

# Machine Learning-Based Analysis on Digital Distractions and Academic Performance of Online Engagement

**Kamala S<sup>1</sup>, Dr. A. Jayanthiladevi<sup>2</sup>**

Research Scholar, Institute of Computer Science and Information Science, Srinivas University, Mangalore, India.<sup>1</sup>

Professor, Institute of Computer Science & Information Science, Srinivas University, Mangalore, India.<sup>2</sup>

**Abstract:** A significant amount of study has been done to determine the impact of digital distraction on students from an international viewpoint, according to the evaluated literature that is accessible from the perspective of the research issue. The research on the proposed issue has been minimal in the Indian setting. Moreover, considering the information of the unavoidable prevalence of distraction among today's pupils, it is necessary to develop specific ways for transforming these distractions into manageable factors. Based on the existing research, it is evident that the current generation of students is easily diverted by several variables, both internal and external to the classroom environment. However, attempting to take into account and analyse all of these elements would result in a research scope that is too broad. The current study will specifically examine distractions experienced by students in classroom situations. Considering the extensive impact of the widespread availability of the internet and digital devices, it is important to evaluate the level of distraction experienced by students in the digital realm and its influence on their academic performance. In terms of a wider viewpoint, the current research project will focus on consolidating the existing literature on how digital distractions affect students' academic performance and highlighting the consequent consequences for both students and instructors. Machine learning techniques have been used in the domain of intelligent diagnostics to address these problems, particularly in detecting anomalous data and structural deterioration.

**Purpose:** The objective is to determine the elements linked to digital distraction among Higher Education students, particularly in classroom environments. To investigate the correlation between digital distractions among Higher Education students and their academic performance. To investigate the correlation between digital distraction and the behavioural characteristics of the Centennials. To develop a comprehensive model that depicts the many elements contributing to digital distraction among Higher Education students and strategies for its effective control.

**Methodology:** Research Methodology may be defined as a methodical and systematic strategy used to address and resolve an issue. It refers to the methods and techniques used by the researcher to explain, clarify, or forecast the phenomena. Specifically, it refers to an explanation of the researcher's strategy to make judgements about. This research was conducted to examine the correlation between student distraction at higher education institutions (HEIs) and their academic performance, as assessed by their CGPA. Furthermore, to narrow down the scope of the research and account for the many potential distractions that students may encounter, the focus was specifically placed on digital distractions that occur inside the classroom setting. To establish the aforementioned association, an initial attempt was undertaken to determine if the classroom environment induces a propensity among students to get digitally distracted. Subsequently, machine learning algorithms were used to identify the characteristics that contribute to digital distraction in the classroom. To address this constraint, this work introduces a new method for monitoring targets. This method combines the distraction-free centre localization technique with machine learning-based data diagnostic technology.

**Keywords:** Digital Technology, Distractions, Machine Learning, Higher Education, Student Performance.

## I. INTRODUCTION

Distraction refers to the act of diverting people' and groups' attention away from their intended focus, making it challenging to receive the necessary information. The name "Distraction" is derived from the Latin words "Dis" and "Trahere", which mean "apart" and "drag" respectively. Distraction occurs when you are diverted or compelled to deviate from your intended job [1].

A student's daily routine is often filled with several distractions. Abundant stimuli are ubiquitous. During a progressive lecture session in a classroom, students are faced with several stimuli that vie for their attention and consideration, in addition to the teacher and the material.

When discussing the causes of student distraction, they may be divided into two categories: self-generated or externally generated. Internally generated causes may include elements such as fatigue, declining health, anxiety, apprehension, personal circumstances, and so on. Alternatively, extrinsic factors that contribute to this phenomenon may include familial situations, technological devices, the audible sounds of smartphones, as well as boisterous and disruptive talks [19].

Regardless of the origin, these distractions have the potential to significantly diminish students' inclination to study and acquire information. Typically, the factors contributing to student distraction may include one or more of the following: Lack of attentiveness towards one's surroundings. The "object of attention" has a limited capacity to generate interest and capture attention. The "something" has robust, pristine, or visually captivating qualities that differ from those of the "object of attention".

