What Apps Do Postsecondary Students with Attention Deficit Hyperactivity Disorder Actually Find Helpful for Doing Schoolwork? An Empirical Study

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Abstract

Attention Deficit Hyperactivity Disorder (ADHD) experts and individuals with ADHD have made many recommendations concerning mobile apps that could potentially help college students succeed. But do students know about these recommended apps? Do they find them useful? How do students use mobile apps for completing schoolwork? To answer these questions we carried out two empirical studies. In study 1, 35 Canadian postsecondary students who self-reported ADHD and 74 students without disabilities completed an online LimeSurvey questionnaire and indicated which of 20 expert recommended schoolwork-related apps they had tried and which they liked. In Study 2, nine students with ADHD specified how they used their technologies to complete schoolwork. Results indicate that students with and without ADHD were familiar with only 13 of the 20 apps recommended by experts, and that they liked only 11. For completing academic work, the most popular apps were built-in smartphone camera and recording apps. Students also found Microsoft, Google, Pomodoro and Kahoot apps helpful. Discord was the most popular app for collaboration with classmates. Results show that students with and without ADHD found the same apps and technologies helpful. To the best of our knowledge this is the first study to actually query students with ADHD about their app use and preferences. We conclude that disability service providers, academic administrators and access technologists need to stay up-to-date about general use mobile apps to enable them to make appropriate recommendations to help students with ADHD succeed in college.

Keywords: Attention Deficit Hyperactivity Disorder (ADHD), college students, mobile technologies and apps

1. Introduction

Given the number of students with ADHD in post-secondary education and their relatively poor academic performance it is vital that information be made available about what technologies these students use and find helpful to do schoolwork.

There are many students in post-secondary education with disabilities, and Attention Deficit Hyperactivity Disorder (ADHD) is among the most prevalent. It affects between 3% and 10% of post-secondary students, whether this information is based on diagnosis or self-report (Green & Rabiner, 2012; Wood, Lewandowski, & Lovett, 2021). ADHD is the most common disability reported among university students in Quebec, Canada's second largest province (AQICESH 2020–2021). ADHD often co-occurs with specific learning disorders, with a mean comorbidity rate of 45% (DuPaul, Gormley, & Laracy, 2013).

1.1 ADHD Causes a Variety of Challenges Related to Doing Academic Work

According to the Mayo Clinic (2019), ADHD symptoms can include: impulsiveness, disorganization, difficulty prioritizing tasks, poor time management, problems focusing on a task, trouble multitasking, restlessness, low frustration tolerance, difficulty completing tasks, and trouble coping with stress. Some consequences of ADHD

are distractibility, poor working memory, difficulties with planning, misjudging how long tasks take, procrastination, forgetfulness, difficulty sustaining attention when bored or not engaged, and difficulties following long explanations (Sedgwick, 2017). Such deficits in executive functioning can result in poor academic performance. For example, studies show that students with ADHD have lower grades than students without disabilities (DuPaul et al., 2021). They are also less likely to graduate from post-secondary education (Budd, et al., 2016).

1.2 Mobile Technologies and Apps are Increasingly Popular

Mobile devices have become an integral part of students' personal and academic lives. Sizable EDUCAUSE studies found that over 97% of American post-secondary students owned a smartphone (Seilhamer et al., 2018). Students use smartphones for a variety of non-academic reasons, such as texting or playing games. However, students also use their smartphones for academic purposes (Fichten et al., 2019). For example, students have used Padlet (2021—a digital notice board) to record their language assignments and uploaded these to their professors' designated site. Professors have also used a variety of English learning apps to help students learn a second language (Zhang & Liu, 2021). In addition, students have used a smartphone for Zoom when Wi-Fi was unavailable or choppy (Berry, 2021) or to search for information (Sambo, Lawal, & Helen, 2021). Moreover, students have used mobile devices to help themselves with psychological interventions (Oliveira et al., 2021) such as mindfulness (Moffitt-Carney & Duncan, 2019) and social anxiety (Lu, Chu, Madden, Parmanto, & Silk, 2021).

