



Mobile phone use and its threat to dependence among secondary school students – an explanatory study

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Abstract

Introduction and Objective. Nomophobia (NMP) is a present-age phobia of loss of use of information and communication technologies (ICT), particularly smartphones.

Materials and method. The study adopted a two-phase, exploratory consequential mixed methods design. The first phase was a quantitative exploration of the degree of NMP. The second mapped the potential area of risks in using modern ICT. Three working hypotheses were established to compare the opinions of secondary school students, their behaviour and degree of NMP. A 20-item anonymous questionnaire was administered to 373 boys and girls aged 14–15 in 11 randomly-selected secondary schools in the Czech Republic.

Results. The results prove that 0.5% of the subjects did not exhibit symptoms of NMP, a very mild form of NMP was detected in 71% of respondents, a mild form of NMP was detected in 18.7% of the respondents, a moderate form of NMP was detected in 7.8% of respondents, and a severe form of NMP was detected in 2% of respondents. Almost three-quarters of the students were not directly at risk of dependence on a mobile phone, but a 10th of the sample exhibited a set of symptoms of behavioural addiction. On average, respondents used 4 applications, communication programmes, social networks, and music players. Girls reported a higher dependence on mobile phones in comparison to boys.

Conclusions. Further investigations should directly ascertain which integrands predict NMP, identifying risk groups, and developing preventive strategies (social and environmental factors) to better understand the underlying cause of NMP.

Key words

prevention, secondary school, healthy behaviour, nomophobia, mobile phone use

INTRODUCTION AND OBJECTIVES

Since the first simple transmission of voice, mobile telephone communication has undergone rapid changes associated with expanding text and picture messages. In due course, the massive use of the internet connection has enabled communication via social networks, online games, and more. The most used digital device is the mobile phone (based on the customs of a particular country), followed by personal computers and tablets [1–3]. Mobiles offer tools for working with information on the internet, taking photos, shooting videos, and using navigation. The attitude to mobile phone can vary from person-to-person, from preoccupation to disinterest or until someone calls or sends a message [4]. The term ‘nomophobia’ was coined in 2008 in the UK as part of a survey focused on the possibility of cases of anxiety disorder caused by excessive use of mobile phones. Nomophobia comes from the anglicism ‘nomophobia’ (no-mobile-phone-phobia) (NMP) and describes a mental state where people

fear being disconnected from mobile phones or losing the mobile network signal [5, 6].

As a result of these unfounded concerns, adverse effects on the physical and mental condition of users might be observed. NMP characterizes a form of phobia that threatens the upbringing and education of a new generation. Current data indicates an increasing tendency in younger emotional disorders amplified by the global COVID-19 pandemic and consequent isolation and mobile phone use [7]. Rodriguez Garcia et al. [8] stated that NMP has not been studied sufficiently in recent years. When the practical, efficacious way to prevent addictions has become one of the predominant educational pursuits in the 21st century [9]. In contemporary society where young and very young children own mobile phones, it is essential to understand and set rules for the usage of mobile phones and other electronic devices at schools and in other educational institutions [10]. As the signs of NMP are already evident in secondary students, it is appropriate to map the situation in schools and to use suitable preventive measures and strategies to curtail its expansion.

Addiction can be described as a disorder, a repeated urge to use a substance or repeat a particular behaviour. An addict cannot resist the urge, despite the negative consequences

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that addictive behaviour creates. It is postulated [11, 12] that NMP can profoundly affect somatic and mental determinants. Reusing substances after a period of abstinence usually leads to a faster re-emergence of symptoms, unlike substance use in persons without addiction [13]. Behavioural addictions can be diagnosed when an individual shows that a specific activity becomes the dominant activity in the person's life and dominates that person's thinking, feelings, and behaviour [11]. When comparing substance and addictive behaviour, it was realized that brain activation, stimulation of the pathological player during the game, and the addict after taking the drug, were analogous [14], which means that both substance and non-substance behaviour activates the same pathways. Specifically, the neurotransmitter dopamine evokes the intense wave of pleasure that one experiences. Therefore, behavioural addictions can be as dangerous as substance addictions [15], even more so when a new behavioural addiction emerges (i.e., internet and computer game addiction, loan, shopping addiction, workaholism, addiction to another person and the extensive care of others, co-dependency) [16].

Technological dependencies represent a subset of behavioural dependencies. According to [17, 18], modern information technologies include television, computer, mobile phone, the internet, and other technologies which are becoming an essential part of the individual and society. Sieberg [19] saw the internet as a platform for freedom and anonymity. Černá et al. [20] claimed that the most vulnerable group on the internet is adolescents who need to experiment with their identity. Dočekal et al. [21] compared the internet to a vast playground where a child can promote the will and desire to learn and create. Further, playgrounds might have an effect on children as future 'addicts'. Spitzer [22, 23] recalled that the internet is changing our brains, which have been evolving for centuries and adapting to the conditions of individual stages of human development without digital technology. He points to the so-called 'digital dementia' (i.e., a disorder of cognitive abilities and mental functioning caused by the long-term use of digital media). The author further asserts that digital media diminish the individual need to perform brain work as modern technologies take over this primary human activity. Furthermore, brain development is delayed, which hampers mental performance and remains below its potential. Zimbardo and Coulombová [24] viewed the internet as a potential medium for establishing healthy relationships and the sexual life of young people.

Alter [14] asserted that modern technologies should primarily make our lives easier. He emphasized the right balance. The last three generations of Czech society can be grouped into Generation X, Y, and Z. Generation X defines people born between 1968–1983 (Socialism era). Generation Y is often referred to as the so-called 'Millennial' generation, people born between 1984–2005 who experienced a rapid enhancement of information technology during pre-teens and adolescence. Lastly, Generation Z cohorts born between 2005–2015 who grew up and are growing up surrounded by ubiquitous modern ICT and cannot imagine life without the internet, where the differences between the real and online world are almost nil [25]. The effects of ICT on the youth can be viewed from a dual perspective. The positives include easy search, access to information, the possibility of self-education, personal development in the form of fun games or competitions, the creation of social groups, development of logical thinking,

memory or perseverance, or spatial imagination. It is also important to acquire skills and knowledge in computer literacy, which is a desirable feature of employers and will probably be highly required in the future [26]. The negative side includes access to an abundant, unverified amount of information and spending a long length of time on ICT, creating potential adversity in personal, verbal, and social communication. Decreased levels of social intelligence can lead to an inability to empathize and discharge aggression in connection with playing computer games. Concerning the negative impacts on an individual's health, it is necessary to recognize the tendency to obesity, the risk of vision damage, back pain, and frequent headaches. Nonetheless, ICT can possess the risk associated with cyberbullying, stalking, hoaxing, and other negative phenomena [26].