Curiously, the present generation of students has a diverse understanding of distraction, which extends beyond just thinking about their future or feeling a constant need to explore new opportunities. Instead, the aforementioned term might be credited with a broader meaning. Due to the current digital era, we may have distractions in the form of pop-ups, alerts, and messages on our mobile devices. Additionally, there is a strong temptation to quickly go through the latest newsfeed on several social media accounts. Moreover, the proliferation of diverse types of electronic devices among today's kids and their excessively unregulated utilisation provide a far larger challenge to confront. Indeed, the rapid advancement of technology has hindered the opportunity to thoroughly assess the advantages and disadvantages of the supposedly beneficial technological opportunities, particularly when it comes to the student population.

S. No	Authors	Findings & Research
1.	Goswami and Singh (2017) [2]	Investigated the prevalence of multimedia addiction among high school students and explored potential gender disparities in multimedia addiction. Results demonstrated that the level of multimedia addiction among higher-secondary students was substantial.
2.	Kesici and Tunc (2018) [3]	Examined the degree of digital addiction (DA) among university students based on their intentions to use digital tools. Students who used digital tools to see films and listen to music at varying frequencies had comparable DA outcomes.
3.	Sharma (2018) [4]	Stated that a study conducted by prominent government hospitals indicated that young individuals have behavioural reliance as a result of their use of the internet and cell phones.
4.	Jamir et al. (2019) [7]	Conducted a study to examine the prevalence of technology addiction among a sample of 885 school students aged 13-18 years in northern India using a cross-sectional research design. Ultimately, the study revealed a significant occurrence (30.3%) of behavioural addiction among adolescents attending rural schools in Haryana, India.
5.	Ramazanoğlu (2020) [8]	Examined the correlations among internet addiction, social media use disorder, and smartphone addiction in high school students. The research discovered a positive correlation across all three dependence.
6.	Rashid et al. (2021) [9]	Examined the frequency of technology use and its impact on health-related concerns among secondary school pupils in Bangladesh. This research demonstrates that several socio-demographic factors influence the use of electronic devices by children and that such usage has a considerable adverse effect on the physical and mental well-being of secondary school students in Bangladesh.
7.	Amudhan et al. (2022) [10]	Conducted a study on the frequency and factors associated with technology addiction (namely internet, gaming, cell phones, and television) among teenagers in India.
8.	Lin (2020) [11]	This study investigates the prevalence of internet addiction and examines the psychological elements that contribute to it during the COVID-19 pandemic.
9.	Ang (2019) [17]	Examined the prevalence of internet addiction, psychological problems, and associated variables among adolescents during the COVID-19 epidemic.

10.	Bećirović et al. (2022) [18]	The Asian Adolescent Risk Behaviour Survey (AARBS) was carried out to analyse and compare the occurrence of internet use and addiction among teenagers in six Asian countries.
11.	Chundawat et al. (2022) [12]	Conducted research to evaluate the psychosomatic problems arising from excessive internet use in school-enrolled teenage children.
12.	Afacan and Ozbek (2019) [13]	Conducted a poll to examine the extent of high school students' reliance on social media. Ultimately, the research demonstrates that a significant proportion of the kids exhibit a mild degree of addiction.
13.	Xuan and Amat (2020) [14]	Performed a comprehensive analysis of the issue of social media dependency among adolescents using the PRISMA methodology. Ultimately, it concludes that the need for fulfilment in real-life connections among young individuals has emerged as the predominant catalyst for dependency on social media, which in turn indirectly contributes to mental health issues.
14.	Paakkari et al. (2021) [15]	The research emphasised the need to closely monitor adolescents who are at risk and experiencing negative health consequences, while also confirming the association between problematic usage of social media and unfavourable health outcomes.
15.	Varona et al. (2022) [16]	The research sought to assess the conceptual and practical definitions of problematic social networking site (SNS) usage among adolescents. There is currently no recognised theoretical framework for assessing problematic social networking site (SNS) use among teenagers. The absence of a theoretical explanation makes it difficult to compare the results of various investigations and accurately evaluate the extent of the problem.

## II. OBJECTIVE

Education is often regarded as the greatest resource for every country. India, as a nation in the phase of having a large population of young people, with a total of 600 million individuals under the age of 25, has significant potential to drive change in all areas of national development. However, this potential can only be realised if the intellectual capabilities of these students are developed strategically and efficiently.

