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# Influence of Smartphones on Students' Life in the Republic of Croatia

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## Abstract

*Smartphone use has become ubiquitous among all generations and is becoming more common among the student population. Very rarely can we find a student who does not own a mobile (smartphone). Smartphones have replaced many of the activities previously done using desktops, laptops, tablets and other electronic devices. Most of the population has also replaced classic alarm clocks with smartphones, and the first morning activity is usually associated with a smartphone ( browsing the news, social media notifications, etc.). During the night, when time should be devoted to rest and sleep, many people are on their mobile phones, disrupting their biological sleeping and wakeing rhythm (circadian rhythm), which is of paramount importance for human health. For this reason, a questionnaire was developed that was conducted among the student population with a sample of 267 students in Croatia during the academic year 2020/2021. The research examined whether respondents used smartphones and how much they used them just before going to sleep, during the night, and just after waking up, as well as whether they used a smartphone as an alarm clock and if they wake up tired in the morning. The results showed that 81.9 % of respondents, most of whom were aged 20-25 (51.7 %), used their smartphone immediately before bedtime. Immediately after waking up, 78.5 % of respondents viewed notifications, content, and message, on their smartphone, and a total of 43 % of respondents often wake up tired in the morning, while 39.7 % find it difficult to attend classes (lectures) in the mornings. Moderate correlations were calculated between the variables "I also use my smartphone just before bedtime" and "During the night, the smartphone is in my immediate vicinity" ($r = .544$, $p = .000 < .01$); "During the night I sometimes wake up to the sound of a smartphone (messages, notifications on social networks)" and "When I wake up*

*during the night, I browse the contents on my smartphone" (r = .489, p= .000< .01); and between the variables "In the morning I often wake up tired" and "I find it difficult to attend classes (lectures) in the morning" (r = .569, p= .000< .01).Using smartphones just before bedtime and during the night disturbs sleep and causes fatigue in the morning. Thus, following classes is likely more difficult and student's concentration is likely poorer.*

**Key words:** *digital technology; health; Smartphones; students; teaching.*

## Introduction

Communication is increasingly taking place in virtual spaces, especially true during the COVID-19 pandemic, most often via applications for smartphones and other electronic devices.

The use of smartphones in Croatia in 2020, according to data from Statista (2021), amounted to a total of 66.13 % of mobile phone users. Many people use smartphones for tasks and activities they previously performed using other electronic devices. In a sample of surveys (Hina, Masterindex, 2019) of 1,000 respondents aged 18-55 in Croatia, data showed that almost all respondents used a mobile phone for an average of 4.7 hours a day, 84 % of respondents used it for online interviews, 82 % for access to email, 81 % for online shopping, 79 % for internet searches, 74 % for social networks, and 64 % for mobile banking. On average, subjects aged 18 to 29 used a mobile phone 5.5 hours per day.

In one recent study, a total of 183 respondents (Yeh,Chang,Ting,Chen, 2020) between the ages of 20 and 30 spent 3.45 hours a day studying and spent 2.75 hours on social media using smartphones.

The use of smartphones during the night can harm a person's biological rhythm, making sleep and circadian rhythm disorders possible (MSD, 2014) as a consequence of the desynchronization of internal and external rhythms of wakefulness and sleep. Desynchronization caused by external influences changes the daily rhythm of other biological functions as well, such as body temperature and hormone secretion, and can lead to insomnia, weakness, depression, irritability, etc. Exposure to natural sunlight accelerates the readjustment of the organism.

Circadian disorders (Lyall, Wyse, Graham et al., 2018) are also associated with various negative mental health and wellbeing outcomes, including major depressive disorder and bipolar disorder, while lower relative amplitude may be associated with increased susceptibility to mood disorders, according to the results of a study conducted on a representative sample of 91,105 respondents between 2013 and 2015 among UK respondents aged 37-73.

Sunni (2020) indicates that light plays a major role in regulating the circadian rhythm and reduces the production of melatonin, an essential hormone that stimulates sleep. The availability of electricity (street lighting, office lighting, light from mobile phones, etc.) provides lighting 24 hours a day, so artificial light has become a permanent part of modern life.

Although research (Gooley, 2008; Bassa, Canazei, Hinterhuber, Weiss, 2013; Leger, Duforez, Gronfier et al., 2018) has shown that circadian rhythm problems can be successfully solved by exposure to strong artificial light. It is recommended that individuals be exposed to strong and short-wave light during the day to support circadian functionality (Knoop et al., 2020) and to avoid light during the night.

Hormones (Gnocchi & Bruscalupi, 2017) such as melatonin, cortisol, gonadal steroids, prolactin, thyroid hormone and growth hormone have daily oscillations. Also, hormones that are sensitive to nutrients such as insulin, leptin, ghrelin and adiponectin oscillate on a circadian basis, and their release is, at least in part, regulated by environmental stimuli during meals and light-dark cycle changes. The body naturally produces melatonin (Suni, 2021), the production of which is closely related to the presence/absence of light. In response to darkness, the pineal gland in the brain triggers the production of melatonin, but exposure to light slows or stops that production. Seven to nine hours of sleep are recommended for both younger and older adults (Suni, 2020).

This research asks how much of an impact the use of smartphones and other electronic devices, especially during the night and before going to bed, has on sleep and health.

## Influence of electronic devices on sleep quality and health in the adult population

A study of 450 undergraduate medical students (Krishnan, Sanjeev, Latti, 2020) found that screen exposure during the time allotted for sleep was associated with increased sleep latency, decreased sleep duration, and increased daytime disturbances. Students spend a lot of time on their smartphones at a time when they should be sleeping. Lying down while using a smartphone and being aware of night activity are also parameters associated with poor sleep quality.

Exelmans & Van den Bulck (2016) conducted a study in 844 Flemish adults (18-94 years of age) on the use of electronic media and sleep habits. The results of the research showed that half of the respondents had their own smartphone and that six out of ten respondents took a mobile phone to the room where they sleep. Sending messages and having conversations when the light in the room was turned off showed longer sleep latency, poorer sleep, more sleep disorders and more dysfunction during the day.

Of the 1,508 adult respondents in a study from the United States (Chang, et al., 2015), 90 % used an electronic device at least a few nights a week an hour before bedtime. Respondents who read a book on an electronic device before bed needed more time to fall asleep, had reduced drowsiness during the evening, reduced melatonin secretion, a later circadian clock time, and reduced wakefulness during the morning, unlike respondents who read a printed book.

A study conducted by Jniene et al. (2019) among 294 medical and pharmaceutical students at the Faculty of Medicine and Pharmacy in Rabat, Morocco on blue light emission of smart devices just before bedtime found that sleep quality was poor in 35.3 % of students. A total of 60.6 % of students put their device under their pillow and

the electronic device disturbed their sleep during the night due to viewing messages. Sleep in 63.3 % of respondents lasted an average of 6.3 hours ± 1.25 hours.

What has been done to protect the health of the individual when using smartphones? Articles on this issue have been published in the Republic of Croatia, and clear recommendations have been given on the use of smartphones, electromagnetic radiation, the effects of mobile phones on health, ways to reduce exposure to mobile devices (Lakić, 2011), the impact of mobile phones on sleep and mental health, cancer, cell phone use and traffic accidents, and the impact of screen time on vision (Hižar, 2018). In 2006, the World Health Organization (WHO, 2006) published a report on the clinical effects of daily exposure to mobile phones in the general population and their impact on the development of head and brain tumours and other outcomes related to morbidity and the effects of RF and microwave radiation on individuals. In 2014 WHO issued a Meeting Report outlining public health guidelines on excessive use of the Internet, computers, smartphones and other electronic devices in the context of "behavioural addiction" associated with excessive use of electronic devices. Although there is a large amount of research (European Parliament, 2019) on the possible risks of radio frequency electromagnetic fields mimicked by smartphones, scientists are still divided on whether cell phone radiation impacts the individual's health. It is greatly important to develop a strategy at both the global and national levels on the proper use of smartphones, with clear indications that excessive and innapropriate use of smartphones impacts the health of the individual, especially young people.