Many non-empirical articles about mobile apps that purport to help post-secondary students with ADHD achieve academically have received attention online. (e.g., ADDitude Editors, 2019). However, there are few, if any, empirical studies. Indeed, most scientific studies on ADHD and smartphones deal with problematic uses such as "smartphone addiction" (Kwon, Kim, & Kwak, 2022) and a variety of problem behaviors (Panagiotidi & Overton, 2022). In addition, articles report on tracking aspects of problematic driving behavior (Fabiano et al., 2021) or exploring the advantages of "ambulatory assessment using smartphones" (Koch et al., 2021). Other areas deal with ADHD treatment or symptom assessment (Pășărelu, et al., 2020), with problematic cell phone use when the student is in flow (Pearson, et al., 2021), with cognitive behavioral interventions to improve symptoms (e.g., Solanto & Scheres, 2021), or with chatbots for mental health (Jang et al., 2021).

Viewing smartphones as tools to help students with ADHD do schoolwork rather than as problems or sources of assessment, addiction or treatment may be a worthwhile framework through which ADHD and academic success can be studied. For example, in a focus group study related to mobile technologies and apps that students used in and out of class to do schoolwork some of the participants self-reported ADHD. We got interested in what they said about what helped them stay alert. These were not simply clocks, timers and notification apps. Instead, students reported apps such as Forest (undated), that works as follows according to the student, "Whenever you want to focus, you plant a tree in the application. The tree will continue to grow as long as you do not use the phone. However, if you leave this app and you use the phone the tree dies. After a certain amount of time the tree finishing growing. You can then check your phone." Another app a student mentioned was Mindly (undated), which helped the student, "brainstorm ideas at the same time as the teacher and allowed (the student) to create schematic maps of their ideas." Another student used their phone." to clear their mind when they 'need a break' and sets a timer on their phone, giving themselves 5 minutes to use their phone in class before they get back to start focusing on the lecture again."

1.3 Purpose of the Present Investigation

Given the lacunae in the literature related to schoolwork, we carried out two studies to find out what apps and mobile technologies students with ADHD find helpful for completing their schoolwork. In Study 1, we asked whether students with and without ADHD were aware of apps that are often recommended by experts (as listed in Fichten, et al., 2020) and whether they liked any of these apps. In Study 2 we asked students with ADHD to name the apps and technologies they found helpful for completing academic work both in class and outside class.

2. Study 1. Do Students with ADHD Know About Apps Recommended for Them by Experts?

The goal of Study 1 was to find out whether students with ADHD were aware of the apps recommended by experts, and whether they found these helpful. In a recent investigation, Fichten et al. (2020) compiled a comprehensive list of apps recommended for college students with ADHD. The researchers did this by examining 23 sources that appeared between 2017 and 2020; sources were based on web searches on sites such as Google, Google Scholar, ADDitude Magazine, and four ADHD Facebook (Meta) groups. For this investigation, of the 131 apps cited, we selected the 20 that were mentioned by at least two different sources and

that had broad availability across mobile devices and operating systems. Most apps were free or under $10. These are described in Table 1.

Table 1. Twenty apps mentioned by experts to help students with ADHD do schoolwork

App	Brief Description
Asana	Helps set goals and track progress using a Gantt chart
Dragon Anywhere	Dictation app for writing documents
Dropbox	Online file hosting that stores all files in the same place, across all devices
Due	'Auto Snooze' automatically reschedules overdue reminders as repeat reminders
Evernote	Task management and note taking that keeps all notes in one place
Focus@Will	Focusing music subscription service; customizes music for different activities
Forest	Growing a virtual tree: helps to set one's smartphone for specific time periods
Freedom	Focusing, distraction management app; blocks websites, apps, etc. for specific time periods
Google Calendar	Web based calendar and reminder that integrates with Gmail
IFTTT (If This Then That)	Connects apps, services, and devices to automate tasks
Microsoft To Do / Wunderlist	Task management app with a daily planner: breaks tasks down into simple steps
Mindnode 5	Mind-mapping brainstorming tool; users can add visual tags to track progress
Pomodoro Timer	Focusing app; sets study and break times
Quizlet	Study app that uses flashcards and games to facilitate learning
Read&Write	Provides text-to-speech, word prediction, and other literacy tools
Remember the Milk	Reminders by email, text, and Twitter; works across all devices
RescueTime	Time management app that tracks time spent on apps, websites, and specific documents
Time Timer	Visual countdown timer; helps notice time remaining for a task
Todoist	Prioritizes tasks, sets daily and weekly goals, rewards for completion
Voice Dream Reader	Provides text-to-speech reading aloud with synchronized highlighting

Note. Adapted from Fichten, et al., 2020.