Moreover, due to the majority of young individuals being part of the centenary generation and possessing distinct characteristics and qualities that are expected to coexist with the current situation, the notion of student distraction is likely to be even more prevalent. Indeed, it has been shown that the kids' propensity for distraction is noticeably elevated and cannot be dismissed. By 2030, the aim is to achieve the sustainable development goals (SDGs). This highlights the need of not just enrolling students, but also ensuring that the intended overall result for the country is achieved.

The attainment of the ultimate objective pursued by a well-developed education system is achieved via a gradual professional trajectory, resulting in advantageous outcomes for individuals, society, and the country as a whole. To achieve this objective, the education system must prioritise improving the understanding of concepts, which will result in a thorough comprehension of their potential practical applications. However, this goal cannot be accomplished if there are distractions present. Therefore, it is important to ensure that pupils are not distracted to accomplish the ultimate goals of national growth and development. The presence of distraction is pervasive and cannot be entirely eradicated, however measures may be taken to reduce its impact.

## III. SOURCES OF DISTRACTION

Diversions may manifest in several forms. These distractions might manifest in the form of phone calls, computers, boisterous conversations with friends, music, or even our thoughts. Extensive study has recognised several elements, such as loud chats, irritating and disruptive behaviours, engaging interactions, the sound of buzzing smartphones, disruptive behaviours occurring nearby, and activities unrelated to the work, as very distracting.

In reality, distractions may originate either from oneself or from other sources. However, both might lead to the emergence of complications related to the concentration and growth of attention on the specific item [20].

External distractions often consist of components such as social interfaces, visual stimuli, phone calls, text messages, music, and so on. Factors such as inattention, worry, weariness, and similar elements might be classified as self-generated distractions. It is noteworthy that the things that might cause distraction alter as time and circumstances evolve. From this fact, it may be inferred that the causes causing distraction are likely to vary and evolve throughout generations, genders, cultures, and even countries. According to the 2014 "Millennials in Adulthood" study by the Pew Foundation, the previous generation, known as Generation Y, has already been labelled as "digital natives" due to their quick and dedicated adaptation to new technology. Indeed, the Insitute-going student populations, who mostly belong to the generational group known as "Centennials", are even more digitally engaged than other generations.

The study conducted by The Educes Centre for Applied Research (ECAR) on Mobile Information Technology in Higher Education found that the acceptance and approval of portable computing devices such as smartphones and laptops in higher education is primarily determined by students. These students view such gadgets as beneficial tools that contribute to their academic success. Undoubtedly, the influence of technology is readily apparent in the field of education.

The widespread use of technology has several advantages. For instance, the phenomena deal with the proximity challenges often encountered by students. Due to the emergence of technology and related devices, students, even those in remote places, now have more opportunities to attend education and uphold their basic rights. Although technology offers several benefits, it also presents some obstacles to children, with "distraction" being a significant issue that needs attention. The dual function of technology, both as a tool for assisting students and as a potential source of distraction, has been positioned competitively. According to the Pew Research Centre, American Insitute students are unlikely to stop or reduce their use of mobile phones, despite being aware of the negative impact it has on their learning. The ownership rate of mobile phones among Americans is far higher, at around 72%, compared to a mere 43% globally [21]. Furthermore, it has been clearly shown that about three-quarters of Americans use their mobile phones to access the internet for an average of around five hours per day. Furthermore, the average number of text messages sent or received by individuals aged 18 to 24 was 109 per day. Therefore, the use of the Internet, resulting from advancements in technology, might be considered a new factor to investigate while examining distractions connected to students. Indeed, the present cohort of students is shown to be less engaged in academic pursuits due to the influence of technology. However, they are more susceptible to the distracting elements of technology. The prevalence of attributing technology addiction to 21st-century intellectuals is increasing.

Another contemporary property, social networking sites, are being used as a means of relief after long periods of study and associated tedium. The excessive and uncontrolled use of such platforms causes pupils to become apathetic and indifferent when it comes to engaging with the community in person. Moreover, distractions in a student's life have the potential to negatively impact their academic performance, often assessed and represented by their CGPA (Cumulative Grade Point Average).

The present generation of young people often engage in multitasking as a result of increased expectations to demonstrate skill in several activities. Multitasking refers to the simultaneous handling of many tasks or the fast switching between activities. However, multitasking, although being seen as a way to do several activities quickly, actually leads to interruptions and poor work performance [22].

