CYBER CHALLENGES FACED BY PEOPLE WITH INTELLECTUAL AND

DEVELOPMENTAL DISABILITIES (IDD)

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UNIVERSITY OF KENT
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Abstract

This study seeks to learn more about the difficulties people with Down syndrome and other forms of intellectual disability encounter when using social media and understand the complexities of online safety and cybersecurity issues this demographic faces. Twitter application programming (API) was used to search for self-identified profiles that tweeted in English. The collected profiles helped in creating the cyber challenges data set. Keywords were used to identify individuals with an intellectual or developmental disability (IDD) and other general learning disabilities. Approximately 150 profiles were established and filtered based on common expressions to remove individuals who did not meet the inclusion criteria, and a final 128 profiles were identified. The sentiments were categorized as positive, neutral, and negative. Each group's frequency was evaluated based on the number of tweets. Individuals with IDD profiles expressed significant neutral (47.2 %%) and negative (36.2%) emotions in cyberspace. A majority expressed experiencing bullying, attributed to the sentiment scores in the figure below. Only a small fraction of users (16.5%) reported positive sentiments in cyberspace. Compared to individuals without IDD, individuals with IDD recorded a higher average of cyber challenges (cyberbullying and toxicity). Non-IDD users had an increased frequency of positive sentiment scores (52.5%) in social media. However, a significant proportion of negative sentiments was recorded (31.3%). A small section of the participants (16.2%) expressed neutral emotions in the cyber environment. The study establishes that people with IDD face more negativity in cyberspace than in the control group.

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1   Introduction

1.1   Background

The diagnosis of IDD could result in human rights restriction, discrimination, stigma, and lifelong labelling (Chadwick et al., 2013)[i]. However, the researchers believe that there has been a shift in attitude towards greater inclusion, tolerance and acceptance, in society, among such individuals. Similarly, expectations of such societal abilities have soared alongside an increase in the complexity of effectively negotiating the modern world, for instance, assumptions on digital literacy. Statistics from the Internet World estimate that three billion individuals use the Internet across the globe and that a third of the global population has acquired smartphones. Researchers in cyberpsychology strongly believe that the Internet and especially social media platforms such as Twitter and Facebook, allow individuals to fully partake in their virtual and real communities, forge positive identities, receive support and broaden their network of friends[ii]. However, Calton and Chapman (2016) claimed that little is known about Internet use by individuals diagnosed with IDD.

It is evident that we live in a digitally dependent world, whereby, with various technologies, life is assumed to be streamlined and easier[iii]. This is meant to include allowing access to services that had been declared unavailable to individuals with a disability. The proliferation of the Internet has brought numerous benefits that individuals diagnosed with IDD could reap numerously[iv]. For instance, the Internet can be an efficient 'leveler' since individuals might mask specific characteristics once they feel that they might be discriminated against or excluded, or even worse, experimented with self-presentations because of their constraints. Despite the immense evolution of technology, there has been little change in reducing the digital

divide, especially through authentication methods. Authentication remains at the forefront in securing the information of Internet users, yet, for numerous individuals and especially ones with IDD, it poses issues in terms of security and usability (Furnell et al. 2021).

Seale[v] postulates that the use of information technology and the Internet in daily life has entered a very critical age, mostly Compiegne (2011) additionally observes that the use of cyber technology has become a cornerstone in most of our societies and has acted as an essential aid to communication. This paradigm shift has helped people across the world to have easy access to information and entertainment. ICT has the capability of promoting information accessibility among people living with intellectual and developmental disabilities. However, according to Chadwick et al.[vi] using ICT has caused a big digital divide between people with disabilities and other citizens. Studies have shown that instead of digital inclusion, the gap has continued to widen in society among people with intellectual disabilities[vii]. There are even barriers that hinder people with IDDs from effectively accessing social media, including Twitter.

People with Downs Syndrome, according to Didden et al.[viii] face many challenges that are technical, structural, and at times cognitive. Most of the cognitive challenges are caused by the slow rate of their development and the general influence of peers in school and parents at home. Most people with Downs Syndrome have to move close to the screens or monitors because most of them are either short-sighted or long-sighted and have to make such adjustments to visualize and conceptualize what they are doing clearly. Such persons may also have psychomotor challenges[ix]. A good example is their challenges using a mouse and even the keyboard since their motor skills are not fully developed.

Kowalski and Fedina[x] argue that People with intellectual disabilities may be affected by the communities` influence on their access to digital platforms. Not many people with Down`s Syndrome and other intellectual disabilities use social media platforms frequently; instead prefer sending messages directly through messages. The parents and other adults may have different opinions about the use of media platforms by the IDDs and hence determine the quality and time they spend online[xi]. The community cannot start to think about IDDs exposure on the Internet and may not encourage them to be active users. Children with Downs Syndrome hardly use the Internet; if they do, they may be unable to use it properly. Their Constraints like these make the IDDs unsure and stagnate in unknowledgeable spots for so long. Seale[xii] suggests that there may be evidence to indicate that caregivers or even family members who work with IDDs may access banned sites such as those with pornographic or aggressive content. Wright[xiii] further agrees with Seale by indicating that the comprehension of risk by people that have an intellectual disability at times is different from that of caregivers and clinicians.

1.2   Description of the Problem

Cyberspace has grown tremendously in the past decade, and so have the challenges associated with cyberspace, especially social media. People with intellectual and developmental disabilities such as down syndrome are largely ignored in the scholarly literature in terms of the challenges they face in cyberspace, and this study seeks to fill this gap. This study aims to address the research gap concerning the cyber challenges encountered by individuals with intellectual and developmental disabilities (IDD), with a particular emphasis on those with Down syndrome and general learning disabilities. The experiences and obstacles individuals encounter

within social media platforms, particularly Twitter, have not been comprehensively explored in existing academic research.

1.3   Research aim and Objectives

The current study sought to learn more about the difficulties people with Down syndrome and other forms of intellectual disability encounter when using social media. Understanding the complexities of online safety and cybersecurity issues faced by this demographic and identifying the unique obstacles they face while using social media platforms like Twitter can be summed up as the problem this study aims to solve.

- Examine information from the Twitter accounts of people with Down syndrome and other forms of learning disability to pinpoint hot-button issues and ongoing conversations. Through this analysis, we will gain an understanding of the topics and concerns commonly raised by people with IDD online.

- Evaluate how people with Down syndrome and other forms of general learning disability use social media compared to those without IDD. Several factors will be investigated, such as posting style, sentiment analysis, and interaction patterns. We aim to learn more about how people with IDD use social media by comparing and contrasting their online behavior.

