courses were already full when they found out that their work terms were cancelled (topics 7, 8, 12).

Finding an unrelated entry-level job is another alternative to unemployment. However, students who found employment as cashiers report concerns about not learning new skills or acquiring relevant work experience for their future careers. Additionally, some students in this situation fear being judged by their family and friends. On the other hand, some students feel they would be ridiculed for wasting their lives if they chose to not work or take courses during this time (topics 3, 13).

Finally, aside from the consequences of cancelled work terms, students who were able find work reported concerns about catching the virus in the workplace (topics 1, 2).

DISCUSSION

To the best of the authors' knowledge, this is the first social media mining study that focuses on the impact of co-operative education on students' well-being. Topic modelling of Reddit discussion communities corresponding to U.S. and Canadian universities revealed the following insights.

Competition for Co-op Placements

Competition for internships, especially in the software and information technology fields, is a frequently discussed negative aspect of co-operative education. Competition for highly paid and relevant opportunities is a source of mental distress, and students who fail to compete and secure a desirable placement feel disappointed. As suggested by prior work, co-op unemployment can lead to mental well-being issues (Cormier & Drewery, 2017; Drewery et al., 2019). Additionally, it was observed in this study that students who secured a position unrelated to their program can feel inferior, disappointed, and unmotivated. This is in line with previous work (Drewery et al., 2016), in which it was observed that students feel satisfied when there is a strong connection between their co-op placement and their academic program.

Previous work reported feelings of anxiety, helplessness, and worry associated with poor performance in WIL placements (Brockner & Guare, 1983; Coetzee & Bergh, 2009; Kerka, 1998). The current study further indicates that some students may express similar negative feelings when they believe that their co-op placements are not as desirable or prestigious than those of their classmates. This finding shows that even students who performed well on their work terms may feel disappointed when they compare themselves to their peers.

These findings suggest actionable insights for academic institutions and students. First, it is important to manage co-op students' expectations. For example, in addition to the networking and career events suggested by previous work (Paull et al., 2019), universities may want to offer workshops that explain the competitive nature of the co-op process and help students find jobs they qualify for. Junior students, specifically, should keep in mind that they may not immediately qualify for the sought-after positions secured by their senior colleagues.

Co-op Interviews

Co-op interviews are a source of stress for several reasons. First, students fear being unprepared or unqualified, especially when competing for sought-after jobs. This has also been noted by previous

work as a source of anxiety and disappointment (Billett, 2015; Smith, 2016; Smith et al., 2019). Similar to previous work suggesting the use of virtual WIL training (Male et al., 2017; Paull et al., 2019; Sachs et al., 2017), universities may want to offer virtual mock interviews to students experiencing interview anxiety. Virtual mock interviews are especially important during the COVID-19 pandemic when most of the interviews are online and in-person coaching is not possible.

Second, interviews often coincide with midterm examinations and other academic deadlines, meaning that students may have to choose between preparing for interviews (including preparing for programming tests) and coursework. Previous work has argued that co-operative education research should consider work-related variables in addition to education-related ones; these work-related variables include skills, job satisfaction, performance assessments, and selection interviews (Rowe, 2015). The findings on co-op interviews align with this suggestion, providing data-driven evidence of another source of anxiety for co-op students.

Motivated by the above observation, an actionable insight for universities is to avoid scheduling co-op interviews during peak academic times. Having more time to prepare, especially for software interviews with programming tests, may reduce anxiety.

Relocation Issues

This study observed that moving to different cities and sometimes countries, for co-op work terms may have a negative impact on students' mental health. In addition to the stress caused by moving to a new location and finding a place to live during a work term, separation from friends and family also leads to stress, loneliness, and disconnection from campus life, as also reflected in previous work (Jones, 2007; McBeath et al., 2018; Paul & Brier, 2001; Rowe, 2015). One actionable insight for universities is to organize periodic online meetings for co-op students to help them socialize and feel connected to campus life. Additionally, previous work suggests that sharing previous WIL experiences can help students (Jackson, 2015; Kaider & Bussey, 2018; Paull et al., 2019). Consequently, universities can share relocation experiences from previous terms with current students during online gatherings. Another actionable insight for universities is to organize workshops that provide advice on coping with frequent moving and finding short-term living arrangements during internships.

Moreover, this study revealed that travel restrictions imposed by governments during the COVID-19 pandemic have exacerbated the stress of moving for some students. This is a new observation as previous work either studied the mental health effects of COVID-19 travel restrictions on the general population (Wang et al., 2020; Zhang et al., 2020), or examined travel requirements and transportation issues concerning WIL students before the pandemic (Gillett-Swan, 2018; Jackson, 2017; Patrick et al., 2008).

Work Term Cancellations during the COVID-19 Pandemic

Cancellation of work terms due to the COVID-19 pandemic has created even more competition for the remaining work terms, graduation delays, as well as pressure to make alternate academic or employment arrangements. Recent work has reported that students are anxious about the future as a result of the pandemic (Sahu, 2020) but did not focus on students in co-op programs, which was the goal of this study.

Financial stress is another common problem that WIL students are concerned about (Forbus et al., 2011; Jackson, 2017; Johnstone et al., 2016). It was also observed that the COVID-19 pandemic has resulted

in WIL work cancellations (Hodges & Martin, 2020). The present study further reveals that co-op cancellations caused by the COVID-19 pandemic have exacerbated this situation: some students who arranged a paid co-op placement lost their jobs, which resulted in financial instability and loan repayment issues.

Motivated by these findings, during the COVID-19 pandemic institutions may want to consider relaxing some co-op related regulations to help students cope with cancelled work terms. Examples include allowing students to graduate with fewer completed work terms than normally required, increasing course capacity to accommodate students who wish to replace a lost co-op semester with an academic semester, and creating additional learning opportunities for unemployed students such as workshops or research assistantships.

CONCLUSIONS

The main findings of this study are as follows. First, students express self-doubt resulting from competition, specifically those unable to secure highly-paid and popular co-op positions, and those placed in entry-level jobs that are unrelated to their academic programs. Second, interviews for co-op positions appear to be causing anxiety: students fear being unprepared or unqualified, especially when interviews coincide with exams. These findings suggest actionable insights for academic institutions, including managing students' expectations and ensuring that co-op interviews do not conflict with academic deadlines. Additionally, a focused study of recent discussions reveals the impact of the COVID-19 pandemic on co-operative education, including increased competition, financial hardship, and pressure to make alternate plans due to cancelled internships.

One limitation of this study is that it only reflects the opinions of students who are active on Reddit. Nevertheless, these findings can serve as a starting point for additional research. One potential direction for future work is to survey students to confirm the findings about the competitive nature of the co-op job market and about interview anxiety. Additionally, course discussion forums may be analyzed to further investigate the impact of co-op interviews on class schedules and academic deadlines. Finally, as social distancing continues to be necessary during the COVID-19 pandemic, it will be important to study online co-op experiences in terms of their effect on students' well-being and skill acquisition.

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