## Methodology

The aim of this research was to examine the frequency of mobile phone use among the student population in Croatia and whether there is a connection between excessive use (especially at night) of smartphones and students' ability to follow along in class the next day.

### *Measuring instrument*

A survey questionnaire was designed specifically for the purposes of this research. It consists of two independent variables (gender, age) and nine dependent variables related to the use of smartphones before bed, at night and after waking up, fatigue after waking up and difficulty following classes in the morning.

The questionnaire was created using the Google Form tool. The survey was posted in Facebook groups for students throughout the Republic of Croatia and was conducted during the academic year 2020/2021. This research fully adhered to the code of ethics, and the respondents were given written instructions on how to fill in the measuring instrument; they were guaranteed anonymity and the right to end the survey at any time; and they were informed that the data obtained by this research would be used exclusively for scientific purposes.

Since this questionnaire was used in research for the first time, it was necessary to determine its basic metric characteristics. The reliability of the scale statement

expressed by the Cronbach alpha coefficient showed that it satisfies Nunnally's and Bernstein's internal consistency criterion of 0.70. Specifically, the obtained coefficient of internal consistency is = 0.778.

Data processing was performed using the statistical package IBM SPSS Statistics 20.

Table 1
*Reliability of Statistics*

| Cronbach's Alpha | Cronbach's Alpha Based on Standardized Items | N of Items |
|---|---|---|
| .778 | .783 | 9 |

### *Research sample*

The research was conducted on a sample of 267 students in the Republic of Croatia and consists of 11 variables:

1 Sample structure by gender
2 Sample structure by age
3 I use my smartphone just before going to sleep.
4 During the night I am sometimes awakened by sound (messages, notifications on social networks).
5 When I wake up during the night, I browse the contents on my smartphone.
6 During the night the smartphone is in my immediate vicinity.
7 I will never give up using a smartphone even when it affects my daily life.
8 I use my smartphone as an alarm clock.
9 Immediately after waking up, I browse notifications, content, messages, on my smartphone.
10 I often wake up tired in the morning.
11 It is difficult for me to follow lectures in the morning.

## Results

The characteristics of the sample with respect to gender are shown in Table 2.As many as 90.6 % of the participants in the research were female, while only 8.6 %were male.

Table 2
*Characteristics of the sample with respect to gender*

| | | Frequency | Percent |
|---|---|---|---|
| Valid | M | 23 | 8.6 |
| | F | 244 | 91.4 |
| | Total | 267 | 100.0 |

The characteristics of research participants with respect to age (Table 3) shows that the largest number of respondents were in the range More than 20 and less than 25 (80.9 %), while 9,4 % were under 20 years of age, 6.4 % weremore than 25 and less than 30 , and 3.4 % were more than 30 years old.

Testing the normality of the distribution (with homogeneity of variance) is an indispensable parameter in education research with regard to the selection of certain statistical parametric or nonparametric tests for testing hypotheses.

Table 3
*Characteristics of the sample with respect to age*

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Less than 20 | 25 | 9.4 | 9.4 | 9.4 |
| | More than 20,less than 25 | 216 | 80.9 | 80.9 | 90.3 |
| | More than 25, less than 30 | 17 | 6.4 | 6.4 | 96.6 |
| | More than 30 | 9 | 3.4 | 3.4 | 100.0 |
| | Total | 267 | | | – |

To determine whether there were statistically significant differences in the normal distribution of study participants with respect to age, the Kolmogorov-Smirnov test was applied (Table 4).

Table 4
*One-Sample Kolmogorov-Smirnov Test*

| | | Age |
|---|---|---|
| N | | 267 |
| Normal Parameters[a,b] | Mean | 2.04 |
| | Std. Deviation | .540 |
| Most Extreme Differences | Absolute | .430 |
| | Positive | .430 |
| | Negative | -.379 |
| Kolmogorov-Smirnov Z | | 7.030 |
| Asymp. Sig. (2-tailed) | | .000 |

a. Test distribution is Normal.
b. Calculated from data.

The results in Table 4 show that the significance is less than .05, so the deviation from the normality is not statistically significant, i.e., the significance in this case is $p = .000 < .05$, which means that the normality of the distribution is confirmed and therefore accepted as such.

Before using the ANOVA parametric test, we determined the assumptions for the application of this test, and they referred to:

1 level of measurement: the dependent variable was measured on an interval scale, which means that the distances between the numerical values correspond to the distances between the characteristics measured;
2 randomness of the sample: although in actual research this assumption is often not met, the results are obtained from a random sample of the basic set;
3 independence of observation: the data obtained are mutually independent, i.e.,no measurement was affected by another measurement;

4 normality of distribution: in social research the values of the dependent variable are very often not a normal distribution. As the sample was large enough (267 respondents) ,significantly more than 30 study participants (Tabachnick and Fidell, 2013), transgression of this assumption did not cause major problems.

Table 5 shows the asymmetries (skewness) of all dependent variables. It was observed that the asymmetry values for the four variables were negative, and per module, greater than one; the results are shifted to the right, towards higher values.

Table 5
*Skewness- measure of asymmetry*

| | Mean | Std. Deviation | Skewness | |
|---|---|---|---|---|
| | | | Statistic | Std. Error |
| I use my smartphone just before going to sleep. | 4.38 | 1.001 | -1.969 | .149 |
| During the night I am sometimes awakened by sound (messages, notifications on social networks) | 1.76 | 1.146 | 1.531 | .149 |
| When I wake up during the night, I browse the contents on my smartphone. | 2.11 | 1.245 | .868 | .149 |
| During the night the smartphone is in my immediate vicinity. | 4.03 | 1.178 | -1.276 | .149 |
| I will never give up using a smartphone even when it affects my daily life. | 2.61 | 1.166 | .349 | .149 |
| I use my smartphone as an alarm clock. | 4.55 | .966 | -2.592 | .149 |
| Immediately after waking up, I browse notifications, content, messages, on my smartphone. | 4.13 | 1.169 | -1.373 | .149 |
| I often wake up tired in the morning. | 3.20 | 1.278 | -.148 | .149 |
| It is difficult for me to follow lectures in the morning. | 3.09 | 1.389 | -.011 | .149 |

Furthermore, from Table 5, it can be seen that the asymmetry values for the three variables are positive and greater than one, and this indicates that the results are shifted to the right towards smaller values.

Homogeneity of variance was examined using the Levene Test of Homogeneity of Variances (Table 6). For seven variables, Leven's test gave values less than .05 (column Sig.), which means that the assumption of homogeneity of variance does not apply to these variables. However, as the analysis of variance is not sensitive the violation of this assumption, this is not an issue because the sizes of the groups are similar: they are smaller d 1.5 (Stevens, 1996).

Table 6
*Levene Test of Homogeneity of Variances*

| | Levene Statistic | df1 | df2 | Sig. |
|---|---|---|---|---|
| I use my smartphone just before going to sleep. | 6.017 | 3 | 263 | .001 |
| During the night I am sometimes awakened by sound (messages, notifications on social networks). | 3.690 | 3 | 263 | .012 |
| When I wake up during the night, I browse the contents on my smartphone. | 2.715 | 3 | 263 | .045 |
| During the night the smartphone is in my immediate vicinity. | 6.166 | 3 | 263 | .000 |
| I will never give up using a smartphone even when it affects my daily life. | 5.000 | 3 | 263 | .002 |
| I use my smartphone as an alarm clock. | 12.358 | 3 | 263 | .000 |
| Immediately after waking up, I browse notifications, content, messages, on my smartphone. | 5.405 | 3 | 263 | .001 |
| I often wake up tired in the morning. | 1.839 | 3 | 263 | .140 |
| It is difficult for me to follow lectures in the morning. | .489 | 3 | 263 | .690 |

Analysis of variance was performed using the ANOVA method, which compares the arithmetic means of several samples. Since the empirical levels of significance in variables 2, 3, 4, 8 and 9 are higher than theoretical levels, the null hypothesis cannot be rejected, and it is concluded that there is no statistically significant difference between the observed groups.