- Learn how involved parents and other caretakers are in helping children with Down syndrome and other learning disabilities learn to use and enjoy digital technologies safely and responsibly. This study investigates how caregivers can best help their loved ones with IDD stay safe and secure while using social networking sites.

- Investigate how people with Down syndrome and other learning disabilities can be better protected online and how this can be done through interventions, strategies, or technological solutions. This goal seeks to determine actionable steps that can be taken to

make the Internet a more secure place for people with intellectual and developmental disabilities.

- Make important discoveries and evidence-based suggestions to researchers, clinicians, and policymakers. The findings from this study will aid in creating policies, interventions, and educational materials that promote online safety and inclusivity for people with intellectual and developmental disabilities (IDD), specifically those with Down syndrome and other forms of general learning disability.

- By exploring these questions, this study hopes to improve our knowledge of how people with Down syndrome and other forms of learning disability navigate social media and help pave the way for a more welcoming and accessible online space for all.

2   Literature Review

2.1   Theoretical Review

2.1.1   Dialogical Theory

2.1.1.1   Dialogism and co-creating communication

Dialogism is defined as a theoretical approach to any form of communication. According to Marková et al.[xiv] the sole premise within this approach is that "human beings live in a world of others and that their language, thought, and existence are extremely interdependent with the language, thought, and the existence of others." Marková[xv] further noted that a *dialogue* could mean an interaction by symbols, pictures, bodily communications, and spoken language. Linell[xvi] contended that speakers alone are less likely to determine all interpretation aspects of their utterances and, therefore, call for the co-authoring of interpretations and utterances. Marková et al.[xvii] also argued that no symbol, sign, or word could speak to individuals similarly. Therefore, through this approach, communication is viewed as a negotiation process, with utterances only showing their explicit meaning through interpretation. Marková[xviii] also clarified that dialogical approaches assume that language, knowledge, and thought can only be generated via interactions between individuals and others. As a meta-theory, this approach can be linked to a description by Ulvik[xix] of professionals taking part in the work of producing *meaning* and co-constructing it with individuals they support.

Research also highlights a more practical role: comprehending the different communication and cognition theories can impact consultation with individuals with complex communication needs. Grove et al.[xx] argued that in an attempt to support individuals living with disabilities, meaning should be seen as the negotiated result of an interaction that usually involves inference. As identified, there is a clear resonance with the dialogical theory. Grove et al. initially described

communication as viewed from a dialogical lens and solely not communication alliances between individuals with disabilities and those supporting them. The dialogical theory posits that all communications are negotiation and inference processes with myriad influences on meaning-making. Marková (2006) postulated that the ideas and concepts of the participants normally shape the dialogue.

2.1.1.2 *Supporting practitioners to think in a dialogical manner*

A study by Gjermestad[xxi] described a situation where practitioners that supported individuals with Profound and Multiple Learning Disabilities (PMLD) offered training and support. According to the researcher, the exercise was a 'narrative.' The researcher's description of 'narrative' was similar to how the dialogical theory describes communication. Gjermestad went further ahead to describe the implications of the approach as a recognition by a practitioner where an individual deploys unique and distinctive methods of communication that ought to be understood under the foundation of the initial context and situation, together with the historical knowledge of the utterances and expressions of the individual. Similarly, in an attempt to describe an increase in confidence in the practitioner's 'narrative,' the researcher discovered that making available arenas for reflection and discussion among staff members was effective, together with creating a forum for sharing different personalized meanings of the body and non-verbal expressions of individuals with Profound Intellectual and Multiple Disabilities (PIMD). The researchers discovered this could contribute to a richer understanding of such individuals and strengthen and promote their fundamental human rights.

2.2   Empirical Review

2.2.1   Technology for individuals with IDD

Internet access and multiple social media activities, through the use of a computer and mobile technologies, have been mentioned to increase the chances for individuals with IDD to carry out activities on social media platforms and allow them to grow in a manner never witnessed before the revolution of technology[xxii]. Such activities facilitate the switching or creation of online identities, where different types of disabilities might possess various social meanings than conventionally possess offline. Additionally, Grace et al.[xxiii] stated that technology can potentially increase communication chances and overcome some challenges that individuals with disabilities often face when expressing themselves face-to-face. Thus, social media and technology activities will likely foster learning and improve social status.

The primary purpose of Assistive Technology (AT) is to bridge the gap between the functional capacity of an individual and similar demands of their environment by allowing daily participation and living. In Norway, for instance, Lussier-Desrochers et al.[xxiv] and Ramsten et al.[xxv] discovered that AT is given to citizens at no fee based on the needs of the individual once evaluated by a prescriber. Evidence on individuals with IDD showed a rise in the use of AT, indicating that AT could potentially improve communication and independence. AT also levelled the balance of power between the support staff and individuals with IDD[xxvi]. However, studies producing such evidence focused solely on individuals with mild/moderate IDD and technology use. Despite adopting AT to support learning, memory (remembering), and thinking, Cognitive Assistance Technology (CAT) is also assumed to increase self-confidence and independent activity.

The results of Wennberg and Kjellberg[xxvii] supported the above expectations. The findings showed that mild IDD young adults who used CAT increased daily activities, depicted greater control, and acquired health-related benefits. Furthermore, Gillespie et al.[xxviii] discovered striking evidence that utilizing CAT supports the memory, self-experience, emotional regulation, and attention of an individual with IDD. Adolfsson et al[xxix] also discovered that individuals with cognitive abilities required greater technological competence and that such technology needed to be adapted individually. These findings suggest that implementing new technologies, especially for communication, requires a thorough understanding of the daily practices and abilities of the individual.

2.2.1.1 *Enhancing technology use*

Throughout history, most researchers have looked into the use of AT for individuals with cognitive limitations. Most of this research is in the light of Augmentative and Alternative Communication (AAC). Nonetheless, technology on AAC has transformed from stand-alone devices to multi-million devices which can be utilized for different purposes, such as computer applications. Braddock et al.[xxx] and LoPresti et al.[xxxi] once suggested that improving the advocacy or design for individuals with disabilities was important to increase the number of users in special populations. Hoppestad (2013)[xxxii] discovered that individuals with mild-to-moderate ID could use computers once allocated the resources. This was combined with support by the firm as a whole and proper staff training which would encourage clients to use computers.