Opinions among the school management professionals in the Czech Republic on the use of mobile devices are diverse. In most instances, the school management leans toward strict forms of restrictions or prohibitions imposed by the school rules, as there are several problems associated with the excessive use of mobile phones at schools [27]. The main risks in children include reading disorders, anxiety, depression, tendencies to obesity, and reduced ability to concentrate, which can lead to reduced emotional control and insufficient empathy in adulthood [28, 29]. Other risks can include financial problems (high fees for telephone services), sleeping disorders, or effects associated with electromagnetic radiation on the human brain [30]. Promoting concentration and reducing stress levels might go hand in hand with reducing mobile phone use [28]. An essential argument for reducing the use of mobile phones at school is the striving to reduce cyberbullying. The more students who use mobile phones, the greater risk of their misuse and unwanted behaviour [28]. Restrictive measures at school concerning mobile phones are also associated with a significant improvement in students' social competencies and a higher degree of social interaction with classmates [27]. Banning the use of mobile phones at school does not solve the problem of addiction. Introducing ethical rules and zones without a mobile phone is more favourable. In 2018, the Ministry of Education in the Czech Republic specified restrictions on mobile phone use in schools. However, it did not recommend a total ban because mobile phones are the personal property of students and tools for education and obtaining and working with information in modern society. However, an effort to designate a site and time to use the cellphone may not be so straightforward. The management of numerous schools in the Czech Republic prohibits students from using mobile phones during classes, and specific rules are set out in the school regulations [31]. The inconsistency in the interpretation of the directive translated to a strict prohibition or limited use of cell phones in some but not all schools [32].

Yildirim and Correia [33] described mobile phone use as a modern phenomenon characterized by so-called smart mobile phones that have fast and convenient access to the internet, enabling users to employ numerous applications, including social networks. In this way, they increase users' fears about the loss of communication, such as voice transmissions, via the mobile network, as well as the use of the vast possibilities of the internet, including social networking. Social networks are the most operated applications on the mobile platform, followed by games, communication, and shopping applications [34]. In France and Germany, the average user spends about two hours a day using a mobile

phone. In developed Asian countries (e.g., South Korea and China) this is doubled, as well as in some countries in South America, e.g. Brazil and Argentina [35].

Svobodová [36] observed nervousness and even panic when a person does not have a mobile phone, the phone is not charged, or has no signal; they constantly check the display and immediately respond to incoming messages. Furthermore, Blinka et al. [37] added strong desire, euphoria, tolerance, withdrawal syndrome, conflict, and relapse to those symptoms. NMP can be associated with headaches or eye pain from constant display monitoring [38]. Because of the need to constantly control the mobile phone, an NMP person cannot concentrate fully in times of worry about losing personal data and passwords due to fraudulent software [6]. One of the most common symptoms of NMP is multi-tasking (performing multiple activities simultaneously on a mobile). Stress hormones excessively stimulate the brain, affecting thinking and the ability to concentrate [39]. The brain is constantly flooded with considerable information, which can weaken concentration.

Internet addiction represents a broad range of drivers of various types of behaviour. Young [40] distinguishes the following: addiction to cybersex and internet pornography, to social networks, addiction to online gambling, shopping or stock trading, addiction to information search and downloading, and addiction to computer games. Internet addiction is associated with using some digital devices that can use the internet connection effectively. Brain imaging studies suggest that internet addicts' neural pathways have abnormalities in the reward centre, control system, and decision-making system when resting or induced [41]. Kardefelt-Winther [42] asserted that internet addicts are the most affected group of people who use the internet excessively. Metabolism or net mania is related to how the users perceive themselves and their surroundings and how they are open to the outside world. The internet gives an addict the impression of having a certain quality of personal prestige in the virtual world. Kabele [43] concluded that the term 'social network' is associated with a service on the internet, providing a particular group of people with different opportunities for communication and data sharing. Services allow individuals to compile a public or semi-public profile within a restricted system [44]. Recent data shows that there are 4.54 billion active internet users worldwide, of which 4.18 billion use a mobile phone to connect. Approximately 3.8 billion internet users actively use social networks, most connecting via mobile phones. The number of internet users is constantly growing, the number of mobile internet users is growing slightly faster, and the number of social network users available mainly through the mobile internet is growing the fastest [45]. Losekoot and Vyhnaníková [46] identified the reasons for the constant growth of social network users in the natural human need to fit into the pack and behave in conformity. The world's most widespread social network is Facebook, with about 2.5 billion users, followed by YouTube, WhatsApp, and Facebook Messenger [47]. Social networks represent a powerful marketing tool [48].

Blinka et al. [37] asserted that excessive use of social networks can be a form of addiction, as all its features are present, including withdrawal symptoms, conflicts with the environment, and relapse. It can be said that they even subconsciously admit their disproportionate time online and have difficulty in admitting it. They feel guilty, and at a

more advanced stage of addiction, changes like those on the internet begin to show. They neglect hobbies, duties, loved ones, and themselves, have excuses for their behaviour and run away from problems. In the case of abstinence, they may suffer from nausea, anxiety, or depression, often insomnia due to exploring social networks several times at night [49]. Fieldingová [50] and Arslan [51] described Facebook as an invaluable resource for meeting human needs, such as communication and belonging. However, she reminds us that this tool has opposite effects in case of overuse.