Table 7 shows the data for each group: number of respondents in the group, arithmetic means, standard deviation and other data.

Table 7
*Descriptives*

| | Age categories | N | Mean | Std. Deviation | Std. Error Lower Bound | 95 % Confidence Interval for Mean | | Min. | Max. |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Upper Bound | Upper Bound | | |
| I use my smartphone just before going to sleep | Less than 20 | 25 | 4.68 | .476 | .095 | 4.48 | 4.88 | 4 | 5 |
| | More than 20. less than 25 | 216 | 4.44 | .953 | .065 | 4.31 | 4.57 | 1 | 5 |
| | More than 25. less than 30 | 17 | 3.65 | 1.367 | .331 | 2.94 | 4.35 | 1 | 5 |
| | More than 30 | 9 | 3.44 | 1.424 | .475 | 2.35 | 4.54 | 1 | 5 |
| | Total | 267 | 4.38 | 1.001 | .061 | 4.26 | 4.50 | 1 | 5 |

| Age categories | | N | Mean | Std. Deviation | Std. Error Lower Bound | 95 % Confidence Interval for Mean | | Min. | Max. |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Upper Bound | Upper Bound | | |
| During the night I am sometimes awakened by sound (messages. notifications on social networks) | Less than 20 | 25 | 1.76 | 1.268 | .254 | 1.24 | 2.28 | 1 | 5 |
| | More than 20. less than 25 | 216 | 1.73 | 1.130 | .077 | 1.58 | 1.88 | 1 | 5 |
| | More than 25. less than 30 | 17 | 1.59 | .618 | .150 | 1.27 | 1.91 | 1 | 3 |
| | More than 30 | 9 | 2.67 | 1.658 | .553 | 1.39 | 3.94 | 1 | 5 |
| | Total | 267 | 1.76 | 1.146 | .070 | 1.62 | 1.89 | 1 | 5 |
| When I wake up during the night I browse the contents on my smartphone | Less than 20 | 25 | 2.08 | 1.412 | .282 | 1.50 | 2.66 | 1 | 5 |
| | More than 20. less than 25 | 216 | 2.15 | 1.252 | .085 | 1.98 | 2.32 | 1 | 5 |
| | More than 25. less than 30 | 17 | 1.76 | .831 | .202 | 1.34 | 2.19 | 1 | 4 |
| | More than 30 | 9 | 2.00 | 1.323 | .441 | .98 | 3.02 | 1 | 4 |
| | Total | 267 | 2.11 | 1.245 | .076 | 1.96 | 2.26 | 1 | 5 |
| During the night the smartphone is in my immediate vicinity | Less than 20 | 25 | 4.16 | 1.143 | .229 | 3.69 | 4.63 | 1 | 5 |
| | More than 20. less than 25 | 216 | 4.06 | 1.138 | .077 | 3.91 | 4.21 | 1 | 5 |
| | More than 25. less than 30 | 17 | 3.29 | 1.724 | .418 | 2.41 | 4.18 | 1 | 5 |
| | More than 30 | 9 | 4.22 | .441 | .147 | 3.88 | 4.56 | 4 | 5 |
| | Total | 267 | 4.03 | 1.178 | .072 | 3.88 | 4.17 | 1 | 5 |
| I will never give up using a smartphone even when it affects my daily life | Less than 20 | 25 | 2.96 | 1.306 | .261 | 2.42 | 3.50 | 1 | 5 |
| | More than 20. less than 25 | 216 | 2.63 | 1.170 | .080 | 2.48 | 2.79 | 1 | 5 |
| | More than 25. less than 30 | 17 | 1.88 | .600 | .146 | 1.57 | 2.19 | 1 | 3 |
| | More than 30 | 9 | 2.33 | 1.000 | .333 | 1.56 | 3.10 | 1 | 4 |
| | Total | 267 | 2.61 | 1.166 | .071 | 2.47 | 2.75 | 1 | 5 |

| | Age categories | N | Mean | Std. Deviation | Std. Error Lower Bound | 95 % Confidence Interval for Mean | | Min. | Max. |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Upper Bound | Upper Bound | | |
| I use my smartphone as an alarm clock | Less than 20 | 25 | 4.92 | .277 | .055 | 4.81 | 5.03 | 4 | 5 |
| | More than 20. less than 25 | 216 | 4.55 | .944 | .064 | 4.42 | 4.68 | 1 | 5 |
| | More than 25. less than 30 | 17 | 3.94 | 1.638 | .397 | 3.10 | 4.78 | 1 | 5 |
| | More than 30 | 9 | 4.56 | .527 | .176 | 4.15 | 4.96 | 4 | 5 |
| | Total | 267 | 4.55 | .966 | .059 | 4.43 | 4.66 | 1 | 5 |
| Immediately after waking up. I browse notifications. content. messages. on my smartphone | Less than 20 | 25 | 4.52 | .586 | .117 | 4.28 | 4.76 | 3 | 5 |
| | More than 20. less than 25 | 216 | 4.20 | 1.110 | .076 | 4.05 | 4.35 | 1 | 5 |
| | More than 25. less than 30 | 17 | 3.12 | 1.576 | .382 | 2.31 | 3.93 | 1 | 5 |
| | More than 30 | 9 | 3.11 | 1.537 | .512 | 1.93 | 4.29 | 1 | 5 |
| | Total | 267 | 4.13 | 1.169 | .072 | 3.99 | 4.27 | 1 | 5 |
| I often wake up tired in the morning | Less than 20 | 25 | 3.20 | 1.528 | .306 | 2.57 | 3.83 | 1 | 5 |
| | More than 20. less than 25 | 216 | 3.25 | 1.218 | .083 | 3.09 | 3.42 | 1 | 5 |
| | More than 25. less than 30 | 17 | 2.47 | 1.463 | .355 | 1.72 | 3.22 | 1 | 5 |
| | More than 30 | 9 | 3.22 | 1.394 | .465 | 2.15 | 4.29 | 1 | 5 |
| | Total | 267 | 3.20 | 1.278 | .078 | 3.04 | 3.35 | 1 | 5 |
| It is difficult for me to follow the lectures in the morning | Less than 20 | 25 | 3.08 | 1.498 | .300 | 2.46 | 3.70 | 1 | 5 |
| | More than 20. less than 25 | 216 | 3.16 | 1.363 | .093 | 2.98 | 3.34 | 1 | 5 |
| | More than 25. less than 30 | 17 | 2.35 | 1.320 | .320 | 1.67 | 3.03 | 1 | 5 |
| | More than 30 | 9 | 2.67 | 1.581 | .527 | 1.45 | 3.88 | 1 | 5 |
| | Total | 267 | 3.09 | 1.389 | .085 | 2.92 | 3.25 | 1 | 5 |

Table 6 shows the results of the Leven test of homogeneity of variance. Namely, it examined the equality of variances in the results for all nine dependent variables. In

the Sig. column significance values for the Leven test are shown. As sizes are significant for the variables "I often wake up tired in the morning" and "It is difficult for me to follow the lectures in the morning" are greater than .05, p = .140> .05 and p = .690> .05, respectively, this means that the hypothesis of equality of variance is confirmed.

However, the homogeneity of the variants was disturbed in seven variables, so we subjected these variables to Robust Tests of Equality of Means. Table 8 shows the sizes of the Welch test and the Brown-Forsythe test, the values of which are indicators that correct the F-ratio in the case of a disturbed assumption of homogeneity of variance.