A study by Khanlou et al.[xxxiii] attempted to discover barriers to accessing and using digital technology to facilitate the needs of the transition stage in employment, community integration, daily living, and even education of young adults with Developmental Disabilities (DD). The use

and permitted access to digital technology exhibited and further promised positive effects on young adults' economic and social integration, facilitating their inclusion into society and supporting their autonomy. The researchers also identified various barriers, including accommodations, literacy, access to community services, the lack of it fit their needs, design, infrastructure, availability, affordability, and training. Upon applying a socio-ecological approach to interpreting the results, the researchers highlighted the significance of facilitators in promoting digital inclusion in individuals with DD and ID.

2.3 Internet use as a 'new' technology for individuals with IDD

The limited literature on Internet use by individuals with IDD shows that they consider technology extremely significant since it allows them to forge an identity and discover where they belong in social networks. A study by Molin et al.[xxxiv] which focused on adults interviewed on different social networking sites, showed that individuals with Intellectual Disabilities (ID) used the Internet to maintain contact with their friends and parents, receive and give support, and make new friends. Many respondents from Shpigelman and Gill's[xxxv] research claimed that making friends through the Internet was easier, with the individuals claiming to be more comfortable making connections online than face to face. Moreover, individuals with IDD reported that the Internet offers a (cyber) space where they can elude the control of their caseworkers or parents and present more self-determination. These individuals are mobile on the Internet and create associations with whom they please, undiscovered and -seen by their caregivers and guardians. They can express their feelings and describe their activities on blogs or social media.

Literature shows that individuals with IDD are more inclined than their non-disabled counterparts to have a 'narrow' social media presence. According to Clement and Bigby[xxxvi] for individuals with IDD, often, such associations are limited to other people with the same disabilities, members of the paid support staff, or family members. In Sweden, Löfgren-Mårtenson et al.'s study[xxxvii] described teachers and parents in special programmes for young adults with ID between 18 and 20 years old as socially isolated. They also added that the Internet became an irreplaceable tool for such youths. Furthermore, students with IDD use the Internet for more than one purpose, including, but not limited to, searching and socializing with friends, chatting, and blogging[xxxviii]. Similarly, these individuals also use the Internet to watch videos, listen to music, and find information. According to Shpigelman and Gill (2014), individuals with IDD believe that being part of either Facebook or Twitter aids them in 'feeling like anybody else' and acquiring a greater sense of belonging.

With this, Seale (2014) believed that it was possible and highly advisable to increase the activities of individuals with ID and IDD in the digital world thanks to the support of individuals around them. Such support would help these individuals through their challenges, facilitating further-reaching and broader associations. Raghavendra et al.[xxxix] taught adolescents with traumatic brain injuries or cerebral palsy the use of the Internet, hoping to expand their social networks. The researchers designated individualized intervention plans founded on the interests and needs of the families and the youths on computer knowledge. Results showed a strong increase in their number of online contacts and interpersonal communication. However, a large variation was also discovered between the participants. To begin with, 11 out of the 16 had never engaged in online communications before. Once the project ended, they all engaged in online conversations, for instance, through Skype, Facebook, or Email, with an overall average of 38

individuals. Moreover, the participants slightly decreased their loneliness scale a few months after the intervention.

2.4 Twitter use among individuals with IDD

According to Cocq[xl] Twitter is an Internet network for receiving and sending tweets, previously identified as short messages. An individual can follow another individual and also be followed. However, mutuality is unnecessary when likened to other social networking platforms. In a tweet, an individual could address another; the platform has also made it possible to retweet a message, mainly because one might find the importance of others reading their tweet and wish to share it. According to Cocq (2019), tweets can also be classified and labelled hashtags (keyword functioning as a sorting device for users to follow).

A study by Griffith et al. (2012) identified manners in which social media platforms aided in sharing information with their doctors or to benefit the community. Individuals presenting rare cognitive conditions used MySpace and Twitter to grow their communities. According to the findings, social media platforms, for rare conditions, could be the only means for individuals in different geographical areas to mingle and share knowledge on their conditions. However, there were also drawbacks to sharing confidential data. Hemsley et al.[xli] conducted a study on a social media platform, Twitter, using participants who used alternative and augmented communication devices. In the two to five years of use, the researcher discovered that the participants that used such devices valued Twitter since it made them feel heard, seen, and visible.

In Magee[xlii] the researcher aimed to test the Hierarchical Adaptive Interface Layout software in identifying the use of the response system (simple) to answer Twitter questions. For instance, respondents could give their answers on their activities or day through a pre-created

question drop-down list or a smiley face chart. The modifications ensured limited mobility with an adaptive manner of posting on Twitter. Additionally, in studying how a head-tracking mouse pointer device worked for people with severely limited mobility, Magee discovered that screen adaptability was present for particular users. The researcher also discovered that when such individuals needed personal assistance to utilize social networking platforms, the above-limited communication privacy. Additionally, in such instances, personal assistants might know how to use social networking platforms but lack the interest or time to do so.

Apart from Twitter, a study by Seale[xliii] discovered that Facebook also connected individuals with disabilities and offered community support for them. University students presenting similar disabilities claimed to use Facebook for support and their classwork. On the same, Valcourt-Pearce[xliv] made use of Facebook to document her experiences with a child born with deafness and multiple disabilities. The researcher claimed that from the onset of the austerity programme, social media networks such as Facebook and Twitter had been significant tools for disability activism in countering government policy.

2.5   Problems Linked to online communication

Researchers investigating individuals with IDD have highlighted risky situations associated with using the Internet and social media platform[xlv]. The researchers mentioned the clashing of a desire to be liked and establish friendship with a vulnerability to violence and exploitation, a tendency to be agreeable, and a wish to be socially desirable, which appeared normal to many individuals with disabilities. This was mostly observed in women. For instance, according to Molin et al. (2015), adults and youths with ID and IDD claimed to accept friend requests only from individuals they recognized or knew. However, the number of 'friends' on Facebook (in

hundreds), together with their conflicting statements such as "I look at the photo of the individual and if he or she looks honest…") suggests otherwise.

A study by Holmes and O'Loughlin (2014) followed clinical vignettes to explain how the need to cultivate relationships could result in losing control. For instance, a 30-year-old woman presenting mild ID symptoms accepted any friend request on Facebook, with one of the 'friends' including a man that extracted more than $100 monthly from the woman and others that made fun of her appearance or sexually assaulted her. A similar example is given of a young woman with mild ID and autism, who understood the term 'friend' and attended parties where most individuals paid no attention to her, including her 'friends.' In Löfgren-Mårtenson's study[xlvi], statements from the participants showed that most of them understood the risks associated with setting up meetings or agreeing to meet on the Internet, including cyber theft. Nevertheless, the researcher hypothesized that such individuals repeated the safety measures they were taught but failed to recall that once exposed to danger. The perception of a 'friend' to individuals with IDD leads them to accept abuse and danger. Most researchers believe that the greatest danger such individuals can perceive is related to them being isolated and deprived of romantic associations.