The current study aims to establish the extent of mobile phone use, together with mapping which of the selected sample makes most use of mobile applications. For better mapping and understanding of the underlying causes of NMP, the following working hypotheses were formulated:

- working hypothesis H1 – the average scored answers to the individual survey questions are not the same among both genders;
- working hypothesis H2 – the averages total NMP-Q scores are not the same among both genders;
- working hypothesis H3 – the average point evaluations for the first 20 questions of the survey are different among both genders.

The questionnaire was categorised into four groups of questions related to the congruent situations:

- **Group 1:** items 1–4, the user has a mobile phone, loses access to information.
- **Group 2:** items 5–10, the user has a mobile phone, but for technical reasons, cannot use it.
- **Group 3:** items 11–15, the user does not have a mobile phone and loses the possibility of communication.
- **Group 4:** items 16–20, the user does not have a mobile phone and loses connection.

The main objective of the investigation was to determine the degree of addiction to mobile phone use, coupled with the realization that mobile applications are used mostly by elementary school students in 8th and 9th grades, aged 13–16 years, from north-eastern Bohemia Hradec Králové region in the Czech Republic. Based on this objective, three working hypotheses were formed that compared the behaviour of boys and girls.

MATERIALS AND METHOD

An anonymous quantitative research survey was carried out in 11 randomly selected elementary schools in eight locations of the Hradec Králové region of the Czech Republic. The investigation took place in the 2019–2020 academic year in 15 classes of the last and penultimate years (in two eighth and 13 ninth grades). The selection of schools was random. Individual schools were personally approached and asked for cooperation. The aim was to obtain a sample of at least 300 respondents. Anonymous questionnaire were completed during social study classes in each school. A more detailed description of the area in which the schools are located is given below:

- Location 1 – the region's largest city with approximately 11,200 inhabitants. There are several primary schools with a total number of 1,614 students. The survey was carried out at three primary schools from that location.

- Location 2 – the second largest city in the region with about 7,000 inhabitants, including surrounding villages and townships. There is one primary school with a total of 770 students.
- Location 3 – a town with approximately 6,200 inhabitants. It houses a children's home with a school – a modern facility with 40 pupils, which implements European principles of educating children with behavioural disorders.
- Location 4 – has approximately 4,500 inhabitants and a primary school with 475 students.
- Location 5 with roughly 2,150 inhabitants, in the foothills of the Eagle Mountains. It has a primary school with 380 students.
- Location 6 – has about 2,000 inhabitants and one primary school with 300 students.
- Location 7 – in the Orlické Mountains, with approximately 1,700 inhabitants. The elementary school has 330 students.
- Location 8 – a foothill village with 1,050 permanent residents. 140 students attend school and half of them commute from the surrounding mountain villages.

The research sample consisted of 373 students: 184 girls (49%) and 189 boys (51%). Correspondingly, 115 were 14 years old (31%) and 222 were 15 years old (60%). Regarding gender and age, there were 14-year-old boys (27%), 14-year-old girls (35%), 15-year-old boys (62%), and 15-year-old girls (57%) among the respondents. The relative frequency of younger and older pupils outside the most represented group ranged from 0.5–6%. The average age of all respondents was 14.7 years. An anonymous investigation comprised two distinct phases. The basis of the first part constituted a nomophobia questionnaire (NMP-Q) that embraces a standardized model introduced in 2014 at the University of Iowa, USA, [33, 52] as a tool for evaluating the NMP level. Czech translation and validation were constituted by Kopecký [53].

The nomophobia questionnaire (NMP-Q) contained 20 items about everyday situations. The introductory nine questions examine the behaviour of respondents if they have a mobile phone with them, but for some reason, they cannot use it. The first four items focused on the situation when the respondent cannot use a mobile phone.

The following five questions map the feelings in situations where they have a mobile phone, but for technical reasons, cannot use them. The subsequent 11 questions examine the behaviour and feelings when they do not have a mobile phone. Items 10–15 concentrate on situations where respondents do not have access to communication via mobile phone (e.g., with friends or family), and items 16–20 ask about situations where respondents lose mobile phone connection. A Likert scale was used to answer the queries. Six categories were offered as part of the percentage agreement with the question that best describes the respondent's behaviour. Thus, the respondent could express the degree of agreement with the relevant item from 0–100% in the range of 20%.

On the low end of the scale, a 0% agreement rate means the respondent would never feel or behave this way. The upper end, 100% agreement, signifies that the respondent always agrees with the question being asked. 20% agreement means the respondent agreed with the question in five cases. Individual scales of answers to the questions were scored from one point to 0% agreement with the question) to six points 100% agreement with the question) in steps of one point. Based on the evaluation of the NMP-Q according to

[53], a slight adjustment was made (more extensive range) reported for mild and moderate rates of NMP [54]. Total scores were calculated by summing-up responses to each item, resulting in NMP scores ranging from 20–120 points, where higher scores correspond to greater nomophobia severity. An NMP-Q score of 20 indicates the absence of nomophobia. Scores range between 21–40, corresponding to a very mild level of nomophobia, 41–60 points to a mild level, 61–80 somewhat more than a mild level, 81–100 represent a moderate level, scores greater than 101–120 corresponding to a severe level of NMP.

The second part of the survey contained a single item focused on the applications preferred by respondents. Subjects were instructed to select the five most frequently used applications according to their preference. From 1 – the most popular, to 5 – the least popular. The list of applications was inferred from the works of Richter [55] and Havranová [54]. To improve our understanding of the respondents' behaviour when using a mobile phone, the applications were categories where the overlapping of some applications was considered. The following categories were selected: social networks, text voice or video communication, listening or downloading music files, playing games, pornographic applications, sports applications, advertising and shopping applications, news sites and applications, internet search engines, and applications for playing and downloading a movie and series files. The survey was conducted voluntarily in June 2019.

Randomly-selected secondary schools were personally visited and asked for cooperation. The questionnaires were prepared in print, and their completion took place anonymously during the social study class. None of the students declined to participate in the survey.

Statistical analysis was performed using Statistical Package for the Social Science (SPSS) version 20. Descriptive statistics were broken down into measurements of central tendency and variability (spread). The F-test was applied to determine the variances in both groups. Based on the results, an unpaired two-sample two-tailed T-test was carried out. The significance level was set at $p > 0.05$.