Table 8
*Robust Tests of Equality of Means*

| | | Statistic[a] | df1 | df2 | Sig. |
|---|---|---|---|---|---|
| I use my smartphone just before going to sleep. | Welch | 5.020 | 3 | 24.750 | .007 |
| | Brown-Forsythe | 4.901 | 3 | 24.822 | .008 |
| During the night I am sometimes awakened by sound (messages. notifications on social networks). | Welch | 1.188 | 3 | 25.124 | .334 |
| | Brown-Forsythe | 1.712 | 3 | 22.704 | .193 |
| When I wake up during the night I browse the contents on my smartphone. | Welch | .984 | 3 | 24.893 | .416 |
| | Brown-Forsythe | .556 | 3 | 37.985 | .647 |
| During the night the smartphone is in my immediate vicinity. | Welch | 1.483 | 3 | 28.360 | .240 |
| | Brown-Forsythe | 2.307 | 3 | 35.428 | .093 |
| I will never give up using a smartphone even when it affects my daily life . | Welch | 7.663 | 3 | 26.085 | .001 |
| | Brown-Forsythe | 4.138 | 3 | 43.259 | .012 |
| I use my smartphone as an alarm clock. | Welch | 7.746 | 3 | 27.198 | .001 |
| | Brown-Forsythe | 3.218 | 3 | 22.588 | .042 |
| Immediately after waking up. I browse notifications. content. messages. on my smartphone. | Welch | 6.134 | 3 | 24.682 | .003 |
| | Brown-Forsythe | 6.157 | 3 | 26.753 | .003 |
| I often wake up tired in the morning. | Welch | 1.462 | 3 | 23.626 | .250 |
| | Brown-Forsythe | 1.543 | 3 | 44.882 | .216 |
| It is difficult for me to follow lectures in the morning. | Welch | 2.068 | 3 | 24.004 | .131 |
| | Brown-Forsythe | 1.860 | 3 | 38.752 | .153 |

a. Asymptotically F distributed.

| | | Statistic[a] | df1 | df2 | Sig. |
|---|---|---|---|---|---|
| I use my smartphone just before going to sleep. | Welch | 5.020 | 3 | 24.750 | .007 |
| | Brown-Forsythe | 4.901 | 3 | 24.822 | .008 |
| During the night I am sometimes awakened by sound (messages. notifications on social networks). | Welch | 1.188 | 3 | 25.124 | .334 |
| | Brown-Forsythe | 1.712 | 3 | 22.704 | .193 |
| When I wake up during the night I browse the contents on my smartphone. | Welch | .984 | 3 | 24.893 | .416 |
| | Brown-Forsythe | .556 | 3 | 37.985 | .647 |
| During the night the smartphone is in my immediate vicinity. | Welch | 1.483 | 3 | 28.360 | .240 |
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| | Brown-Forsythe | 6.157 | 3 | 26.753 | .003 |
| I often wake up tired in the morning. | Welch | 1.462 | 3 | 23.626 | .250 |
| | Brown-Forsythe | 1.543 | 3 | 44.882 | .216 |
| It is difficult for me to follow lectures in the morning. | Welch | 2.068 | 3 | 24.004 | .131 |
| | Brown-Forsythe | 1.860 | 3 | 38.752 | .153 |

a. Asymptotically F distributed.

Table 9 shows the following values: sum of squares, number of degrees of freedom and deviations of results from their arithmetic mean for analysis of different groups (between-groups) and analysis of the same subjects (with-groups). In this table we are particularly interested in the probability column p ( the last column, denoted by Sig.). For the four dependent variables (I use my smartphone just before going to sleep; I will never give up using a smartphone even when it affects my daily life; I use my smartphone as an alarm clock; Immediately after waking up, I browse notifications, content, messages, on my smartphone)

the probability is less than or equal to .05, which means that for these variables there are statistically significant differences between the arithmetic means. To determine which group differs from which groups, we see this from Table 10, Multiple Comparisons, which also lists the statistical significance of the differences between each pair of

groups. The Mean Difference (I-J) column lists these differences; those differences marked with an asterisk (*) are statistically significant.

Table 9
*ANOVA*

| | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| I use my smartphone just before going to sleep . | Between Groups | 20.032 | 3 | 6.677 | 7.117 | .000 |
| | Within Groups | 246.762 | 263 | .938 | | |
| | Total | 266.794 | 266 | | | |
| During the night I am sometimes awakened by sound (messages. notifications on social networks). | Between Groups | 8.072 | 3 | 2.691 | 2.075 | .104 |
| | Within Groups | 341.104 | 263 | 1.297 | | |
| | Total | 349.176 | 266 | | | |
| When I wake up during the night I browse the contents on my smartphone . | Between Groups | 2.471 | 3 | .824 | .528 | .663 |
| | Within Groups | 410.158 | 263 | 1.560 | | |
| | Total | 412.629 | 266 | | | |
| During the night the smartphone is in my immediate vicinity. | Between Groups | 10.154 | 3 | 3.385 | 2.482 | .061 |
| | Within Groups | 358.663 | 263 | 1.364 | | |
| | Total | 368.816 | 266 | | | |
| I will never give up using a smartphone even when it affects my daily life. | Between Groups | 12.877 | 3 | 4.292 | 3.236 | .023 |
| | Within Groups | 348.831 | 263 | 1.326 | | |
| | Total | 361.708 | 266 | | | |
| I use my smartphone as an alarm clock. | Between Groups | 9.722 | 3 | 3.241 | 3.574 | .015 |
| | Within Groups | 238.443 | 263 | .907 | | |
| | Total | 248.165 | 266 | | | |
| Immediately after waking up. I browse notifications. content. messages. on my smartphone. | Between Groups | 31.740 | 3 | 10.580 | 8.383 | .000 |
| | Within Groups | 331.931 | 263 | 1.262 | | |
| | Total | 363.670 | 266 | | | |
| I often wake up tired in the morning. | Between Groups | 9.693 | 3 | 3.231 | 2.000 | .114 |
| | Within Groups | 424.786 | 263 | 1.615 | | |
| | Total | 434.479 | 266 | | | |
| It is difficult for me to follow lectures in the morning. | Between Groups | 11.968 | 3 | 3.989 | 2.094 | .101 |
| | Within Groups | 501.051 | 263 | 1.905 | | |
| | Total | 513.019 | 266 | | | |

Table 7, Descriptives, gives the arithmetic means for each group of subjects. In our case, from Table 9, ANOVA, (column Sig.), it is observed that for the four variables the probability is less than .05, i.e., it shows that the results in these groups are statistically significant.

## Post hoc tests

Table 10
*Multiple Comparisons*
*Tukey HSD*

| Dependent Variable | (I) Age | (J) Age | Mean Difference (I-J) | Std. Error | Sig. | 95 % Confidence Interval | |
|---|---|---|---|---|---|---|---|
| | | | | | | Lower Bound | Upper Bound |
| I use my smartphone just before going to sleep | Less than 20 | More than 20. less than 25 | .240 | .205 | .644 | -.29 | .77 |
| | | More than 25. less than 30 | 1.033* | .305 | .004 | .25 | 1.82 |
| | | More than 30 | 1.236* | .377 | .006 | .26 | 2.21 |
| | More than 20 less than 25 | Less than 20 | -.240 | .205 | .644 | -.77 | .29 |
| | | More than 25 less than 30 | .793* | .244 | .007 | .16 | 1.42 |
| | | More than 30 | .995* | .330 | .015 | .14 | 1.85 |
| | More than 25 less than 30 | Less than 20 | -1.033* | .305 | .004 | -1.82 | -.25 |
| | | More than 20 less than 25 | -.793* | .244 | .007 | -1.42 | -.16 |
| | | More than 30 | .203 | .399 | .957 | -.83 | 1.24 |
| | More than 30 | Less than 20 | -1.236* | .377 | .006 | -2.21 | -.26 |
| | | More than 20 less than 25 | -.995* | .330 | .015 | -1.85 | -.14 |
| | | More than 25 less than 30 | -.203 | .399 | .957 | -1.24 | .83 |
| During the night I am sometimes awakened by sound (messages. notifications on social networks) | Less than 20 | More than 20 less than 25 | .029 | .241 | .999 | -.59 | .65 |
| | | More than 25 less than 30 | .172 | .358 | .964 | -.75 | 1.10 |
| | | More than 30 | -.907 | .443 | .173 | -2.05 | .24 |
| | More than 20 less than 25 | Less than 20 | -.029 | .241 | .999 | -.65 | .59 |
| | | More than 25 less than 30 | .143 | .287 | .959 | -.60 | .88 |
| | | More than 30 | -.935 | .387 | .077 | -1.94 | .07 |
| | More than 25 less than 30 | Less than 20 | -.172 | .358 | .964 | -1.10 | .75 |
| | | More than 20 less than 25 | -.143 | .287 | .959 | -.88 | .60 |
| | | More than 30 | -1.078 | .469 | .101 | -2.29 | .14 |
| | More than 30 | Less than 20 | .907 | .443 | .173 | -.24 | 2.05 |
| | | More than 20 less than 25 | .935 | .387 | .077 | -.07 | 1.94 |
| | | More than 25 less than 30 | 1.078 | .469 | .101 | -.14 | 2.29 |