2.1 Method

2.1.1 Participants

Participants were 35 Canadian postsecondary students who self-reported ADHD (16 females, 17 males, two who indicated a non-binary gender) and 74 students without disabilities (47 females, 26 males, one who did not indicate gender). As recommended by Banerjee, et al. (2020), we used self-report and excluded 22 students who indicated that they also had a comorbid learning disability (now referred to as a specific learning disorder). Students with specific learning disorders often have difficulties with reading accuracy, rate, fluency and comprehension (dyslexia), difficulties with spelling and written expression (dysgraphia), and problems with number sense and mathematical reasoning (dyscalculia) (American Psychiatric Association, 2013). We excluded students with specific learning disorders because we did not want to confound the findings with those apps that primarily address the limitations arising from learning disabilities, such as literacy, screen reading and dictation apps. Rather, we chose to focus on apps that could be most useful to assist students with ADHD. Students were provided with a list of 14 disabilities/impairments and asked to indicate as many disabilities as applied to them. Other than a specific learning disorder, the most common comorbidity for the 35 students with ADHD was a mental health related disability (n = 21).

Table 2 and an analysis of variance comparison (Disability x Institution x Group) show that university students were significantly older than junior/community college students $F(1,100) = 4.80$, $p = .031$, and that students with ADHD were significantly older than nondisabled students, $F(1, 100) = 10.13$, $p = .002$. The interaction was not significant. The fact that students with disabilities are older than their peers without disabilities is a common finding (Fleming et al., 2017).

Table 2. Age of college and university students with and without ADHD

Institution	Group					
	ADHD			No disability		
	n	Mean	SD	n	Mean	SD
College	25	23.52	7.53	32	20.16	2.58
University	10	25.90	7.17	37	22.46	2.76

Table 2 and the Chi Square test also show that a larger proportion of students with ADHD than without disabilities attended a junior/community college than a university, $X^2(1,105) = 5.57$, $p = .018$. As noted in the Procedure section, college students with ADHD are overrepresented in the sample due to the recruitment strategies used. Students with ADHD were enrolled in 11 different schools; those without disabilities in 16 different schools. The majority of university students were pursuing a Bachelor's degree.

2.1.2 Procedure

During fall 2020, we administered an accessible online LimeSurvey questionnaire that had been approved by the Research Ethics Board of Dawson College. Participant recruitment proceeded in a variety of ways. Email invitations were sent to Canadian postsecondary students with and without disabilities who had participated in our previous research and who had agreed to be contacted for future studies. There were notices put on the web sites of advocacy groups and other organizations for students with disabilities. We indicated that we were interested in participants who were currently enrolled in a Canadian college or university. In addition, we also advertised for students with disabilities at the Canadian college where the ethics certificate was issued. Students with ADHD were participating in a larger investigation, and all received a $25 Amazon gift card.

On the LimeSurvey questionnaire we listed the 20 schoolwork-related apps presented in Table 1, placed checkboxes alongside them, and asked, "Which of the following apps have you tried? (Select all that apply)." Using JavaScript, we presented apps students indicated having tried and, again using checkboxes, asked, "Of the apps that you tried, which ones did you like? (Select all that apply)."

2.2 Results

Table 3 indicates which apps students with ADHD and students without disabilities tried and which they found helpful. At least one student in each group was familiar with 13 of the 20 apps: Asana, Dropbox, Dragon Anywhere, Due, Evernote, Forest, Google Calendar, IFTT, Pomodoro Timer, Quizlet, Read&Write, Todoist, and Microsoft To Do / Wunderlist. Both groups of students liked most of these, although students with ADHD did not indicate liking Asana, Due, Microsoft To Do / Wunderlist, or Forest.