RESULTS

The findings from the first section of the survey (i.e., the first 20 questions) are presented. This is followed by identification of the respondents' mobile phone use preferences based on their answers to one question and, ultimately, an analysis of the working hypotheses of this study.

Findings of NMP-Q (first phase)

Item 1: *I would feel uncomfortable without constant access to information via my mobile phone.* Most of the responses were relatively moderate for both genders. One-third of the group responded with a 20% agreement rate, a quarter with a 40%, and 16% with a 60% concurrent value. The relative frequencies of the remaining options were around 10% without major differences between genders.

Item 2: *I would be upset if I could not look at the information on my mobile phone when I needed it.* The answers to this question were relatively evenly distributed throughout the

entire sample. Approximately one-fifth was between 20% – 100% agreement rate. Only 6% of respondents dissented from the majority opinion.

Item 3: *It would make me nervous if I could not receive messages (events, weather, etc.) on my mobile phone.* Students did not evaluate this situation as being burdensome. The average frequency of 0% – 40% agreement rate was 20%. Moderate differences between genders up to 6% were also observed.

Item 4: *I would be upset if I could not use my mobile phone and its capacity when I needed it.* Most subjects would be upset if they will not be able to use a mobile phone if needed. The entire sample recorded a higher than 60% agreement with almost 60% frequency. There was a slight difference of 6% – 8% between the genders, which was observed in the 20% – 40% and 80% – 100% agreement rates.

Item 5: *It will scare me if the battery runs out in my phone.* Respondents assessed this situation with a 0–20% agreement rate with 29% – 40% frequency in both genders. The frequency decreased from 6% – 8% with a higher agreement rate. Girls exhibited a significantly higher frequency of 40% than boys, with 27%.

Item 6: *I would panic if I used my monthly data limit or ran out of credit.* This situation would not trouble students much. More than half of the respondents strongly disagreed with the statement (i.e., there was a 0% agreement rate), and a fifth expressed a 20% agreement. A higher level of agreement was observed within a frequency from 4 to 9%. No significant differences were detected between genders.

Item 7: *If I did not have an operator signal or Wi-Fi, then I would constantly check if I was already connected.* Most subjects responded with a low level of agreement with this statement. A disagreement was evident in 27% of the sample and a 20% agreement rate in a quarter of the sample. A third of respondents expressed a 60% 100% agreement rate. No significant differences were observed between all subjects.

Item 8: *If I could not use my mobile phone, I would be afraid that I would get lost, get stuck, and others.* Nearly half of the students disagreed, 20% somewhat disagreed, and 20% agreed. The frequency of significant disagreements was higher for boys, 54%, compared to girls, 39%. Remaining categories exhibit frequency from 4% – 6%.

Item 9: *If I could not use my mobile phone for a while, I would feel compelled to check it.* One-third of students disagreed with this statement in principle, a quarter expressed a 20% agreement, and a fifth with a 40% agreement. The frequencies of the remaining categories ranged from 4% – 12%. 4% of boys and 9% of girls would feel the urge to check their mobile phones constantly.

Item 10: *I would feel nervous because I can't communicate with my family or friends immediately.* 20% of agreement, one-third of the respondents, followed by 40% consent in one-fifth of students. Categories with a higher level of agreement were represented with a frequency of about 10%. One-third of boys and 41% of girls stated a 60% agreement rate.

Item 11: *I would be afraid because my family or friends would not be able to contact me.* As with the previous item, high levels of agreement, 80% and 100%, were significantly higher for girls, 27%, compared to boys – 14%. The most frequent agreement rates in the whole group were 20% (acknowledged by a quarter of respondents) and 40% (favoured by a 5th of respondents).

Item 12: *I would feel nervous because I could not receive SMS messages and calls.* Total disagreement was expressed by boys by 23% compared to girls by 16% while girls chose a high degree of agreement of 80% and 100% by 22%, compared to 12% in boys. The 20% consent rate was the highest frequency third in the entire group.

Item 13: *I would be nervous because I would not be in contact with my family and friends.* Boys expressed more substantial disagreement – 18%, than girls – 11%. A high level of agreement with the statement (i.e., between 80–100%) was expressed by 25% of the girls and 16% of the boys. The highest frequency was detected in the whole group at a 20% rate in 28% of students and 40% consent in 5%.

Item 14: *I would be nervous because I would not know if anyone wanted to contact me.* A high level of concern was recorded in 13% of participants. A quarter of the respondents expressed evident disagreement, almost a 3rd of the students expressed 20%, and a quarter of them had a 40% agreement rate.

Item 15: *I would be nervous because my constant contact with family and friends would be disconnected.* The frequencies of occurrence of the categories 0%, 20%, and 40% of the agreement rate in the whole group were relatively equal, ranging between 22–26%. Girls showed a slightly higher level of uneasiness in the 60% categories, and a higher level of agreement (34% in total), compared to boys 28% in total.

Item 16: *I would be nervous because I would be disconnected from my online identity.* Three-quarters of the students essentially disagreed with the 20% agreement rate. The frequencies of the remaining categories ranged from 3% – 9%. There were no significant differences in responses between genders.

Item 17: *I would feel uncomfortable because I would not be able to update information from my social networks and online media.* The respondents indicated that they would not feel uncomfortable if they could not update information about themselves on social networks and websites by mobile phone. The finding was comparable to the previous question. More than half of the respondents of both genders strongly disagreed. A quarter of the subjects expressed a 20% agreement rate. The remaining categories had low frequencies, from 3% – 12%.

Item 18: *I would feel uncomfortable because I would not be able to receive update notifications from my online contacts.* Approximately 70% of students will not feel uncomfortable – 0% and 20% agreement rate. The frequencies of the remaining categories were lower, ranging from 3% – 13%. There were no significant differences between the responses of boys and girls.

Item 19: *I would be nervous because I could not check my emails.* The lowest agreement was recorded in this question. Three-quarters of the subjects feel comfortable. One-fifth expressed a 20% agreement rate. The frequencies of the remaining categories varied from 0–6%.