Normand and Sallafranque St-Louis[xlvii] discovered different variables linked to the sexual cyber-solicitation of adults and youths. Findings showed that chatting, depression, loneliness, social isolation, and physical or sexual abuse, both present and past, improved the chances of facing sexual cyber-solicitation. Unfortunately, all variables apart from chatting exhibited more prevalence among individuals with autism and ID than in the overall population. As stated by Löfgren-Mårtenson et al.[xlviii] such vulnerability merged with the decentralized social media worries parents and caseworkers in health, social services, and school environments. The

concerns of adults, parents, and caseworkers include; 1) prosecution of young individuals who fail to see serious or negative consequences of their social media statements or actions such as sexual solicitation, threats, defamation, or harassment[xlix]. 2) Buijs et al.[l] listed abuse and maliciousness, including theft and violence, when communications on social media platforms lead to face-to-face meetings. 3) MacMullin et al.[li] listed addiction or excessive Internet use. 4) cyberbullying and cyber-harassment. 5) Dodwell (2013) listed the exposure to inappropriate media content such as pornographic material. In addition, a few researchers, such as Ho et al.[lii] claimed a possible connection between different mental health disorders (anxiety, depression, and addiction) and the excessive use of the Internet.

Despite researchers failing to exhibit a cause-and-effect relationship, they claim that using the Internet causes problems by exacerbating different mental health issues. Still, the reverse might equally exhibit some truth; mental health issues could potentially be pushing individuals with IDD to spend most of their time online. For instance, Ybarra et al.[liii] discovered that many individuals with a disability, mostly youths who were targets of bullying, showed signs of depression while being victims. According to Helweg-Larsen et al[liv]., in 2012, between 30 to 69% of such cases, parents were unaware of the meet-ups. It can then be concluded that the increasing concern for the safety and well-being of individuals with socio-emotional and cognitive limitations spending most of their time on the Internet deserves attention. It remains definite that the desire of these individuals to see their soulmates drives their use of online dating sites and social media. Additionally, it can be claimed that individuals with IDD are generally looking for partners on the Internet to establish an offline relationship with any individual, preferably without disability.

2.5.1 Training, Support, and Educational Constraints

Raghavendra et al.[lv] claim that people with intellectual disabilities require much support. The need for training is dire. Most of this support is provided by the immediate families or employed staff that require essential skills in handling special needs and which they may barely be aware of. This can greatly limit IDDs from fully taking advantage of the digitization that's all over. Some caregivers even see the use of the Internet as inappropriate. Glencross et al.[lvi] further opine that the lack of practical support in individuals with severe cases may limit them while using the Internet. The families that provide the care and support may not have sufficient time for the rigorous requirements and obligations, bearing in mind that they must balance with other crucial commitments in their homes. Supporting people with IDDs can be challenging for the family caregivers and those employed to look after them (Bayor et al., 2009). Parsons et al. (2008) argue that service providers may hinder the accessibility of the Internet because of organizational culture and the different attitudes of caregivers. Over time, the Internet has hindered human association and interaction because of the seclusion.

2.5.2 Challenges Associated with Personal Incapability in Using the Internet

Caton and Chapman[lvii] argue that many people in this category may have personal limitations that render them unable to fully or even partially use the Internet. This makes accessing the Internet and many other platforms, such as Twitter, challenging since most of the operational input mechanisms include typing, which requires a lot of physical movement; coordination may pose a challenge. This even affects their ability to read and understand (Wehmeyer et al., 2004:52). Navigating the Internet is difficult, and the execution of complicated

tasks coupled with logical reasoning in a sequence is a mountain of a task. Some websites may require difficult passwords and codes, and many screen elements do not help much[lviii].

Additionally, Slonje et al.[lix] indicated that many individuals with IDD experience cyber bullying at least once a week. Around 4% to 9% reported bullying in cyberspace. There was a relatedness between cyberbullying and the intelligence quotient. This negatively impacted the esteem of such learners and the stress levels of individuals with IDDs[lx]. Therefore, proactive measures need to be implemented to arrest this vice that threatens to destroy the fabric of individuals with intellectual and developmental disabilities. These disabilities tend to be bullied on the Internet most of the time because of their disposition.

3   Possible Approaches to the Problem

This study utilized the top2vec model to predict the most common topics within the cyber challenges datasets and perform in-depth analysis. It also conducted sentiment analysis, which involved creating a labelled dataset using the Transformer learning approach –The transformers model. The model was used to train and test the labeled data. The model was applied to predict the sentiments from the collected datasets.

3.1   Data Collection

During data collection, Twitter application programming (API) was used to search for self-identified profiles that tweeted in English. The collected profiles helped in creating the cyber challenges data set. Keywords were used to identify individuals with an intellectual or developmental disability (IDD) and other general learning disabilities. The common keywords included IDD, Down syndrome, Williams syndrome, discrimination, bullying, scams, cyberspace, and learning disability. Approximately 150 profiles were established and filtered

based on common expressions to remove individuals who didn't have the disabilities mentioned above. An additional search was conducted to ascertain and verify the self-proclaimed profiles. The users were evaluated in the context of tweets, and those who met the criteria were incorporated. Upon extensive review, 128 profiles were identified to have IDD.

A control group was formed for comparison. The control dataset contained a group of randomly selected Twitter users who did not report having IDD. The dataset had a sample size of 100 users. The sample size was achieved after excluding organization accounts and commercial users –only including users verified to have a history of IDD. The final data contained the IDD data set (128 profiles) and the non-ID dataset (100 profiles).

3.2   Top2Vec Model and Topic Modelling

Searching, organizing, and summarizing huge data values is a key issue in NLP. Topic modelling is often employed when the text is too large to be judiciously read and sorted manually. The approach can identify the topics present in the text or dataset. The Top2Vec is based on the concept that most semantically similar documents indicate or reveal the underlying topic[lxi]. The model outputs the jointly embedded document, topic, and word vectors in that their differences exhibit semantic similarity. Unlike the conventional topic modelling approaches like LDA, Top2Vec does not require data preprocessing (stopwords removal, text lemmatization, and stemming). Word2Vec was used to jointly create embedded documents and word vectors in the initial step. This helps cluster similar tweets and the most common words together. The subsequent step is utilizing the UMAP to generate document vectors in lower dimensional. According to Le & Mykolaiv (2014), document vectors in high-dimensional embedding are often very sparse; thus, dimension reductions are critical in finding dense areas. The third step is

finding dense areas of tweets with the help of HDB-SCAN. The higher-level topic represents a broader theme, while lower-level topics represent more specific sub-topics. Each dense area computes the centroid of document vectors reference to the original dimension, for instance, the topic vector. The selection of the adequate granularity level in the topic hierarchy helps focus on specific topics and explore different abstraction levels based on the requirements of the analysis. The hot topics and representative tweets are then visualized in the topic hierarchy. Appropriate interactive visualization tools help navigate the topics and gain insights into the datasets. This study used the cosine similarity feature of top2vec to find the most representative topics using keywords. The word cloud was also created to help visualize the common key.