Table 3. Apps students had tried and those they liked

Which of the following apps have you tried?					
Students with ADHD (n=35)			Students without any disabilities (n = 74)		
n	%	name	n	%	name
22	63%	Dropbox	44	59%	Dropbox
20	57%	Google Calendar	42	57%	Google Calendar
11	31%	Evernote	29	39%	Quizlet
9	26%	Quizlet	13	18%	Evernote
6	17%	Microsoft To Do / Wunderlist	6	8%	Microsoft To Do / Wunderlist
4	11%	Pomodoro Timer	5	7%	Forest
4	11%	Read & Write	4	5%	Pomodoro Timer
4	11%	Todoist	3	4%	Asana
2	6%	Forest	2	3%	IFTTT (If This Then That)
1	3%	Asana	2	3%	Read & Write
1	3%	Dragon Anywhere	1	1%	Focus@Will
1	3%	Due	1	1%	Todoist
1	3%	IFTTT (If This Then That)	1	1%	Freedom
			1	1%	Time Timer
			1	1%	Voice Dream Reader
Of the apps that you tried, which ones did you like?					
15	43%	Google Calendar	33	45%	Google Calendar
12	34%	Dropbox	27	36%	Dropbox
7	20%	Quizlet	24	32%	Quizlet
4	11%	Read & Write	6	8%	Evernote
3	9%	Evernote	3	4%	Pomodoro Timer
2	6%	Pomodoro Timer	2	3%	Read & Write
1	3%	Dragon Anywhere	1	1%	Todoist
1	3%	IFTTT (If This Then That)	3	4%	Forest
1	3%	Todoist	2	3%	Microsoft To Do / Wunderlist
			1	1%	Asana
			1	1%	Freedom

2.3 Discussion

The findings how that students with and without ADHD were aware of only approximately half of the apps that were recommended by experts (as listed in Fichten, et al., 2020)—although they liked most of these. It should be noted that of the 20 items that were recommended by at least two independent sources of expertise, none of the 35 students with ADHD were familiar with the following seven apps: Focus@Will, Freedom, Mindnode 5, Remember the Milk, RescueTime, Time Timer, and Voice Dream Reader. It is also noteworthy that students without disabilities had results similar to those of students with ADHD.

3. Study 2. How Do Apps Help Students with ADHD Do Academic Work in Class and Out of Class?

Here we wanted to find out how students with ADHD used apps and technologies that they found beneficial for academic work in class and out of class.

3.1 Method

3.1.1 Participants

Participants consisted of nine of students with ADHD who participated in Study 1 (4 males, 4 females, and 1 student who indicated a non-binary gender). Their median age was 26. Five students attended a junior/community college and four attended a university. Of course, none of the participants self-reported a specific learning disability because these students had already been removed for Study 1. The most common comorbidity was a mental health-related disability ($n = 5$).

3.1.2 Procedure

We sent email invitations to all of the students who participated in Study 1 asking them to participate in a follow-up telephone or Zoom interview related to their use of technologies to complete schoolwork. The protocol was approved by the college's Research Ethics Board. Students who volunteered were interviewed in the spring-summer of 2021 by an interviewer and a note taker. Students were sent a $20 Amazon gift card in appreciation of their participation. Two trained individuals coded forty-one statements recorded during the interviews in accordance with a coding manual (developed by Harvison et al., 2021). The inter-rater reliability was 88%.

3.2 Results

Results in Table 4 indicate that the largest number of comments were made in the completing coursework, classroom, and social media categories. This was followed by the focus/concentration, scheduling and task management, and institution or instructor-mandated groupings. There were fewer comments in the studying, academic-related reminders, organization of academic documents, and the personal and well-being categories.

Table 4. Number of students who made at least one comment in the "helpful in completing academic work" in class and in the outside class categories (maximum = 9)

Activity	Helpful in completing academic work in class (face-to-face or via ZOOM)	Helpful in completing academic work outside class	Sum
Completing coursework	6	5	11
Social media and communication	2	6	8
Classroom	7	0	7
Focus/concentration	3	2	5
Institution or instructor-mandated apps	4	1	5
Scheduling and task management	2	3	5
Studying	2	2	4
Academic-related reminders	0	3	3
Organization of academic documents	2	0	2
Personal and well-being	1	1	2

3.2.1 Helpful in Completing Academic Work in Class (Face-to-Face or via Zoom)

Below we describe, in order of frequency, those technologies that students indicated were helpful to complete academic work in class. We excluded specialized apps (e.g., apps for computer programming or professional photography courses) because of the small sample size.