Item 20: *I would feel weird because I would not know what to do.* Most respondents indicated that they need to know what to do without a mobile phone. Most respondents reacted negatively or dissentingly, with 0% and 20% agreeing rates, with more than 60% concurrence between boys and girls. The frequencies of the remaining categories ranged from 5% – 17%.

Findings from the second phase of the study.

The second part of the questionnaire was designed to evaluate the internet use behaviour of the respondents. Students were asked to select five out of 12 items from the primary menu that they use most often. On average, four and one applications were selected without significant differences between genders. Each respondent used an average of three social networks and one programme to communicate. Almost every third student used an application to listen to music. Respondents also added their favourite applications directly, with an average of 0.28 applications per person. When considering the entire set, 373 respondents marked 1,634 applications in the introductory offer, adding 4.4 new applications per student. Approximately every 4th girl and almost every 3rd boy entered one additional application.

Girls often mentioned applications designed for chatting, recording, playing multimedia files, and photo processing. Boys more often expanded the list to include applications focused on sports matches and results, games, journalism, and erotic content. Online viewing of films and series has become a common area of interest. In almost 70% of the applications used, social networks (e.g., Messenger, YouTube, Instagram, and Facebook) represent the most frequent category. 20% followed communication programmes for internet calling and chatting, and 10% for music applications and games. Girls preferred Instagram, Pinterest, TikTok and Twitter, while boys preferred Facebook, music apps, and Reddit.

DISCUSSION

Testing of working hypotheses

The results are summarized in Table 2. The null hypothesis is not rejected for items one to four in the first set of questionnaire items about losing access to information. For items five to nine of the second set of scenarios that focus on the loss of mobile phones and capabilities use, the rejection of the null hypothesis is evident in items five, seven and nine. For items 10–15 of the third set of situations related to loss of communication, the rejection of the null hypothesis concerned items 10–13, with a statistical significance between the genders. Statistical significance was observed in items five and eight between the groups, with a greater propensity

Table 1. Evaluation of survey questions, statistical indicators of position, and variability (Table of authors)

Questionnaire item	Entire set (n = 373)				Boys (n = 189)				Girls (n = 184)			
	Item scoring	Standard deviation	Average agrees (%)	Average deviation (%)	Item scoring	Standard deviation	Average agrees (%)	Average deviation (%)	Item scoring	Standard deviation	Average agrees (%)	Average deviation (%)
1	3.05	1.11	41.0	22.2	3.08	1.20	41.6	24.1	3.02	1.01	40.4	20.2
2	3.80	1.30	56.0	26.0	3.85	1.32	57.0	26.5	3.74	1.27	54.8	25.4
3	2.92	1.31	38.4	26.2	2.94	1.26	38.8	25.2	2.90	1.35	37.9	27.1
4	3.81	1.28	56.2	25.6	3.89	1.25	57.8	25.1	3.72	1.31	54.5	26.3
5	2.45	1.32	29.0	26.4	2.25	1.20	25.1	23.9	2.65	1.37	33.0	27.4
6	2.00	1.12	20.0	22.4	1.92	1.06	18.4	21.2	2.08	1.18	21.5	23.6
7	2.78	1.39	35.6	27.8	2.78	1.36	35.7	27.2	2.78	1.40	35.5	28.0
8	2.13	1.13	22.6	22.6	1.96	1.03	19.2	20.7	2.30	1.16	26.1	23.2
9	2.51	1.26	30.2	25.2	2.52	1.21	30.4	24.2	2.51	1.27	30.1	25.3
10	3.06	1.27	41.2	25.4	2.86	1.20	37.1	24.1	3.28	1.31	45.5	26.1
11	3.11	1.26	42.2	25.2	2.93	1.16	38.6	23.2	3.30	1.32	46.0	26.4
12	2.88	1.28	37.6	25.6	2.69	1.19	33.9	23.8	3.07	1.33	41.4	26.5
13	3.10	1.30	42.0	26.0	2.91	1.22	38.2	24.4	3.29	1.33	45.8	26.5
14	2.65	1.26	33.0	25.2	2.60	1.18	32.0	23.7	2.71	1.27	34.1	25.4
15	2.90	1.32	38.0	26.4	2.83	1.27	36.6	25.3	2.97	1.31	39.5	26.3
16	1.91	1.04	18.2	20.8	1.90	1.00	18.0	20.0	1.93	1.00	18.6	20.0
17	1.98	1.06	19.6	21.2	2.03	1.07	20.6	21.4	1.92	0.97	18.4	19.4
18	2.05	1.08	21.0	21.6	2.13	1.05	22.6	21.1	1.97	1.00	19.4	20.0
19	1.38	0.63	7.6	12.6	1.44	0.63	8.8	12.6	1.33	0.49	6.5	9.8
20	2.40	1.31	28.0	26.2	2.33	1.21	26.6	24.2	2.48	1.30	29.7	26.0
1–20	2.64	1.20	32.9	24.0	2.59	1.15	31.8	23.1	2.70	1.20	33.9	23.9

to NMP in girls than boys. Girls exhibited a higher degree of NMP. The null hypothesis cannot be rejected for items 14 and 15. In items 16–20 in the 4th set of scenarios, mapping reactions to the loss of connection, the null hypothesis cannot be rejected for any of the items. Statistical significance between the answers of boys and girls were not detected. Out of 20 questions, in six questions, rejection of the null hypothesis was observed. Departing from the straight course, six items rejected the null hypothesis, which was insufficient to reject the null hypothesis in the 20 items. The second working hypothesis is depicted in Table 2. The variances of both sets turned out to be identical. The level of significance was $p > 0.05$, and the null hypothesis was not rejected. The average overall scores did not significantly differ between boys and girls.