| Dependent Variable | (I) Age | (J) Age | Mean Difference (I-J) | Std. Error | Sig. | 95 % Confidence Interval | |
|---|---|---|---|---|---|---|---|
| | | | | | | Lower Bound | Upper Bound |
| When I wake up during the night I browse the contents on my smartphone | Less than 20 | More than 20 less the 25 | -.068 | .264 | .994 | -.75 | .61 |
| | | More than 25 less than 30 | .315 | .393 | .853 | -.70 | 1.33 |
| | | More than 30 | .080 | .485 | .998 | -1.18 | 1.34 |
| | More than 20 less than 25 | Less than 20 | .068 | .264 | .994 | -.61 | .75 |
| | | More than 25 less than 30 | .383 | .315 | .615 | -.43 | 1.20 |
| | | More than 30 | .148 | .425 | .985 | -.95 | 1.25 |
| | More than 25 less than 30 | Less than 20 | -.315 | .393 | .853 | -1.33 | .70 |
| | | More than 20 less than 25 | -.383 | .315 | .615 | -1.20 | .43 |
| | | More than 30 | -.235 | .515 | .968 | -1.57 | 1.10 |
| | More than 30 | Less than 20 | -.080 | .485 | .998 | -1.34 | 1.18 |
| | | More than 20 less than 25 | -.148 | .425 | .985 | -1.25 | .95 |
| | | More than 25 less than 30 | .235 | .515 | .968 | -1.10 | 1.57 |
| During the night the smartphone is in my immediate vicinity | Less than 20 | More than 20 less than 25 | .100 | .247 | .978 | -.54 | .74 |
| | | More than 25 less than 30 | .866 | .367 | .088 | -.08 | 1.82 |
| | | More than 30 | -.062 | .454 | .999 | -1.24 | 1.11 |
| | More than 20 less than 25 | Less than 20 | -.100 | .247 | .978 | -.74 | .54 |
| | | More than 25 less than 30 | .766* | .294 | .048 | .01 | 1.53 |
| | | More than 30 | -.162 | .397 | .977 | -1.19 | .87 |
| | More than 25 less than 30 | Less than 20 | -.866 | .367 | .088 | -1.82 | .08 |
| | | More than 20 less than 25 | -.766* | .294 | .048 | -1.53 | -.01 |
| | | More than 30 | -.928 | .481 | .219 | -2.17 | .32 |
| | More than 30 | Less than 20 | .062 | .454 | .999 | -1.11 | 1.24 |
| | | More than 20 less than 25 | .162 | .397 | .977 | -.87 | 1.19 |
| | | More than 25 less than 30 | .928 | .481 | .219 | -.32 | 2.17 |

| Dependent Variable | (I) Age | (J) Age | Mean Difference (I-J) | Std. Error | Sig. | 95 % Confidence Interval | |
|---|---|---|---|---|---|---|---|
| | | | | | | Lower Bound | Upper Bound |
| I will never give up using a smartphone even when it affects my daily life | Less than 20 | More than 20 less than 25 | .326 | .243 | .539 | -.30 | .95 |
| | | More than 25 less than 30 | 1.078* | .362 | .017 | .14 | 2.01 |
| | | More than 30 | .627 | .448 | .501 | -.53 | 1.78 |
| | More than 20 less than 25 | Less than 20 | -.326 | .243 | .539 | -.95 | .30 |
| | | More than 25 less than 30 | .752* | .290 | .049 | .00 | 1.50 |
| | | More than 30 | .301 | .392 | .869 | -.71 | 1.31 |
| | More than 25 less than 30 | Less than 20 | -1.078* | .362 | .017 | -2.01 | -.14 |
| | | More than 20 less than 25 | -.752* | .290 | .049 | -1.50 | .00 |
| | | More than 30 | -.451 | .475 | .778 | -1.68 | .78 |
| | More than 30 | Less than 20 | -.627 | .448 | .501 | -1.78 | .53 |
| | | More than 20 less than 25 | -.301 | .392 | .869 | -1.31 | .71 |
| | | More than 25 less than 30 | .451 | .475 | .778 | -.78 | 1.68 |
| I use my smartphone as an alarm clock | Less than 20 | More than 20 less than 25 | .369 | .201 | .259 | -.15 | .89 |
| | | More than 25 less than 30 | .979* | .299 | .007 | .20 | 1.75 |
| | | More than 30 | .364 | .370 | .758 | -.59 | 1.32 |
| | More than 20 less than 25 | Less than 20 | -.369 | .201 | .259 | -.89 | .15 |
| | | More than 25 less than 30 | .610 | .240 | .056 | -.01 | 1.23 |
| | | More than 30 | -.005 | .324 | 1.000 | -.84 | .83 |
| | More than 25 less than 30 | Less than 20 | -.979* | .299 | .007 | -1.75 | -.20 |
| | | More than 20 less than 25 | -.610 | .240 | .056 | -1.23 | .01 |
| | | More than 30 | -.614 | .393 | .400 | -1.63 | .40 |
| | More than 30 | Less than 20 | -.364 | .370 | .758 | -1.32 | .59 |
| | | More than 20 less than 25 | .005 | .324 | 1.000 | -.83 | .84 |
| | | More than 25 less than 30 | .614 | .393 | .400 | -.40 | 1.63 |

| Dependent Variable | (I) Age | (J) Age | Mean Difference (I-J) | Std. Error | Sig. | 95 % Confidence Interval | |
|---|---|---|---|---|---|---|---|
| | | | | | | Lower Bound | Upper Bound |
| Immediately after waking up. I browse notifications. content. messages. on my smartphone | Less than 20 | More than 20 less than 25 | .316 | .237 | .543 | -.30 | .93 |
| | | More than 25 less than 30 | 1.402* | .353 | .001 | .49 | 2.32 |
| | | More than 30 | 1.409* | .437 | .008 | .28 | 2.54 |
| | More than 20 less than 25 | Less than 20 | -.316 | .237 | .543 | -.93 | .30 |
| | | More than 25 less than 30 | 1.086* | .283 | .001 | .35 | 1.82 |
| | | More than 30 | 1.093* | .382 | .024 | .10 | 2.08 |
| | More than 25 less than 30 | Less than 20 | -1.402* | .353 | .001 | -2.32 | -.49 |
| | | More than 20 less than 25 | -1.086* | .283 | .001 | -1.82 | -.35 |
| | | More than 30 | .007 | .463 | 1.000 | -1.19 | 1.20 |
| | More than 30 | Less than 20 | -1.409* | .437 | .008 | -2.54 | -.28 |
| | | More than 20 less than 25 | -1.093* | .382 | .024 | -2.08 | -.10 |
| | | More than 25 less than 30 | -.007 | .463 | 1.000 | -1.20 | 1.19 |
| I often wake up tired in the morning | Less than 20 | More than 20 less than 25 | -.055 | .268 | .997 | -.75 | .64 |
| | | More than 25 less than 30 | .729 | .400 | .264 | -.30 | 1.76 |
| | | More than 30 | -.022 | .494 | 1.000 | -1.30 | 1.26 |
| | More than 20 less than 25 | Less than 20 | .055 | .268 | .997 | -.64 | .75 |
| | | More than 25 less than 30 | .784 | .320 | .071 | -.04 | 1.61 |
| | | More than 30 | .032 | .432 | 1.000 | -1.09 | 1.15 |
| | More than 25 less than 30 | Less than 20 | -.729 | .400 | .264 | -1.76 | .30 |
| | | More than 20 less than 25 | -.784 | .320 | .071 | -1.61 | .04 |
| | | More than 30 | -.752 | .524 | .479 | -2.11 | .60 |
| | More than 30 | Less than 20 | .022 | .494 | 1.000 | -1.26 | 1.30 |
| | | More than 20 less than 25 | -.032 | .432 | 1.000 | -1.15 | 1.09 |
| | | More than 25 less than 30 | .752 | .524 | .479 | -.60 | 2.11 |