3.3   Data Preprocessing

Text processing involves data cleaning and preparation. To preprocess the tweets, the following steps are followed:

- Expand the shortened version of words to their original form.

- Remove HTML tags

- Text tokenization

- Perform lemmatization to convert all tokens into their root wood

- Use the NLTK library to remove stopwords.

- Remove special characters which add noise to the data

- Convert and standardize the accented characters into ASCII characters since tweets used in the analysis are in English.

- Convert all words into lowercase.

Figure 1: Preprocessing Steps

3.4   Sentiment Labelling and Classification

The posts on Twitter are highly subjective, which makes them appropriate for sentiment classification. In supervised machine learning approaches, data labelling is integral, and it is often difficult to manually verify labels on a large data set. The first step was to label the tweets for this study using Python-based libraries such as VADER and SentiWord Net. The sentiments were categorized as either positive, negative, or neutral based on the overall sentiment expressed in the tweets.

3.5   Transformers Model

Transformers model uses the attention masking approach that learns contextual relationships between words in a text. The model was based on transformers architecture, which utilized the pre-trained BERT model trained on a large-scale corpus of text[lxii]. The model was fine-tuned for sentiment classification on the collected Twitter datasets. The model was trained using the training data, where the input was preprocessed data, and the output was the sentiment label. It was optimized using gradient descent algorithms, specifically the Adam model. The performance of the model was evaluated based on the validation data. The evaluation metrics used include accuracy, precision score, F1-score, and recall score, which were computed to establish the model's effectiveness in predicting sentiments. The model performance was further optimized by tuning hyperparameters. The hyperparameters of the transformers model, such as the number of epochs, batch size, and learning rate, were tuned based on the grid search approach to establish the most optimal configuration that helps maximize the model's

performance. Moreover, the model helped generate sentiment scores for each class, where the highest score represented emotional intensity. The number of tweets contained in each sentiment class was computed to attain the emotion frequency. The sentiment intensity and frequency between the two groups were compared between the two groups.

3.6   Ethical considerations

Several ethical and legal implications are associated with researching IDD-related data using Twitter data. Even though the study utilized the Twitter API to collect publicly available data without user consent, the Twitter privacy policy[lxiii] reveals that users have consented to their publicly available data being used for non-commercial research (Twitter Privacy Policy, 2023). The study observed the ethical principle of confidentiality by dropping all user names and removing personally identifiable information from the dataset.

4   Results, Testing, Verification

4.1   Sentiment Classification

Sentiment frequency involves how often individuals express their sentiments. The sentiments were categorized as positive, neutral, and negative. Each group's frequency was evaluated based on the number of tweets. Individuals with IDD profiles expressed significant neutral (47.2 %%) and negative (36.2%) emotions in cyberspace. A majority expressed experiencing bullying, attributed to the sentiment scores in the figure below. Only a small fraction of users (16.5%) reported positive sentiments in cyberspace. They noted to have experienced reduced possibilities of cyberbullying. Compared to individuals without IDD, individuals with IDD recorded a higher average of cyber challenges (cyberbullying and toxicity). Non-IDD users had an increased frequency of positive sentiment scores (52.5%) in social media. They faced reduced negative effects on cyber cyberbullying, toxicity, and aggression compared to their IDD counterparts. However, a significant proportion of negative sentiments was recorded (31.3%). A small section of the participants (16.2%) expressed neutral emotions in the cyber environment. In sum, the emotions expressed significantly differed between users with IDD and those without IDD.
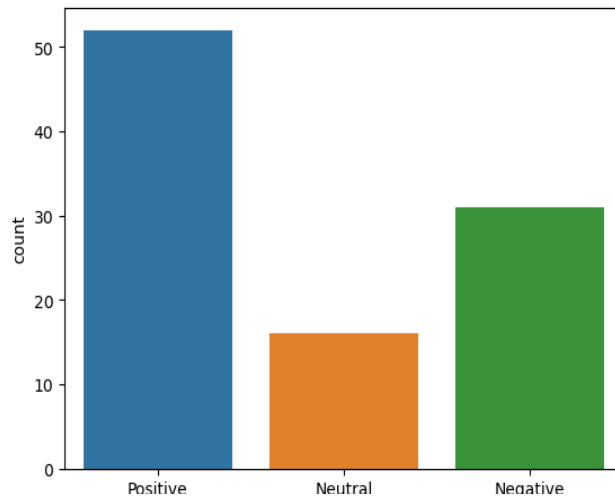
Figure 2: Sentiment distribution for IDD profiles
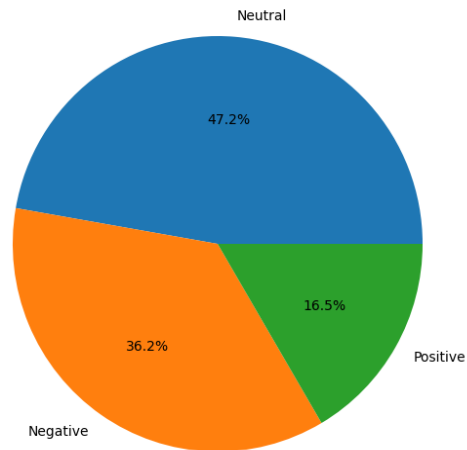
Figure 3: Control group

4.2 Topic Modelling

The Top2Vec model and word cloud were utilized to identify the common topics in the datasets. The word cloud produced the top 50 prevalent words in both datasets. The topics were derived from the clusters of top keywords in the control group and IDD dataset. Clusters represent topics users are likely to discuss and whether there might be correlations and differences between the obtained topics. We manually clustered the top 50 keywords in each

group, resulting in two topics, as shown below, and revealing significant differences between the IDD and non-IDD datasets. The two topics are aggression and toxicity and bullying.