Classroom environments contribute equally to student distraction. The interconnection between students, instructors, and the teaching-learning process in the classroom all play crucial roles in shaping the outcomes of learning. Classrooms that seem to be comparable have distinct variations in the prevailing environment for teaching and learning. Students form challenging assessments about the ongoing class by just concentrating on classroom factors such as the class atmosphere and the professors' method of conveying ideas. Indeed, the greater the passivity of the learning experience, the higher the likelihood of pupils being distracted.

#### **IV. EFFECTS OF DISTRACTION**

Experiencing several sorts of distractions is quite prevalent among the present generation cohorts. Underperforming and engaging in wrongdoing are seen as consequences of a preoccupied state of mind. Engaging in the act of "studying" is not a complex endeavour, but attempting to study while in a state of mental distraction is unlikely to provide the desired results.

The challenges of comprehending new topics, diminished concentration, and studying just to pass evaluations are apparent manifestations of distraction. Because multitasking hampers the ability to engage in deep thought and only yields surface outcomes, individuals often have difficulties with attention.



There is a growing body of scientific evidence that supports the idea that cognitive overload may lead to distraction and ultimately result in poor academic performance [23].

The increasing use of digital devices such as laptops, PCs, and internet-enabled mobile phones has sparked a discussion over the potential impact of prolonged technology use on student performance, which is now considered a significant area of focus. Several studies have been conducted to determine the impact of technology on student attitudes and learning outcomes.

Different and conflicting opinions of educators about the consequences of unregulated internet use and digital technology have been collected in many study projects. The use of technology in education enhances the learning experience for students by providing learning applications, platforms, and valuable information. Therefore, one may rely on the positive impact of using technology in education [24]. However, students also use technology for non-academic objectives.

A survey indicated that around 77% of respondents acknowledged the beneficial impact of Internet use on students' research abilities. However, a significant 87% of respondents said that digital technologies are responsible for generating a generation that lacks focus and is easily distracted. Indeed, the negative impact caused by technology in terms of distraction outweighs the data supporting technology's role as an academic tool. Instructors have expressed a negative view of the kind and level of focus shown by students who heavily rely on digital technology for activities that need a high level of attention. The use of digital gadgets in class has been seen to negatively impact students' ability to pay attention and follow essential instructions. Conversely, the alleged benefits included facilitating connectivity, assisting with academic responsibilities, alleviating boredom, and providing amusement. Students who engage in Instant Messaging (IM) were shown to be unduly diverted from academically important tasks.

The detrimental impact of utilising computers during lectures was substantiated by the meagre results achieved by these students on recall and recognition tests. Furthermore, it resulted in a worse comprehension of educational material, an increased tendency to multitask during class, and a greater level of distraction. Moreover, research has shown the detrimental impact of this method on pupils who rely on manual note-taking. This reciprocal effect was shown to apply to multitasking as well. Indeed, the literature analysis provides evidence that a basic comprehension of course content followed by a decrease in overall performance is seen when individuals engage in multitasking. Moreover, engaging excessively on Facebook and other social networking platforms while studying has resulted in a detrimental impact on the overall semester GPA.

Acquiring a deeper understanding of the factors that cause students to lose focus in modern classrooms, as well as the intricate connection between distraction and students' academic performance, will undoubtedly aid in the development of strategies and models to reduce the significant impact of distraction. This research will provide an opportunity to gather insights into the distinctive behavioural characteristics of the Centennials. Consequently, this will further confirm that the distraction experienced by centennial students is not their fault, but rather a result of their inherent programming that prevents them from avoiding distractions in a progressing class [25]. Additionally, this research aims to optimise the allocation of resources to mitigate the distraction, but not eliminate it, and minimise the intensity of its consequences.

## V. RESEARCH GAP

During the evaluation of the literature about the current study field, some gaps were identified. Sufficient research exists about the impact of several variables on the propensity of Higher Education students to get distracted. The majority of the aforementioned studies relate to territories outside of India.

- The amount of research conducted on the anticipated issue in the Indian setting has been minimal.
- The topic of digital distraction is often superficially addressed without delving into its profound and wide-ranging consequences. Insufficient effort has been made to address the repercussions of a digitally preoccupied young generation. There is still a lack of widespread recognition about the detrimental impact of "digital distraction" on our cognitive abilities.
- The prevalence of distraction among the Centennials has not been thoroughly examined. Due to their adeptness at multitasking, Centennials often struggle to maintain concentration during class. As a result, pupils get focused on less profitable stimuli in their environment, which ultimately causes them to become distracted.
- Moreover, the current circumstances that have compelled students to spend more time on screens for academic purposes may further intensify their inclination towards distractions once the situation returns to normal. The current situation has resulted in the rise of digital distraction as a significant issue that necessitates identifying the underlying causes of distraction among students to provide effective strategies for managing the problem.