| Dependent Variable | (I) Age | (J) Age | Mean Difference (I-J) | Std. Error | Sig. | 95 % Confidence Interval | |
|---|---|---|---|---|---|---|---|
| | | | | | | Lower Bound | Upper Bound |
| It is difficult for me to follow the lectures in the morning | Less than 20 | More than 20 less than 25 | -.082 | .292 | .992 | -.84 | .67 |
| | | More than 25 less than 30 | .727 | .434 | .339 | -.39 | 1.85 |
| | | More than 30 | .413 | .537 | .868 | -.97 | 1.80 |
| | More than 20 less than 25 | Less than 20 | .082 | .292 | .992 | -.67 | .84 |
| | | More than 25 less than 30 | .809 | .348 | .095 | -.09 | 1.71 |
| | | More than 30 | .495 | .470 | .717 | -.72 | 1.71 |
| | More than 25 less than 30 | Less than 20 | -.727 | .434 | .339 | -1.85 | .39 |
| | | More than 20 less than 25 | -.809 | .348 | .095 | -1.71 | .09 |
| | | More than 30 | -.314 | .569 | .946 | -1.78 | 1.16 |
| | More than 30 | Less than 20 | -.413 | .537 | .868 | -1.80 | .97 |
| | | More than 20 less than 25 | -.495 | .470 | .717 | -1.71 | .72 |
| | | More than 25 less than 30 | .314 | .569 | .946 | -1.16 | 1.78 |

*. The mean difference is significant at the 0.05 level.

Furthermore, a difference in response was sought around individual respondents 'claims. This was done by applying the arithmetic mean and standard deviation (Table 11).

Table 11
*Descriptive Statistics*

| | N | Sum | Mean | Std. Deviation |
|---|---|---|---|---|
| Year | 267 | 544 | 2.04 | .540 |
| I use my smartphone just before going to sleep. | 265 | 1161 | 4.38 | 1.001 |
| During the night I am sometimes awakened by sound (messages. notifications on social networks). | 265 | 463 | 1.75 | 1.142 |
| When I wake up during the night I browse the contents on my smartphone | 265 | 558 | 2.11 | 1.245 |
| During the night the smartphone is in my immediate vicinity | 266 | 1071 | 4.03 | 1.180 |

| | N | Sum | Mean | Std. Deviation |
|---|---|---|---|---|
| I will never give up using a smartphone even when it affects my daily life | 265 | 692 | 2.61 | 1.169 |
| I use my smartphone as an alarm clock | 265 | 1208 | 4.56 | .956 |
| Immediately after waking up. I browse notifications. content. messages. on my smartphone | 265 | 1094 | 4.13 | 1.174 |
| I often wake up tired in the morning | 265 | 849 | 3.20 | 1.281 |
| It is difficult for me to follow the lectures in the morning | 262 | 809 | 3.09 | 1.396 |
| Valid N (listwise) | 262 | | | |

In addition, the chi-square and the chi-square designation were determined. The relationship between the two variables was examined by the applied chi-square test. It is based on a cross table in which the categories of one variable (year of life) are crossed with the categories of another variable (all nine dependent variables). The obtained chi-square values are shown in Table 12.

Table 12
*Test Statistics*

| | I use my smartphone just before going to sleep | During the night I am sometimes awakened by sound (messages, notifications on social networks) | When I wake up during the night I browse the contents on my smartphone | During the night the smartphone is in my immediate vicinity |
|---|---|---|---|---|
| Chi-Square | 332,.345[a] | 285.341[a] | 117.775[a] | 168.000[a] |
| df | 4 | 4 | 4 | 4 |
| Asymp. Sig. | .000 | .000 | .000 | .000 |

| I will never give up using a smartphone even when it affects my daily life | I use my smartphone as an alarm clock | Immediately after waking up, I browse notifications, content, messages, on my smartphone | I often wake up tired in the morning | It is difficult for me to follow the lectures in the morning |
|---|---|---|---|---|
| 48.412[a] | 50.,041[a] | 208.375[a] | 16.727[a] | ..191[a] |
| 4 | 4 | 4 | 4 | 4 |
| .000 | .000 | .000 | .002 | .268 |

a. 0 cells (0,0 %) have expected frequencies less than 5. The minimum expected cell frequency is 53,4.

In order for the value of the chi-square to be significant, it needs to be a Significanceof 0.05 or less. The tables below show the chi-square test values. From Tables 7-15, it can be seen that only five chi-square values are significant for particles 7, 10, 11 and 14. The other seven chi-square values are greater than 0.05, meaning they are not statistically significant.

Table 13 shows that smartphones are mostly used before going to sleep by respondents aged 20-25 years (51.7 %). A total of 26.8 % respondents Agreed with the statement that they use smartphones just before going to sleep, and 61.1 % of respondents Strongly agreed to this survey statement. Chi-square test value $\chi 2 = 332{,}345$ df (4), $p = 0.000$. The obtained data can be considered statistically significant.

Table 13
*The use of smartphones immediately before going to sleep*

| | | | I use my smartphone just before going to sleep. | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Strongly disagree | Disagree | Neither agree nor disagree | Agree | Strongly agree | Total |
| Age | Less than 20 | Count | 0 | 0 | 0 | 8 | 17 | 25 |
| | | % of Total | 0.0 % | 0.0 % | 0.0 % | 3.0 % | 6.4 % | 9.4 % |
| | More than 20. less than 25 | Count | 8 | 4 | 10 | 55 | 137 | 214 |
| | | % of Total | 3.0 % | 1.5 % | 3.8 % | 20.8 % | 51.7 % | 80.8 % |
| | More than 25. less than 30 | Count | 2 | 1 | 4 | 4 | 6 | 17 |
| | | % of Total | 0.8 % | 0.4 % | 1.5 % | 1.5 % | 2.3 % | 6.4 % |
| | More than 30 | Count | 1 | 2 | 0 | 4 | 2 | 9 |
| | | % of Total | 0.4 % | 0.8 % | 0.0 % | 1.5 % | 0.8 % | 3.4 % |
| Total | | Count | 11 | 7 | 14 | 71 | 162 | 265 |
| | | % of Total | 4.2 % | 2.6 % | 5.3 % | 26.8 % | 61.1 % | 100.0 % |

For the statement "During the night, I am sometimes awakened by sound (messages, notifications on social networks)", a total of 4.5 % and 7.5 % of respondents Fully agreed and Agreed, respectively, that the sound of a smartphone wakes them up during the night; most of these respondents were aged 20 to 25. More than half of the respondents (59.6 %) answered that the sound on their smartphone does not wake them up during the night, and this also mostly applied to the respondents aged 20-25 (49.1 %). Regardless of the lower percentage of a total of 12 % of all respondents who are not woken up by their smartphone during the night, it should be considered that it disturbs their sleep and quality of rest during the night. Chi-square test value $\chi 2 = 285.341$ df (4), $p = 0.000$. This data can be considered statistically significant.