Table 1: Topic description

Topic	Description	Keywords used to search
Bullying	Bullying involves aggressive behaviour that centers on intentional and repeated mistreatment of another person intending to harm, intimidate or cause distress.	Harassment, misogyny, bullying, violence, bully,
Toxicity	Toxicity involves negative, harmful, or destructive behaviour in different contexts and in individuals with different conditions. It encompasses patterns that might damage or hurt individuals or the environment.	Fuck, bullshit, hoe, whore, sexism, victim,

4.3   Common keywords in the Datasets

Table 2: Top words

	IDD dataset	Control group dataset
1	Suckks	Stressful
2	Whore	Clarification
3	Dessert	Fun
4	Remains	Ignorance
5	Isis	Ban
6	Theblock	Please
7	White	Apologize
8	Jasongio	Holeh
9	Heads	Relate
10	Food	Analogy

From inspection of the commonly identified words, it is clear that individuals with IDD recorded high bullying, toxicity, and aggression cases in cyberspace compared to individuals without learning disabilities (see Figures 4 and 5). This suggests possible differences in how individuals with different conditions interact on social platforms.

4.4   Topic1: Bullying

Individuals use online platforms to harass, intimidate or harm others. This can be through sending threatening messages, posting offensive content, or spreading rumours. Some tweets indicated that a significant number of users experienced some form of bullying. Negative words

like bullying, misogyny, and harassment described the experience of most IDD users. The following tweets represent cases of bullying:

> *... RT @srhbutts: CEO of sony europe vehemently, unequivocally condemns #gamergate as misogynistic harassment.*

> *... @MelissaRyan Look at what DC Public Schools are doing for bullying LGBT students now that @m_rhee is gone.*

Users with IDD users discussed bullying and harassment more than users who reported not having the condition based on their profile description. Common issues discussed were negative and revolved around bullying, common among under privileged groups. In comparison, the control group focused more on positive things, which largely centred on food, fun, and other important concepts and analogies. The word list associated with the group is shown in Figure 4 in Appendix 1.

4.5   Topic 2: Toxicity and Aggression

Toxicity and aggression in cyberspace are significant issues that negatively influence users' experience and overall well-being. Upon inspection, a cluster of words (see Figure 5) associated with aggression was observed among individuals with IDD. Aggressive words like whore, hoe, bullshit, suckks, violence, victim, and sexists were obtained. From the output, it is clear that individuals with IDD experience significantly high and different toxicity than those without learning disabilities related to IDD. Tweets, as shown below, reveal highly aggressive behaviour discussed or reported by the profiles:

> *... a classy whore? Or more red velvet cupcakes?*

> *...I hope this round humbled the girls; they can't cook #MKR*

> *...Oh hey, you should be ashamed of your disgusting self*

In the control group users, there were minimal cases of aggression. This suggests they were less likely to use terms implying toxicity towards others. Instead, they embraced positive things and often used positive terms to express their views. As expressed in the word cloud, the common keywords largely focused on fun, efforts, remorse (apologize), and related issues. However, some words like ignorance emerged, which can be predictors of aggression and toxic behaviour in certain cases. Overall, non-IDD users talked about aggression or used fewer toxic phrases than their IDD counterparts.

4.6   Model Performance and Metric Comparison

The performance of the transformers model was evaluated on three key metrics: Precision score, F1-score, and recall.

Table 3: Metrics comparison

Class	Precision-Model IDD	Recall-Model IDD	F1-score-Model IDD
0	58.333333	63.636364	60.869565
1	71.428571	90.909091	80.000000
2	0.000000	0.000000	0.000000
	Precision-Model non-IDD	**Recall-Model non-IDD**	**F1-score-Model non-IDD**
0	25.000000	14.285714	18.181818
1	0.000000	0.000000	0.000000
2	64.285714	75.000000	69.230769

Precision-measured the accuracy of positive predictions by evaluating the ratio of true positives to the total number of positive predictions (true positives + false positives). It focuses on the correctness of the model to predict instances without including false positives. A high

precision score suggests a low rate of false positives. From the table above, the model recorded 58.33%, 71.11 %, and 0% precision scores for the sentiments in the IDD dataset. This implies that high rate of false positives in the IDD dataset. Contrastingly, for the control group, the model recorded 25%, 0%, and 64.28% precision scores for the sentiments (negative, neutral, positive). The precision score for a positive class label is 64.58%, which suggests that true positives are slightly above average. Recall value evaluates the ability of the model to predict positive instances correctly. It emphasizes the ability of the model to avoid false negatives, revealing that a high recall score implies a lower rate of false negatives. For the IDD dataset, the recall values are 63.63%, 90.90%, and 0.0% for sentiments (negative, neutral, and positive). This model correctly identifies instances of negative labels, followed by neutral labels, but it struggles to capture most of the positive instances.

The model recorded recall scores of 14.29%, 0.0%, and 75% for the non-IDD dataset. This shows that, for the control group, the model correctly identifies positive instances but struggles to identify negative and neutral sentiments. Finally, the F1 score measures the model's accuracy by balancing the recall and precision scores. It provides a general evaluation of the model performance by considering the false positives and negatives. A higher F1 score suggests a better trade-off between recall and precision. The model yielded 60.87%, 80%, and 0% F1-scores for the sentiments. This indicates that the model is effective in predicting negative sentiments and correctly identifies neutral scores but less effective than negative sentiments and fails to predict positive sentiments correctly. For the non-IDD dataset, the F1 scores attained were 18.18%, 0%, and 69.23%, revealing that the model struggles to identify negative and neutral sentiments but

performs better in identifying positive sentiments. The figure below summarizes the precision, recall, and F1 scores for a model in predicting sentiments between the two groups.
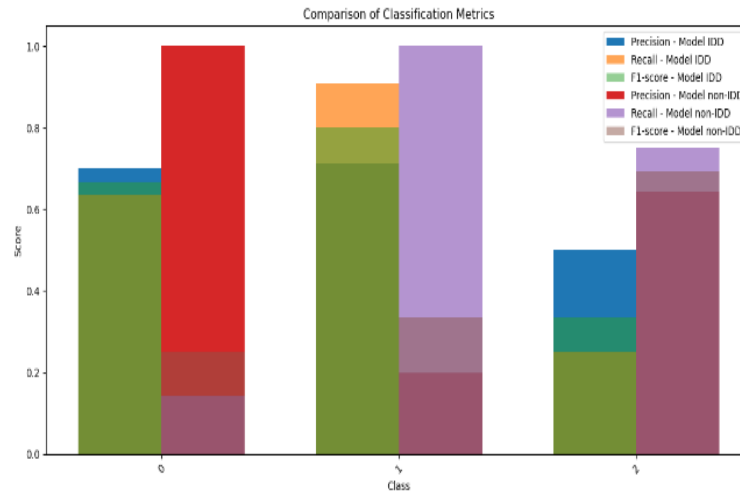

Figure 4: Comparison of metrics for the sentiments

4.7   Discussion

The study investigated the difficulties individuals with forms of intellectual and developmental disabilities (IDD) encounter when using social media. Through this study, the researcher also aimed to understand the complexities of online safety and cybersecurity issues these individuals face while using Twitter. The findings of this study make significant contributions to the vast literature on assessing how different factors might protect against the psychological adjustment difficulties relating to cyber-security and -victimization. Moreover, the findings also underscore the significance of researchers focusing more on the cyber experiences of individuals with IDD.