1) Classroom Category

The most common items in this category dealt with *camera* and *recording* apps. Students used their phones to take photos of notes or other information on the board when instructors did not post these online. Recording lectures on students' phones was also mentioned several times. These proved useful when professors did not post their lectures, and especially when students were asking the instructor questions during class.

Apps mentioned by only one student include *Notability* on a tablet, used to take screenshots and to add handwritten notes. A student also mentioned the benefits of posted asynchronous classes as these allowed them to listen and take notes. A *tablet* was also described as helpful for notetaking, and a polling app, *TurningPoint,* was seen as useful as it allows students to answer questions and for the instructor to review their answers.

2) Completing Coursework Category

Here the most frequently mentioned app was *Kahoot*, which students used to ask questions in class, for quizzes where the instructor could provide immediate feedback, and as an interactive language learning app. *Excel* was also popular for calculations and for a statistics course. For writing, students mentioned *Microsoft Word* and *LibreOffice*. To assist with math, students referred to *WolframAlpha*, and to an unnamed free open-source calculus website that shows step-by-step solutions to problems.

Other items mentioned only once include *Connected Papers*, a web site that helps explore, in a visual way, academic papers relevant to students' research assignments, *Google Translate* for a language class, *Khan Academy* for step-by-step learning, *Reverso* for correcting English grammar for a non-English speaking student, and *Wikipedia* to look up terms, words, and definitions.

3) Institution or Instructor-Mandated Apps

Zoom was mentioned twice, especially Zoom breakout rooms that allow students a choice of topic. Items mentioned only once are online quiz platforms that allow students to practice for tests, and *Slack* to communicate with others in their classes.

4) Studying

In this category students also mentioned *Kahoot* as it stores students' scores and allows them to see their improvement over time, *Khan Academy* for studying, unnamed *music* apps that set the mood for studying, and Quizlet for classes that require memorization.

5) Focus / Concentration

Apps mentioned once include *Microsoft OneNote*, *voice recording* of lectures in class as this can make up for missed items and lapses in attention when taking notes and listening to *water sounds* to help with concentration.

6) Social Media and Communication

Slack and *Zoom* were mentioned as helpful for connecting with classmates. Zoom break out rooms were viewed as especially helpful and were seen as resembling in person classes which allow students to participate.

7) Organization of Academic Documents

In this category, two technologies were mentioned once: *Draw.io* for drawing flowcharts and help with visualization and organization, and *Microsoft OneNote* which allows students to gather all their notes in one place.

8) Scheduling and Task Management

Seen as useful were students' *calendars* on their phones. Also helpful was consulting the school's learning management system to keep track of what is going on at school.

9) Personal and Well-Being

Apps for *meditation* were seen as helpful to reduce anxiety.

3.2.2 Helpful in Completing Academic Work Outside Class

Below we describe the technologies that students mentioned using for non-specialized courses (i.e., not computer programming or professional photography courses) that were helpful in completing academic work outside class.

1) Social Media and Communication

These technologies were the most commonly mentioned. In particular, *Discord* was referred to several times; it is used to communicate with the class using chat and text, sharing screen shots of course slides, and asking questions for class members to answer. *Facebook* was also mentioned, but only once.

2) Completing Coursework

In this category students mentioned screen reading tools such as *Read&Write*, *Adobe Acrobat*, and *ABBY*. *Google Docs* was also referred to—it was used when students needed feedback or corrections on their text. Other than these technologies, students simply used *Microsoft Word* to do assignments and an unnamed electronic *dictionary* app to help with studying languages.

3) Scheduling and Task Management

Google Calendar was mentioned most frequently; this helps with time-management and scheduling of daily tasks. One student also noted using a digital *to do list* for organization.