A total of 16.2 % of all respondents browse content on a smartphone during the night when they wake up, and this is entirely done by respondents aged 20 to 25, 7.0 %. Chi-square test value $\chi 2 = 117{,}775$ df (4), $p = 0.000$. The obtained data can be considered statistically significant.

Table 14
*During the night the smartphone is in my immediate vicinity*

| | | | During the night the smartphone is in my immediate vicinity. | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Strongly disagree | Disagree | Neither agree nor disagree | Agree | Strongly agree | Total |
| Age | More than 20 | Count | 1 | 2 | 2 | 7 | 13 | 25 |
| | | % within age | 4.0 % | 8.0 % | 8.0 % | 28.0 % | 52.0 % | 100.0 % |
| | More than 20, less than 25 | Count | 12 | 13 | 22 | 71 | 97 | 215 |
| | | % within age | 5.6 % | 6.0 % | 10.2 % | 33.0 % | 45.1 % | 100.0 % |
| | More than 25, less than 30 | Count | 5 | 1 | 1 | 4 | 6 | 17 |
| | | % within age | 29.4 % | 5.9 % | 5.9 % | 23.5 % | 35.3 % | 100.0 % |
| | More than 30 | Count | 0 | 0 | 0 | 7 | 2 | 9 |
| | | % within age | 0.0 % | 0.0 % | 0.0 % | 77.8 % | 22.2 % | 100.0 % |
| Total | | Count | 18 | 16 | 25 | 89 | 118 | 266 |
| | | % within age | 6.8 % | 6.0 % | 9.4 % | 33.5 % | 44,4 % | 100.0 % |

A total of 44.4 % of respondents have a smartphone in their immediate vicinity during the night (Table 14). More than half (52 %) of respondents under the age of 20 Strongly agree with the statement. There is a very small percentage of all respondents (6.8 %) who Strongly disagree with the statement. Chi-square test value $\chi^2 = 168.000$ df (4), p=0,000. The obtained data can be considered statistically significant.

A total of 22.7 % of respondents answered the question that they would never give up a smartphone even when it already greatly affected their lives (Table 15), and 19.2 % of respondents completely disagree with this statement. It was found that 27.9 % of respondents gave a neutral answer, which may indicate insecurity or perhaps insufficient awareness of the influence of smartphones on their daily lives. Chi-square test value $\chi 2= 48.412$ df (4), p=0,000 The obtained data can be considered statistically significant.

Table 15
*I will never give up using a smartphone even when it affects my daily life*

| | | | I will never give up using a smartphone even when it already greatly affects my daily life. | | | | | Total |
|---|---|---|---|---|---|---|---|---|
| | | | Strongly disagree | Disagree | Neither agree nor disagree | Agree | Strongly agree | |
| Age | Less than 20 | Count | 4 | 6 | 5 | 7 | 3 | 25 |
| | | % within age | 16.0 % | 24.0 % | 20.0 % | 28.0 % | 12.0 % | 100.0 % |
| | More than 20. less than 25 | Count | 41 | 60 | 64 | 33 | 16 | 214 |
| | | % within age | 19.2 % | 28.0 % | 29.9 % | 15.4 % | 7.5 % | 100.0 % |
| | More than 25. less than 30 | Count | 4 | 11 | 2 | 0 | 0 | 17 |
| | | % within age | 23.5 % | 64.7 % | 11.8 % | 0.0 % | 0.0 % | 100.0 % |
| | More than 30 | Count | 2 | 3 | 3 | 1 | 0 | 9 |
| | | % within age | 22.2 % | 33.3 % | 33.3 % | 11.1 % | 0.0 % | 100.0 % |
| Total | | Count | 51 | 80 | 74 | 41 | 19 | 265 |
| | | % within age | 19.2 % | 30.2 % | 27.9 % | 15.5 % | 7.2 % | 100.0 % |

Table 16
*I use my smartphone as an alarm clock*

| | | | I use my smartphone as an alarm clock. | | | | | Total |
|---|---|---|---|---|---|---|---|---|
| | | | Strongly disagre | Disagree | Neither agree nor disagree | Agree | Strongly agree | |
| Age | Less than 20 | Count | 0 | 0 | 0 | 2 | 23 | 25 |
| | | % within age | 0.0 % | 0.0 % | 0.0 % | 8.0 % | 92.0 % | 100.0 % |
| | More than 20. less than 25 | Count | 9 | 2 | 6 | 39 | 158 | 214 |
| | | % within age | 4.2 % | 0.9 % | 2.8 % | 18.2 % | 73.8 % | 100.0 % |
| | More than 25. less than 30 | Count | 3 | 1 | 1 | 1 | 11 | 17 |
| | | % within age | 17.6 % | 5.9 % | 5.9 % | 5.9 % | 64.7 % | 100.0 % |
| | More than 30 | Count | 0 | 0 | 0 | 4 | 5 | 9 |
| | | % within age | 0.0 % | 0.0 % | 0.0 % | 44.4 % | 55.6 % | 100.0 % |
| Total | | Count | 12 | 3 | 7 | 46 | 197 | 265 |
| | | % within age | 4.5 % | 1.1 % | 2.6 % | 17.4 % | 74.3 % | 100.0 % |

A total of 74.3 % of respondents said that their smartphone serves as an alarm clock (Table 16), so it is possible to conclude that these respondents do not use analog or digital alarm clocks, which may also indicate that the smartphone is in their immediate vicinity. As an alarm clock, smartphones are mostly used by respondents under 20 years of age (92 %), followed by respondents over 20 years of age and less than 25 (73.8 %). It is least used as an alarm clock by respondents over 30 years of age, although the data indicate that it is used by more than half of respondents of that age. It is possible to conclude that all younger generations use smartphones as their alarm clocks. Chi-square test value $\chi^2$ = 505,041 df (4), p=0,000. The obtained data can be considered statistically significant.

Table 17

*Immediately after waking up, I browse notifications, content, messages, on my smartphone*

| | | | Immediately after waking up. I view notifications. content. messages. on my smartphone. | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Strongly disagree | Disagree | Neither agree nor disagree | Agree | Strongly agree | Total |
| Age | Less than 20 | Count | 0 | 0 | 1 | 10 | 14 | 25 |
| | | % within age | 0.0 % | 0.0 % | 4.0 % | 40.0 % | 56.0 % | 100.0 % |
| | More than 20. less than 25 | Count | 11 | 10 | 19 | 58 | 116 | 214 |
| | | % within age | 5.1 % | 4.7 % | 8.9 % | 27.1 % | 54.2 % | 100.0 % |
| | More than 25. less than 30 | Count | 3 | 4 | 4 | 0 | 6 | 17 |
| | | % within age | 17.6 % | 23.5 % | 23.5 % | 0.0 % | 35.3 % | 100.0 % |
| | More than 30 | Count | 2 | 1 | 2 | 2 | 2 | 9 |
| | | % within age | 22.2 % | 11.1 % | 22.2 % | 22.2 % | 22.2 % | 100.0 % |
| Total | | Count | 16 | 15 | 26 | 70 | 138 | 265 |
| | | % within age | 6.0 % | 5.7 % | 9.8 % | 26.4 % | 52.1 % | 100.0 % |

Immediately after waking up, 78.5 % of all respondents (Table 8) view notifications, content, and messages on their smartphone. This is mostly done by younger respondents (less than 20 years old), of whom a total of 40.0 % Agree with the statement and 56 % Strongly agree. For respondents who are over 30 years old, a total of 22.2 % of them completely agree with the statement. Chi-square test value $\chi^2$= 36,119 df (12), p=0,000. The obtained data can be considered statistically significant.