Table 2. Statistical testing of the first two working hypotheses (Table of authors)

Questionnaire item	Significance level differences of the F-test	Variances of non-paired two-sampled double-sided T-test	Significance level of the T-test	Verdict on the null hypothesis	Group of items
1	$p < 0.05$	mismatching	$p > 0.05$	do not reject	1
2	$p > 0.05$	matching	$p > 0.05$	do not reject	
3	$p > 0.05$	matching	$p > 0.05$	do not reject	
4	$p > 0.05$	matching	$p > 0.05$	do not reject	
5	$p > 0.05$	matching	$p < 0.05$	reject	2
6	$p > 0.05$	matching	$p > 0.05$	do not reject	
7	$p > 0.05$	matching	$p > 0.05$	do not reject	
8	$p > 0.05$	matching	$p < 0.05$	reject	
9	$p > 0.05$	matching	$p > 0.05$	do not reject	3
10	$p > 0.05$	matching	$p < 0.05$	reject	
11	$p > 0.05$	matching	$p < 0.05$	reject	
12	$p > 0.05$	matching	$p < 0.05$	reject	
13	$p > 0.05$	matching	$p < 0.05$	reject	4
14	$p > 0.05$	matching	$p > 0.05$	do not reject	
15	$p > 0.05$	matching	$p > 0.05$	do not reject	
16	$p > 0.05$	matching	$p > 0.05$	do not reject	
17	$p > 0.05$	matching	$p > 0.05$	do not reject	-
18	$p > 0.05$	matching	$p > 0.05$	do not reject	
19	$p < 0.05$	mismatching	$p > 0.05$	do not reject	
20	$p > 0.05$	matching	$p > 0.05$	do not reject	
1–20	$p > 0.05$	matching	$p > 0.05$	do not reject	-

The third working hypothesis evaluated the difference between how males and females responded to the 20 questionnaire items. The null hypothesis was rejected concordantly with the average of the boys' and girls' responses. The higher rate of NMP in girls was evident. When comparing 20 items, no statistical significance was observed between boys and girls. That cannot be said about testing individual pair items. In summary, girls showed a higher rate of NMP than boys. The most significant differences in students' reactions were related to fears that they would not be able to communicate with family or friends via mobile phone immediately.

A comprehensive evaluation of the NMP rate shows that 2% of students suffered from severe and 7.8% from moderate

NMP. In contrast, 0.5% of them exhibited virtually no signs of NMP. A modest degree of NMP was observed in 18.7% of students. The most numerous groups of respondents – 42.3%, fell into the range of mild NMP and very mild NMP – 28.7%. Most students (71.6%) were not at risk of NMP. The opposite is true for about one-tenth of the students. When examining the results of the overall rate of NMP by gender, the girls were slightly more at risk in mild, moderate, and severe forms of NMP. Only about 1% of girls were asymptomatic for NMP. That could not be said about boys. Not surprisingly, respondents mostly agreed with the statement in items two and four (i.e., *I would be angry if I could not use a mobile phone when needed*). Boys expressed a slightly higher degree of agreement than girls.

The overall evaluation showed that the average level of agreement in the first part of the questionnaire reached 32.9%, specifically – 31.8% for boys and 33.9% for girls. The higher consent rate for girls concerning items 5, 10, and 11–13. Conversely, the lowest level of agreement was observed for item 19 on feeling anxious if they could not check emails.

When comparing results to those from [56] investigation (comparable questionnaire, methodology), the mean values in the current study were significantly lower, which can be explained from a diverse frame of reference. The presented sample consisted of members of Generation Z who were significantly younger than the Generation Y participants in Yildirim's study [33]. Considering that members of the current sample lived in different social environments, this may underestimate their behaviour and react subconsciously with a lower level of agreement than would correspond to their actual behaviour. Tams et al. [57] proposed that the indirect effect of NMP is non-significant only when situational certainty and controllability come together, which means subjects know for how long they will not be able to use their phones and how control over a situation. Jia Nie et al. [58] claimed that computers do not alleviate the separation anxiety that individuals experience when they interrupt their smartphone activity. Furthermore, smartphone separation anxiety may depend on the type of mobile activity disrupted. Sui [59] further asserted that most of the research on NMP de-contextualizes the sources of NMP rather than focusing on communication and how it occurs. The author emphasized social and environmental factors that necessitate mobile phone use in contemporary society. To better understand the attachment, benefits, and adversities of mobile phone use, the social and ecological environment should also be investigated.

Clear rules and agreements for using mobile phones in an educational establishment in the EU school system have yet to be determined. EU schools have different positions on this issue, therefore, specific methodological recommendations about mobile phone use need to be set. According to [60, 61], it is vital to include in school rules the use of ICT on the school premises and during classes and breaks. Furthermore, there is a need for cooperation between the school management and educational counselor, as well as the unification of teachers' positions in the educational process, and ultimately, the cooperation of students' legal representatives. In public, NMP has not been considered something dangerous, but it has often been underestimated. There is a need for a clearly defined set of rules with articulated benefits and adverse outcomes and consequences for students' health and wellbeing. The school regulations should state the rules for using a mobile phone [54]. Even though ICT dependence and the utilization of

mobile phones in schools do not fall within the remit of the educator himself, the professional approach of schools can promptly detect students' undesirable behaviour. The teacher can establish contact with the student and gain trust and aid.

Ultimately, the presented investigation has limitations. The results cannot be generalized, but they are valid in the monitored region and the addressed segment of the population. However, the desirability effect and the study design may be influenced by self-report instruments. A multi-centre study with the help of randomly-selected primary schools with similar characteristics and social and environmental variables would contribute to a more profound mapping of the NMP. The study's strength is its incorporation in helping to understand related issues, build knowledge, and provide evidence in a diverse social environment (Eastern European Country).

CONCLUSIONS

- 1) Behavioural type of addiction is often underestimated in the current Czech population, which is especially true for elementary school students.
- 2) Approximately every 10th respondent in the sample was at risk of or already affected by a more severe form of nomophobia. In contrast, every 5th respondent showed symptoms of a milder form of nomophobia. This finding is a warning. In reality, the frequency of nomophobia in the population of primary school pupils may be even higher.
- 3) Almost all students use forms of communication through social networks, many of them simultaneously. A number of these applications are a potentially risky environment due to threats of leakage of sensitive data, social naivety of respondents, blind faith in the anonymity of the online space, and insufficient security of personal communication links.
- 4) The priority is to maintain a healthy school climate and its positive influence on upbringing and education, while maintaining equal access and a certain amount of freedom for students when using personal means of communication, e.g., during the lunch break or between lessons.
- 5) It is essential that teaching staff progress in detecting and solving cases of addictive behaviour always in a uniform and professional manner, cooperate and communicate with colleagues, school management, legal representatives of the students, as well as professionals in the field.
- 6) Education aimed at clearly defined rules should help the pupil understand that mobile phone use can significantly help when it is controlled, but allowing it to grow beyond our control will have an antagonistic effect.