Findings from the study showed significant differences between Twitter users with Down Syndrome and general learning disabilities and the control group on social interactions and

behavioral tendencies. Individuals with IDD frequently described difficulties with rest, focus, and organization. This is also supported by Morisse et al.[lxiv] who claimed that the field of IDD is strongly influenced by the Quality of Life (QOL) paradigm, where, through this framework, the researchers identified feelings of unrest and lack of focus in individuals with ID. Like this study, the framework strongly supports the equality of these individuals, which reflects in various concepts (empowerment, inclusion, emancipation, and self-determination). The two groups of the current study also related to stories of substance abuse. However, control group members disclosed that they faced these issues less frequently.

Literature disclosed that individuals with IDD often lack peer friendships, especially after work hours for adults and school hours for adolescents and youths. Therefore, this study's findings also help in understanding the emotional trajectories and unique perspectives of individuals with IDD who use social media platforms. According to the study's sentiment analysis, individuals with IDD displayed higher levels of frustration and perplexity and lower levels of curiosity, empathy, and excitement compared to the control group. Moreover, individuals with IDD displayed an increased affective reactivity that manifested in elevated levels of joy, anger, disorientation, sadness, and anxiety. Burrel et al. (2017) affirmed that frustrations were often reported on such individuals, especially during conflicts over inflexibility or repetitive behaviors. Respondents in Burrel et al.'s study claimed that anger and frustrations came from a combined desire to transform their situations together with a sense of hopelessness. However, most respondents reported that realizing their relatives with ID could not change their situation; they opted to change their perception of it, which appeared essential.

A definition by The American Association of Intellectual and Developmental Disabilities (AAIDD)[lxv] on intellectual disability highlights limitations in adaptive behaviour and intellectual functioning, expressed in practical, social, and conceptual adaptive skills. However, the AAIDD stressed that the limitation in such individuals co-exists with a certain type of strength and that the level of life functioning in individuals with IDD improves once appropriately personalized support is provided over a sustained period. This coincides with the current study's findings as the results also stress the need for support systems and tailoring interventions to the unique requirements of individuals with Down Syndrome and various forms of general learning disabilities. Literature has shown that individuals with ID have difficulties using technology, especially computer interfaces. Nevertheless, most individuals with IDD declare that they use social media accounts with no assistance, implying that individuals with ID with cognitive disabilities participate in social networking sites and surf the Internet, as similarly discovered by Shpigelman and Gill (2014). At the same time, participants stated that they also faced challenges when using social media platforms, in this case, Twitter.

Empirical foundations were identified in various studies, such as one by Magee (2012), who aimed to identify the use of the response system (simple) to answer Twitter questions in individuals with IDD, and Hemsley et al.[lxvi] who carried out a study on Twitter on individuals with intellectual disabilities that used augmented and alternative devices of communication. The current study categorized the participants' sentiments as positive, neutral, and negative. In the two groups, the frequency was elevated based on the number of tweets. According to the findings, profiles of individuals with IDD showed significant negative and neutral emotions in cyberspace. A large number of these individuals reported instances of bullying. Only a few

individuals reported positive sentiments in cyberspace. Such participants reported reduced possibilities of cyberbullying. This supported the findings of Ybarra et al. (2015), who also discovered that a large number of individuals with a disability, mostly youths, were targets of bullying and were later exhibiting signs of depression. Cyberbullying and cyber-harassment were also mentioned in Löfgren-Mårtenson et al.'s (2015) study.

Numerous studies -such as one by Holmes and O'Loughlin (2014)- that have investigated individuals with IDD highlight risky situations linked to the use of the Internet, particularly social media platforms. It was identified that different factors led individuals with disabilities to social media interactions, and they included; a clashing desire to be liked, the desire to establish a friendship which often led to a vulnerability to exploitation and violence, a wish to be socially desirable, and a certain tendency to be agreeable. All this appeared normal to individuals with IDD. Molin et al.[lxvii] study also support this, where participants (youths and adults) claimed to accept online requests only from individuals they were familiar with. However, the researchers discovered conflicting evidence as the number of followers on social media platforms together with the statements came from strangers, often perceived by individuals with IDD as 'he or she looks honest." When likened to individuals without IDD, participants (group of individuals with IDD) recorded higher averages of cyber challenges, including toxicity and cyber-bullying. This also coincides with the findings of Holmes and O'Loughlin (2014), who discovered that individuals with IDD were exposed to toxicity and cyber-bullying because of their desire to cultivate relationships which could potentially lead to a loss of control.

The findings of this study also showed that non-IDD users had an increased frequency of positive sentiment scores in social media space. Unlike individuals with IDD, they faced reduced

negative effects of cyberbullying, toxicity, and aggression. Holmes and O'Loughlin (2014) believed this was possible because non-IDD individuals did not always perceive that most individuals were "friends, " so they were less exposed to danger and abuse. Existing literature also highlighted that the greatest danger individuals with IDD are most likely to face or perceive relates to them being isolated or deprived of relationships, including romantic ones. Findings also showed that non-IDD individuals recorded negative sentiments, with an even smaller number of participants expressing neutral emotions regarding the cyber environment. Overall, the findings of this study support researchers who claim that using the Internet causes problems, only differing where researchers claim that such issues exacerbate mental health issues. It is also wise to entertain the thought that the reverse might be true; mental health issues could, perhaps, be pushing individuals to spend most of their time on social media platforms. To sum it up, this study's findings identified that the expressed emotions significantly differed between users with IDD and those without IDD.

It can then be concluded that the increasing concern for the safety and well-being of individuals with socio-emotional and cognitive limitations spending most of their time on the Internet deserves attention.