4) Academic-Related Reminders

Three students mentioned *Google Calendar* in this category. They used it to send them reminders and to help remember appointments and meetings.

5) Focus / Concentration

To help with focus and concentrating, a student described two random interval timer apps: *Interval Timer* and *Stay on Task*. These send random rings and serve to remind students to focus on the task. Students also mentioned the *Pomodoro Timer* app: this helps to structure students by preventing going off-task and providing work and break times.

6) Studying

In this category the *Pomodoro Timer* app featured prominently as it helps schedule study time and breaks.

7) Personal and well-being

Here students mentioned two apps: *Insight Timer* for meditation and *Respirelax*, a paced breathing app that helps reduce anxiety.

3.3 Discussion

The results of Study 2 describe how students with ADHD used apps and technologies that they found beneficial for academic work in class and out of class. Students were most likely to use the following technologies to assist them with academic task: a camera and a recording app, Discord, Excel, Google Calendar, Kahoot, Khan Academy, Microsoft OneNote, Pomodoro Timer, Slack, WolframAlpha, Word, and Zoom.

Other items mentioned, although less frequently, include: a free open-source calculus website, a music app, a tablet, a to do list, ABBY, Adobe Acrobat, an electronic dictionary, apps for meditation, the calendar on the phone, Connected Papers, Draw.io, Facebook, Google Docs, Google Translate, Insight Timer, Interval Timer, LibreOffice, Microsoft Word, Notability, online quiz platforms, posted asynchronous classes, Quizlet, Read&Write, Respirelax, Reverso, Stay on Task, TurningPoint, water sounds, and Wikipedia.

4. General Discussion

Our study is the first empirical investigation that actually queried post-secondary students with disabilities about their familiarity with and use of apps and technologies that are often mentioned in the literature as being especially helpful for academic work. A key finding is that students with ADHD and those with no disability generally found the same apps and technologies to be useful. Moreover, students with ADHD knew only about only half of the apps recommended for them by experts, and they, along with their peers without disabilities, liked most of these. Also, the largest proportion of the apps and technologies mentioned worked across most platforms and operating systems, making it relatively easy for students, both with and without ADHD, to keep organized.

Students with ADHD were aware of only half of the apps that are often recommended by experts, although they indicated liking most of these. Some apps and tools stand out as being helpful for academic work in class and out of class. More important than the names of the technologies are the functions that these serve for students with ADHD. For example, a key function of smartphones and tablets that came up repeatedly was to take photos and screen shots of the instructor's materials and to record lectures. Another mobile digital tool, the calendar, was seen as very useful for a variety of reasons. As a student noted, "A paper agenda can be forgotten at home!" Google Calendar was seen as especially useful as it can send students reminders in addition to helping them remember appointments and meetings.

Kahoot (n.d.), was also seen as useful. A multipurpose education tool, Kahoot can be used to respond to polling, work on practice questions, complete interactive quizzes, obtain immediate feedback, and track improvement

over time. Although other online quiz platforms were also mentioned, Kahoot really stood out.

Students found communication with other students to be important. To do this they used mainly *Discord* although they also mentioned *Zoom* and *Slack* several times. *Facebook* was mentioned only once. As a student noted, Discord is typically a student-run platform. It is usually started when a student sends a message to their entire class asking students to join the group. Students then use Discord to communicate with group members using chat and text, as well as sharing screen shots of course slides, and asking questions for class members to answer.

Students also indicated a need for structure and help with focus and concentration. They noted that *Pomodoro Timer* was especially helpful as it scheduled both study and break times. In addition, students mentioned two random interval timer apps: *Interval Timer* and *Stay on Task*. These apps send random rings that serve to remind distractible students to bring their mind back to the task they need to complete. Students also indicated listening to water sounds to help with concentration and listening to music that set the mood for studying. One student especially liked *Microsoft OneNote* for helping with organization; they were delighted with its ability to be able to gather all their notes in one place, saying "It's like having a binder."

Other popular academic tools include tools to help with step-by-step learning such as *Khan Academy* and *Wolfram Alpha* (for mathematics). Not surprisingly, students felt that features of the Microsoft Office suite, such as *Word* and *Excel*, were useful for writing and for calculations. Electronic dictionaries and translation tools (e.g., *Google Translate*, *Reverso*) were also seen to facilitate academic work.