REFERENCES

1. GS.Statcounter. Mobile Vendor Market Share Europe. <http://gs.statcounter.com/vendor-market-share/mobile/europe/#monthly-201803-201903-bar> (access: 2022.07.11)
2. Tomek P. Mobilní historie – milníky ve vývoji mobilní komunikace. <https://www.mobilmania.cz/clanky/mobilni-historie-milniky-ve-vyvoji-mobilni-komunikace/sc-3-a-1111658/default.aspx> (access: 2022.07.11)
3. Clement J. Worldwide mobile app revenues in 2014 to 2023. [https://www.statista.com/statistics/269025/worldwide\[online\]-mobile-app-revenue-forecast/](https://www.statista.com/statistics/269025/worldwide[online]-mobile-app-revenue-forecast/) (access: 2022.07.11)
4. Broža P. Mobilů je v Česku víc než pevných linek. <https://www.mobilmania.cz/clanky/mobilu-je-v-cesku-vic-nez-pevných-linek/sc-3-a-1001558/default.aspx> (access: 2022.07.11)
5. Bhattacharya S, et al. NOMOPHOBIA – NO MOBILE PHONE PHOBIA. *J Family Med Prim Care*. 2019;8(4):1297–1300.
6. Güzel S. Fear of the Age: Nomophobia (No-Mobile-Phone). *J Acad Perspect Soc Stud*. 2018;1:20–24.
7. Qutishat M, Lazarus ER, Razmy AM, et al. University students' nomophobia prevalence, sociodemographic factors and relationship with academic performance at a University in Oman. *Int J Africa Nurs Sci*. 2020;13:1–6.
8. Rodríguez-García AM, Moreno-Guerrero AJ, Belmonte JL. Nomophobia: An Individual's Growing Fear of Being without a Smartphone – A Systematic Literature Review. *Int J Environ Res Public Health*. 2020;17(2):580.
9. Emanuel R, Bell R, Cotton C, Craig J, Drummond D, Gibson S, et al. The truth about smartphone addiction. *College Student J*. 2015;49(2):291–299.
10. Slaninová R. Fenomén nomofobie! Jak moc je závislost na mobilu nebezpečná. <https://www.flowee.cz/76-archiv-2017/eco/technika/2632-fenomén-nomofobie-jak-moc-je-zavislost-na-mobilu-nebezpečna> (access: 2022.07.11)
11. Vacek J, Vondráčková P. Behaviourální závislosti, klasifikace, fenomenologie a terapie. <https://adoc.tips/vacek-j-vondrakova-p-behaviouralni-zavislosti-klasifikace-fen.html> (access: 2022.07.11)
12. Starcevic V. Behavioural addictions: A challenge for psychopathology and psychiatric nosology. *Australian New Zealand J Psychiatry*. 2016;50(8):721–725.
13. Van Wormer K, Rae Davis D. *Addiction treatment*. Cengage Learning, 2016.
14. Alter A. *Neodolatelné*. Pub Host. 2018.
15. Coulshed V, Orme J. *Social work practice*. Bloomsbury Publishing; 2018.
16. Krejčí M. Behaviourální závislost. <https://www.digidetox.me/1-behaviouralni-zavislost/> (access: 2022.07.11)
17. Vacek J. Nelátkové závislosti – Behaviourální závislosti. *Centrum adiktologie*. <https://adiktologie.cz/file/behaviouralni-zavislosti.pdf> (access: 2022.07.11)
18. Brosch T, Sander D. *Handbook of value: perspectives from economics, neuroscience, philosophy, psychology and sociology*. Oxford University Press; 2015.
19. Syvertsen T. *Digital detox: The politics of disconnecting*. Emerald Group Publishing; 2020.
20. Whittaker E, Kowalski RM. Cyberbullying via social media. *J School Viol*. 2015; 14(1): 11–29.
21. Dočekal D, et al. *Dítě v síti*. Mladá fronta, 2019.
22. Spitzer M. *Digitální demence*. Host; 2016.
23. Chasiakos R, Linda Y, et al. Children and adolescents and digital media. *Pediatrics*. 2016;138(5):e20162593.
24. Zimbaro P, Coulombová N. *Odpojený muž*. Grada Publishing; 2017.
25. Müllerová L. Generace Z i Husákovy děti: kam patříte vy? <https://www.prozeny.cz/clanek/generace-z-i-husakovy-deti-kam-patrite-vy-57010> (access: 2022.07.11)
26. Vacek J. Závislostní chování na internetu a hraní her u dětí. *Centrum adiktologie*. <https://docplayer.cz/68074803-Zavislostni-chovani-na-internetu-a-hrani-her-u-deti.html> (access: 2022.07.11)
27. Fišer J. Francie uzákonila zákaz používání mobilních telefonů ve školách. <https://mobilizujeme.cz/clanky/francie-uzakonila-zakaz-pouzivani-mobilnich-telefonu-ve-skolach> (access: 2022.07.11)
28. Brdečka B. Proč mobily ve škole zakazovat. *Metodický portál inspirace a zkušenosti učitelů*. <https://spomocnik.rvp.cz/clanek/21948/> (access: 2022.07.11)
29. Drahoš D. Děti neudrží pozornost. Ve třídách bez mobilu mají lepší výsledky. https://www.denik.cz/z_domova/deti-neudrzi-pozornost-ve-tridach-bez-mobilu-maji-lepsi-vysledky-2016020.html (access: 2022.07.11)
30. Kopecký K. Rizikové formy chování českých a slovenských dětí v prostředí internetu. *Univerzita Palackého*; 2015.
31. Andrys O. Mobilní telefony ve školách – nemluvme jen o zákazech, ale využijme také příležitosti a vychovávejme. *Informační bulletin ČŠI*, 12, 6–7. http://www.csicr.cz/html/2018/Informacni_bulletin_CSI_12/flipviewerxpress.html (access: 2022.07.11)
32. Kopecký K. Mobilní telefony ve škole. <https://www.seznamzpravy.cz/clanek/zakaz-pouzivani-mobilu-ve-skolach-reditele-narazili-na-skolni-inspekci-61498> (access: 2022.07.11)
33. Yildirim C, Correia AP. Exploring the dimensions of nomophobia: Development and validation of a self-reported questionnaire. *Comput Human Behav*. 2015;49:130–137.
34. Riley P. *Mobile App Usage Statistics 2018*. <https://themanifest.com/app-development/mobile-app-usage-statistics-2018> (access: 2022.07.11)
35. AppAnnie. *The State of Mobile 2019*. <https://www.businessofapps.com/data/app-statistics/#6> (access: 2022.07.11)