4.8   Implications

Implications for advocacy and public awareness of the cyber problems faced by people with Down syndrome and other types of intellectual and developmental disabilities are significant as a result of this study. As the findings of this study make their way into the mainstream, caregivers, educators, politicians, and the general public will have a deeper appreciation for the specific challenges and hazards experienced by people with intellectual and

developmental disabilities when navigating the Internet. The findings of this research can be used to improve the digital inclusion of persons with intellectual and developmental disabilities (IDD) through revised policies, curriculum, and interventions. Guidelines, treatments, and instructional materials can be created to enhance the digital experiences of persons with Down syndrome and general learning difficulties and to keep them safe online by addressing the identified cyber hurdles and risks. Moreover, the purpose of this research is to enable persons with intellectual and developmental disabilities to fully participate in online communities. Platforms, interfaces, and technologies that are accessible and tailored for people with IDD can be developed after their unique needs are understood. People with Down syndrome and other learning difficulties may feel more included in society and more empowered in the digital world if this happens.

The results of this study can contribute to the overall effort to make the Internet a safer, more inclusive place for persons with intellectual and developmental impairments. This research aims to provide evidence-based suggestions and guidelines for professionals, policymakers, and organizations working in disability rights and digital inclusion by analyzing the cyber obstacles experienced by persons with intellectual and developmental disabilities. The results can be generalized to others with intellectual and developmental disabilities, not just those with Down syndrome or learning problems like the study's subjects. This research delves deeper into the interaction of neurodevelopmental disorders and cyber issues, expanding our understanding of the digital experiences and needs of persons with IDD.

Many governments have policies and legislation promoting inclusion, but such laws are mostly on paper[lxviii]. The governments of the day are not proactive enough to ensure people with intellectual and development activities benefit from such policies. Not much has been done to

avail Internet and other platforms to IDDs and the change in attitude by society. Alhaboby et al.[1]

consider that many programs' universal outlooks may not be friendly. There is a need for special

programs and specialized designs to meet the needs of special users. The governments may have

the will but lack the appropriate strategies to include people with IDs (Normand and

Sallafranque, 2016). Most programs and products available on media platforms are usable by all

and are not specifically tailored for special needs. Although there are legal ramifications, not

much has been done to promote compliance and even implement the penalties that have been

wanting.

5   Summary, Conclusions, Evaluation

Previous research indicated that individuals establish social identity by interacting with other individuals. Adding to the face-to-face interactions, social identity has also been identified to be formed online and especially in social networking sites such as Twitter. It remained definite that the desires of individuals with IDD to see remain socially desirable, accompanied by a clashing desire to be liked, drove their use of social networking sites. In addition, it can further be concluded that these individuals are generally looking for a 'friend,' and to some extent, soulmate with the objective of establishing an offline association with an individual, most preferably, one without disability.

There are potentially numerous risks on social media networks, however, it is also wise to point out the benefits for individuals with IDD. For instance, social media platforms offer their users an opportunity to expand their social circle and maintain contact regularly. Like other individuals, social networking sites also offer individuals with IDD a chance to make their opinions and thoughts known, which, is likely to make them feel like they have control over. Therefore, as studies highlight the downsides of cyber spaces to individuals with IDD, it remains important to get the balance right; offering same freedom and rights whilst making sure they are empowered to deal with difficulties experience on social media platforms.

Transdisciplinary and inclusive action and research are also needed to assess and describe the effectiveness of caregiver practices in the protection of individuals with IDD against cyber challenges. It is also important to emphasize that these caregivers are not the sole entities responsible for ensuring safe internet use for these individuals.

The current research has shed light on the unique behavioral patterns and social interactions of Twitter users diagnosed with Down syndrome and general learning disabilities such as William syndrome, learning disability (UK), and intellectual disability (USA). The results of this investigation underscore the significance of utilizing Twitter as a means of monitoring and analyzing individuals afflicted with these ailments, furnishing valuable perspectives that may be employed to enhance medical assistance, diagnostic standards, and mechanisms for the automated identification of associated impairments. By analyzing data and insights from social media platforms such as Twitter, scholars, psychiatrists, and medical practitioners can gain a deeper understanding of the challenges faced by individuals with Down syndrome and general learning disabilities. This will enable the formulation of more precise interventions aimed at enhancing the mental well-being of said individuals. Despite the limitations of this study, further investigation into the intricate interplay between individuals with disabilities and social media across diverse online platforms is warranted. Social media platforms such as Twitter offer a distinctive avenue for enhancing our comprehension of Down syndrome, learning disabilities, and associated disorders. This, in turn, can enhance the digital well-being and inclusivity of individuals affected by these conditions.

There were significant differences between Twitter users with Down syndrome and general learning disabilities and the control group regarding behavioral tendencies and social interactions. People with intellectual and developmental disabilities frequently described difficulties with focus, organization, and rest. In contrast, members of the control group, or non-IDD group, discussed these issues less frequently. Sentiment analysis revealed that compared to a control group, people with IDD showed lower levels of excitement, empathy, and curiosity and higher levels of perplexity and frustration. Furthermore, people with IDD showed increased

affective reactivity, manifested in elevated anxiety, sadness, disorientation, anger, and joy. In general, people with IDD, as shown by word clouds and polarity detection in sentiment analysis, generally showed negative and neutral sentiments, while the non-IDD group showed more positive and neutral sentiments.

The findings of this study are important because the facilitate the comprehension of the unique perspectives and emotional trajectories of people with IDD who use social media. The findings stress the need for tailoring interventions and support systems to the unique requirements of people with Down syndrome and other forms of general learning disability. Some caveats to this study must be taken into account. The data may be skewed or inaccurate because the study relied on self-reported conditions. A more accurate picture of people's IDD status could be gleaned from future studies if they incorporated objective measures like diagnostic evaluations and medical records. In addition, Twitter was the only social media site examined in this study. Future research could benefit from a more comprehensive understanding of how people with IDD use various forms of digital media if additional social media sites were included in the analysis.
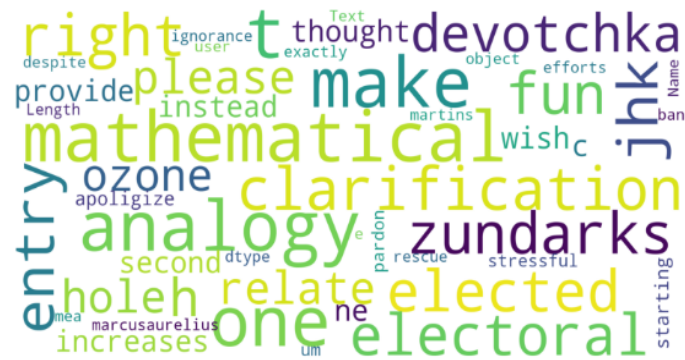
6   Appendix 1

Figure 5: word cloud for Non-IDD dataset

Figure 6: Word cloud for IDD dataset

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