Students felt that apps to help cope with anxiety were helpful. These apps include those for meditation, such as *Insight Timer*, and a paced breathing app, *Respirelax*.

4.1 Limitations and Future Directions

The key limitations revolve around the small sample sizes. For Study 1, only 35 students with ADHD participated. In part, this is due to our exclusion of 22 additional students who also self-reported a specific learning disorder. In addition, only 26% of students who were invited went on to participate in Study 2. Future studies should include a larger number of participants and explore the academic impact of using various apps.

4.2 Implications and Practice Recommendations

Our findings clearly point to the conclusion that what are good apps for students with ADHD are good apps for student without disabilities. Both groups of students, those with ADHD and those with no disability, found the same apps and technologies to be helpful. Indeed, both groups seemed to favor tools that facilitated tasks related to academic work, with less interest expressed about apps that addressed the functional limitations of ADHD, such as difficulties with organization, concentration, and time management. While some students indicated a need for structure, focus and concentration, few used many of the apps suggested by experts. It may be that students with ADHD do not find the tools that exist to be helpful. Further studies that explore where the challenges lie will determine what approach needs to be taken to better support executive functioning of students with ADHD through the use of technology. Students without ADHD could also benefit from these new approaches.

4.2.1 Faculty

The role that faculty play in students' use of technology was evident in the research. The most common items mentioned by students about apps used in class dealt with camera and recording apps. Yet, faculty are often reticent about students recording them, either visually or auditorily. What are the barriers that prevent students from recording faculty and what is the best way to overcome these, as students clearly want to be able to review lecture material in this manner? Academic administration may need to take the lead in setting policy regarding the rights of students and of faculty when it comes to recording. Furthermore, it may be essential for academic administration to provide greater technical support for faculty who want to record and upload their lectures but simply find the process too cumbersome.

Faculty continue to play a vital role in encouraging the use of apps both inside and outside the classroom by viewing apps as helpful tools rather than distractions. Students described their preference for Kahoot and other online quiz platforms for completing course work. Considering that students in general, but particularly those with ADHD, have difficulty sustaining attention when bored or not engaged, the use of apps which garner their interest should be maximized.

4.2.2 Minimize the Number of Platforms

One student with ADHD explicitly expressed their pleasure in being able to gather all their notes in one location.

This is the antithesis of what is occurring on many campuses today, where professors' use of multiple learning management systems is permitted. Disorganization, a common trait of ADHD, makes keeping track of assignments and course materials over multiple platforms exceptionally challenging. It would be easy to rectify this situation if institutions developed guidelines restricting the number of platforms allowed.

4.2.3 Encourage Student Run Communication

More students mentioned communicating with their peers via a student-run technology like Discord than through Zoom chats and course blogs. As students with ADHD often have difficulty with planning, with judging how long tasks take, with procrastination, and with forgetfulness, they might benefit from peer support. In addition, they may be more comfortable approaching classmates than faculty, whom they fear might be judgmental. It is vital that these communication platforms remain student-run. But how can students and faculty foster their development? Good access to Wi-Fi on campus and sufficient quiet spaces for small study groups to gather might be just two small steps in the right direction.

4.2.4 Stakeholders and the Need to Stay Up-to-Date

Among the implications presented, there is one common thread: the involvement of numerous stakeholders. It is necessary for students with ADHD to inform themselves about existing apps and to try using them. Disability service providers and access technologists have a responsibility for staying up-to-date about tools available to students and to transfer this knowledge to them. Faculty have a major role to play in both encouraging and facilitating the meaningful use of apps in their courses. Information and computer technology staff are needed to keep the hardware and software operating for the campus community. However, it is the academic administration that is best situated to develop and implement policies that promote responsible use of apps, technologies and platforms within their educational institutions. Additionally, let us not forget about those software developers who have the expertise to respond to the emerging needs of all students, including those with ADHD. Indeed, it will involve collaboration among many stakeholders to provide apps that most students with ADHD will actually find helpful when doing schoolwork!

Acknowledgments

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