36. Svobodová M. Šest příznaků závislosti na mobilním telefonu. https://www.idnes.cz/onadnes/zdravi/jak-se-projevuje-zavislost-na-mobilnim-telefonu.A160516_102736_zdravi_pet (access: 2022.07.11)
37. Blinka L, et al. Online závislosti. Grada Publishing, 2015.
38. Daei A, Ashrafi-rizi H, Reza Soleymani M. Nomophobia and Health Hazards: Smartphone Use and Addiction Among University Students. *Inter J. Preventive Med.* 2019;10(1):202. doi: 10.4103/ijpvm.IJPVM_184_19.
39. Krejčí M. DigiDetox. Pointa Publishing, 2019.
40. Young K. A therapist's guide to assess and treat Internet addiction. https://scholar.google.cz/citations?hl=cs&user=cMOY-SIAAAAJ&view_op=list_works&sortby=title (access: 2022.07.11)
41. Chai Y, He J, Jiang Q, Nie Y, et al. Advances of brain imaging in internet addicts with brain damage. *Chines J. Behav Med Brain Sci.* 2017;12:85–89.
42. Kardefelt-Winther D. A conceptual and methodological critique of internet addiction research: Toward a model of compensatory internet use. *J Hum Behav.* 2014;31:351–354.
43. Kabele J. Sociologická encyklopedie. https://encyklopedie.soc.cas.cz/w/S%C3%AD%C5%A5_soci%C3%A1n%C3%AD (access: 2022.07.11)
44. Kuss, DJ, Griffiths, MD. Social networking sites and addiction: Ten lessons learned. *Inter J Environ Res Public Health.* 2017;14(3):311.
45. Clement J. Global digital population as of October 2019. <https://www.statista.com/statistics/617136/digital-population-worldwide/> (access: 2022.07.11)
46. Losekoot M, Vyhánková E. Jak na síť. Jan Melvil Publishing; 2019.
47. Clement J. Most popular social networks worldwide as of October 2020, ranked by number of active users. <https://www.statista.com/statistics/272014/global-social-networks-ranked-by-number-of-users/> (access: 2022.07.11)
48. Smith K. 53 Incredible Facebook Statistics and Facts Brandwatch. <https://www.brandwatch.com/blog/facebook-statistics/> (access: 2022.07.11)
49. Alguliyev R, Ojagverdieva S. Conceptual model of national intellectual system for children safety in internet environment. *Inter J Comp Network Informat Security.* 2019;11(3):40–47.
50. Fieldingová O. Digitální detox. CPress; 2018.
51. Arslan O, et al. Nomophobia Prevalence among Pre-Service Teachers: A Case of Trakya University 2017. *Trakya Üniversitesi Eğitim Fakültesi Dergisi.* 2017;7(1):86–95.
52. Gregoire C. This Scientific Test Will Tell You How Addicted You Are To Your Smartphone. http://www.huffingtonpost.com/2015/05/18/nomophobia-smartphone-sep_n_7266468.html (access: 2022.07.11)
53. Kopecký K. Trpíte nomofobií? Otestujte se! <https://www.e-bezpeci.cz/index.php/rizikove-jevy-spojene-s-online-komunikaci/online-zavislosti/1059-nomofobie> (access: 2022.07.11)
54. Havranová M. Průzkum závislosti na mobilním telefonu u žáků základních škol (Diplomová práce). https://is.muni.cz/auth/th/lgh5g/Diplomova_prace_Havranova_2020.pdf (access: 2022.07.11)
55. Richter F. App Users Spend 77 % of their time on their Top 3 Apps. <https://www.statista.com/chart/3835/top-10-app-usage/> (access: 2022.07.11)
56. Yildirim C. Exploring the dimensions of nomophobia: Developing and validating a questionnaire using mixed methods research. <https://lib.dr.iastate.edu/etd/14005/> (access: 2022.07.11)
57. Tams S, Legoux R, Majorique Léger PM. Smartphone withdrawal creates stress: A moderated mediation model of nomophobia, social threat, and phone withdrawal context. *Comput Hum Behav.* 2018;81:1–9. <https://doi.org/10.1016/j.chb.2017.11.026>
58. Nie J, Want P, Lei L. Why can't we be separated from our smartphones? The vital roles of smartphone activity in smartphone separation anxiety. *Comput Hum Behav.* 2020;109. <https://doi.org/10.1016/j.chb.2020.106351>
59. Sui A, Sui W. Not getting the message: Critiquing current conceptualizations of nomophobia. *J Tech Society.* 2021;67. <https://doi.org/10.1016/j.techsoc.2021.101719>
60. Hronová M. Nové metodické doporučení k prevenci kyberšikany. <https://www.e-bezpeci.cz/index.php/tiskove-zpravy/1291-metodicke-doporuceni-2018> (access: 2022.07.11)
61. Zajíček J. Netolismus. MŠMT ČR. <http://www.msmt.cz/vzdelavani/socialni-programy/metodicke-dokumenty-doporuceni-a-pokyny> (access: 2022.07.11)