- The universal acceptance of the prevalence of digital distraction, particularly among young digital natives, is widely acknowledged. However, little consideration has been given to the strategies that might be used to effectively address the issue of students' inclination towards digital distractions.

## VI. CONCLUSION

Efforts were undertaken to ascertain the nature and magnitude of the digitally distracting behaviours exhibited by students during class by identifying the activities in which they frequently entangled themselves during that time. The pupils were found to engage in activities such as web browsing, playing mobile games, accessing social networking sites, monitoring emails, and engaging in text message-based conversations. In general, students attending higher education institutions are more susceptible to distractions. The problem is particularly concerning when considering the student population consisting of the Centennial generation. Due to their exposure to the world, these cohorts have acquired a temperament that is very dependent on technology and its related components. Indeed, their inclination to get deeply absorbed in the constantly expanding realm of technology and gadgets is certain to significantly rise shortly. The findings of the current research revealed that a large proportion of the participants reported utilising the Internet extensively.

## REFERENCES

- [1]. Afacan, O., & Ozbek, N. (2019). Investigation of social media addiction of high school students. *International Journal of Educational Methodology*, 5(2), 235-245. <https://doi.org/10.12973/ijem.5.2.235>
- [2]. Goswami, V., & Singh, D.R. (2017). A Study on Multimedia Addiction among Higher Secondary School Students. *International Journal of Scientific Research in Science and Technology*, 3(7), 115-118.
- [3]. Kesici, A., & Tunç, N.F. (2018). Investigating the Digital Addiction Level of University Students According to Their Purposes for Using Digital Tools. *Universal Journal of Educational Research*, 6(2), 235-241. <https://doi.org/10.13189/ujer.2018.060204>
- [4]. Sharma, P. (2018, March 2). Mobiles & internet are trapping the youth, says a survey by Top Hospitals. *India Today*. Retrieved July 28, 2018, from <https://www.indiatoday.in/mail-today/story/mobiles-internet-are-trapping-the-youth-says-survey-by-top-hospitals-1180599-2018-03-02>
- [5]. Sharma, P., Kumar, A., Lamba, R., Awasthi, A. (2021). Internet addiction and academic performance among high school urban students. *International Journal of Health and Clinical Research*, 4(6), 237-240.
- [6]. Sharma, S., Singh, A., Bhatia, A., Kohli, A., & Pandey, R. (2022). Relationship of Internet Addiction with Social Connectedness, Self Esteem, Anxiety, Depression, and Insomnia. *Journal of Positive School Psychology*, 6 (6), 1547-1556.
- [7]. Jamir, L., Duggal, M., Nehra, R., Singh, P., & Grover, S. (2019). Epidemiology of technology addiction among school students in rural India. *Asian journal of psychiatry*, 40, 30–38. <https://doi.org/10.1016/j.ajp.2019.01.009>
- [8]. Ramazanoğlu, M. (2020). The Relationship between High School Students' Internet Addiction, Social Media Disorder, and Smartphone Addiction. *World Journal of Education*, 10(4), 139. <https://doi.org/10.5430/WJE.V10N4P139>
- [9]. Rashid, S. M., Mawah, J., Banik, E., Akter, Y., Deen, J. I., Jahan, A., Khan, N. M., Rahman, M. M., Lipi, N., Akter, F., Paul, A., & Mannan, A. (2021). Prevalence and impact of the use of electronic gadgets on the health of children in Secondary Schools in Bangladesh: A cross-sectional study. *Health Science Reports*, 4(4). <https://doi.org/10.1002/hsr2.388>
- [10]. Amudhan, S., Prakasha, H., Mahapatra, P., Burma, A. D., Mishra, V., Sharma, M. K., & Rao, G. N. (2022). Technology addiction among school-going adolescents in India: epidemiological analysis from a cluster survey for strengthening adolescent health programs at district level. *Journal of public health (Oxford, England)*, 44(2), 286–295. <https://doi.org/10.1093/pubmed/fdaa257>
- [11]. Lin M. P. (2020). Prevalence of Internet Addiction during the COVID-19 Outbreak and Its Risk Factors among Junior High School Students in Taiwan. *International journal of environmental research and public health*, 17(22), 8547. <https://doi.org/10.3390/ijerph17228547>
- [12]. Chundawat, D. S., Yadav, K. C., Mudgal, S. K., Yadav, Y., Gaur, R., & Malhotra, V. (2022). A Study on Psychosomatic Problems Related to the Problematic Internet Use among Adolescents at Selected Schools of Aspur Block, Dungarpur, and Rajasthan. *Mymensingh medical journal: MMJ*, 31(2), 539–546.
- [13]. Xuan, Y. J., & Amat, M. A. C. (2020). Social Media Addiction and young people: A systematic review of literature. *Journal of Critical Reviews*, 7(13). <https://doi.org/10.31838/jcr.07.13.97>
- [14]. Pakkari, L., Tynjälä, J., Lahti, H., Ojala, K., & Lyyra, N. (2021). Problematic Social Media Use and Health among Adolescents. *International journal of environmental research and public health*, 18(4), 1885. <https://doi.org/10.3390/ijerph18041885>

- [15]. Varona, M. N., Muela, A., & Machimbarrena, J. M. (2022). Problematic use or addiction? A scoping review on conceptual and operational definitions of negative social networking sites use in adolescents, *Addictive Behaviors*, 134. <https://doi.org/10.1016/j.addbeh.2022.107400>
- [16]. Amudhan, S., Prakasha, H., Mahapatra, P., Burma, A. D., Mishra, V., Sharma, M. K., & Rao, G. N. (2022). Technology addiction among school-going adolescents in India: epidemiological analysis from a cluster survey for strengthening adolescent health programs at district level. *Journal of public health (Oxford, England)*, 44(2), 286–295. <https://doi.org/10.1093/pubmed/fdaa257>
- [17]. Ang, C. S., Teo, K. M., Ong, Y. L., & Siak, S. L. (2019). Investigation of a Preliminary Mixed Method of Phubbing and Social Connectedness in Adolescents. *Addiction & health*, 11(1), 1–10. <https://doi.org/10.22122/ahj.v11i1.539>
- [18]. Bećirović, E., & Pajević, I. (2020). Behavioral Addictions in Childhood and Adolescence - Pandemic Knocking Door. *Psychiatria Danubina*, 32(Suppl 3), 382–385.
- [19]. Winstone, L., Mars, B., Haworth, C., & Kidger, J. (2021). Social media use and social connectedness among adolescents in the United Kingdom: a qualitative exploration of displacement and stimulation. *BMC public health*, 21(1), 1736. <https://doi.org/10.1186/s12889-021-11802-9>
- [20]. Wu, J., & Siu, A. (2020). Problematic Mobile Phone Use by Hong Kong Adolescents. *Frontiers in psychology*, 11. <https://doi.org/10.3389/fpsyg.2020.551804>
- [21]. Xin, M., Xing, J., Pengfei, W., Houru, L., Mengcheng, W., & Hong, Z. (2018). Online activities, prevalence of Internet addiction and risk factors related to family and school among adolescents in China. *Addictive Behaviors Reports*, 7, 14–18. <https://doi.org/10.1016/j.abrep.2017.10.003>
- [22]. Xuan, Y. J., & Amat, M. A. C. (2020). Social Media Addiction and young people: A
- [23]. Systematic review of literature. *Journal of Critical Reviews*, 7(13). <https://doi.org/10.31838/jcr.07.13.97>
- [24]. Yang, S.-Y., Wang, Y.-C., Lee, Y.-C., Lin, Y.-L., Hsieh, P.-L., & Lin, P.-H. (2022). Does smartphone addiction, social media addiction, and/or internet game addiction affect adolescents' interpersonal interactions? *Healthcare*, 10(5), 963. <https://doi.org/10.3390/healthcare10050963>
- [25]. Zhang, X., Gao, F., Kang, Z., Zhou, H., Zhang, J., Li, J., Yan, J., Wang, J., Liu, H., Wu, Q., & Liu, B. (2022). Perceived Academic Stress and Depression: The Mediation Role of Mobile Phone Addiction and Sleep Quality. *Frontiers in public health*, 10. <https://doi.org/10.3389/fpubh.2022.760387>