A total of 19.6 % of respondents often wake up tired in the morning, and respondents under the age of twenty are most tired (28 % Strongly agree with the statement and 20 % Agree with the statement). It could be concluded that students are tired exactly because they have a smartphone next to them, because they check messages at

night and wake up to the sound of certain applications, which can result in fatigue, inadequate sleep, and sleep deprivation. Although the chi-square test is $\chi2=16,727$ df (4), p=0,002, and the data are not considered statistically significant, care should be taken to educate younger populations not to use a smartphone during bedtime, or at least two hours before, and not to keep it close at night. If they have to use it as an alarm clock—although it would be better to get an analog alarm clock— it should be set to flight mode.

A total of 22.9 % of respondents Stronglyully agree and 16.8 % of respondents Agree with the statement that it is difficult to follow classes in the morning. This data may indicate that one of the reasons could be related to the use of smartphones during the night because insufficient sleep affects mood and concentration, and therefore it is possible that some respondents find it difficult to follow lectures in the morning. Chi-square test value $\chi2= 5,191$ df (4), p=0,268

## Discussion and conclusion

One of the requirements of the use of ICT (Ružić-Baf, Kadum & Damić, 2020) is that a person speeds up certain work processes, gaining time, and thus has more and more free time. Unfortunately, for many individuals, modern technology has done just the opposite.

Improper use of mobile (smart) phones also has negative implications for an individual's health. The link between insomnia and mobile phone use has been studied by authors (Fossum, Nordnes, Storemark et al., 2014; Exelmans & Van den Bulck, 2016) who concluded that insomnia, daytime sleepiness, morning drowsiness, and chronotype are among the most common side effects of the use of electronic devices. Frequent use of digital technologies and mobile phones also affects the mental health of students, including depression, anxiety, stress, etc. (Thomée, Härenstam, & Hagberg, 2011; Matar Boumosleh & Jaalouk, 2017; Višnjić, Veličković, Sokolović et al., 2018; Liu, Wing, Hao et al., 2019; Kang, Liu, Yang et al., 2020; Islam, 2021). Small, Lee, Kaufman et al. (2020) state that excessive use of digital technology affects brain function and behavior, and in addition to having consequences for sleep, it also manifests itself in lack of attention, dependence on digital technology, impaired brain development and social isolation.

In the research presented in this paper, it is possible to conclude that 87.9 % of students use smartphones just before going to bed, and it was proven in the study by Saling & Haire (2016) that a total of 75 % of respondents in a sample of 397 adult respondents used a smartphone at least once a month after the lights were turned off.

Our research also shows that 77.9 % of students have a smartphone in their immediate vicinity during the night, while a total of 12 % of them are woken up by notifications on the smartphone during the night, which can be associated with sleep disturbances and effects on the circadian rhythm, resulting in morning drowsiness and difficulties following lectures in the morning.

Rafique, Al-Asoom, Alsunni et al. (2020) also obtained data showing that 70 % of respondents (students in a representative sample of 1,925 respondents) keep a mobile phone turned on next to their pillow, and only 19.7 % of respondents use airplane mode during the night.-

In our research, a total of 77,9 of respondents had a mobile phone in their immediate vicinity during the night. When they wake up during the night, 16.2 % of respondents browse content on a mobile phone. Abdalqader, Ariffin Ghazi et al. (2018) state that the factors influencing insomnia in respondents (students) are related to the frequency of access to social networks, time spent on social networks, especially during the evening and before going to bed, and the use of other electronic devices before going to sleep.

Most respondents use a smartphone as an alarm clock, so in the morning, immediately after waking up, their first activity is browsing content on a smartphone. The obtained data show that a small, but not negligible, percentage (19.6 %) of respondents wake up tired in the morning, and 39.7 % of respondents find it difficult to follow lectures in the morning.

It can be concluded that education on this issueis greatly needed for students of all ages. First, it is necessary to educate parents of children already in kindergarten about the possible negative consequences of excessive use of smartphones. Education should be conducted by a multidisciplinary team of experts (pedagogues, computer scientists, psychologists, doctors, etc.) for students in the first grade of primary school of study on the possible harmful consequences of inappropriate and excessive use of smartphones. Students should learn about instructions for the "smart use of smartphones" (1. storing a mobile phone overnight in another room, or if this is not possible, then turning on airplane mode; 2. not keeping a mobile phone close at night; 3. not using a mobile phone or other electronic devices for at least two hours before going to bed andreturning to the habit of reading, as well as introducing relaxation techniques that prepare the body for sleep; 4. using a digital and/or analog alarm instead of using an alarm clock on your mobile phone; 5. using a mobile phone only when necessary and setting aside time during the day for at least an hour or two, when the mobile phone is not used; 6. spending as much time as possible in daylight, in nature, exercising and other activities that do not involve the use of a mobile phone; 7. limiting and setting time for reviewing content and posting on social media; 8 limiting and setting time for browsing information on the Internet; 9. In the case of "boredom", finding activities that will replace the use of mobile phones; 10. being guided by the principle of "less is more" - with less use of smartphones and other electrical devices, we contribute more to a healthier lifestyle).

Given that the research was conducted on a sample of the student population, it is evident that younger students are more likely to use smartphones compared to older colleagues, which may lead to the conclusion that younger populations are increasingly using digital technologies. Most respondents answered that a smartphone is in their immediate vicinity during the night. It would certainly be wise to move the device to

another room and replace it with a digital or analog alarm clock, and by this very simple and accessible solution, exposure to smartphone light just before bedtime (browsing messages, social networks, etc.) and waking up to application sounds, calls, messages, etc. during the night would be avoided. Students would wake up more rested in the morning and thus they would be more able to concentrate during morning lectures, but these are certainly indications for possible future research.

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# Utjecaj pametnih telefona na studente u Republici Hrvatskoj


## Sažetak

*Uporaba pametnih telefona postala je sveprisutna među svim generacija, a sve je učestalija i među studentskom populacijom. Vrlo se rijetko može pronaći student koji ne posjeduje mobilni (pametni) telefon. Mobilni su (pametni) telefoni kod većine ispitanika zamijenili mnoge aktivnosti koje su ranije odrađivane pomoću stolnih računala, prijenosnih računala, tableta i ostalih elektroničkih uređaja (rad s elektroničkom poštom, pretraživanje informacija na internetu, pristup društvenim mrežama i dr.). Većina je populacije zamijenila i klasične budilice pametnim telefonima (nerijetko se pametni telefoni nalaze na noćnim ormarićima, a kod nekih ispitanika i na krevetu) te se upravo kod većine populacije koja posjeduje pametni telefon jutarnje buđenje veže uz prvu jutarnju aktivnost uporabe pametnoga telefona (pregledavanje vijesti, pregledavanje obavijesti na društvenim mrežama i druge aktivnosti).*

*Uporaba pametnih telefona tijekom noći, kada bi trebalo odvojiti vrijeme za odmor i san, većina studenata provodi za svojim mobilnim telefonima i time remete svoj biološki ritam spavanja i buđenja (cirkardijalni ritam) koji je od iznimne važnosti za ljudsko zdravlje.*

*U tu svrhu izrađen je anketni upitnik koji je proveden među studentskom populacijom na uzorku od 267 studenata u Hrvatskoj tijekom 2020./2021. akademske godine. Istraživanjem se htjelo ispitati koriste li ispitanici i koliko pametne telefone neposredno prije odlaska na spavanje, tijekom noći, neposredno prije buđenja, koriste li pametni telefon kao budilicu te bude li se ujutro umorni. Dobiveni su rezultati pokazali da pametni telefon neposredno prije spavanja koristi ukupno 81,9 % ispitanika, od čega najviše ispitanika u dobi od 20 do 25 godina, njih ukupno 51,7 %. Neposredno nakon buđenja 78,5 % ispitanika na pametnom telefonu pregledava obavijesti, sadržaje i poruke.*

*Ukupno 43 % ispitanika ujutro se često bude umorno, a 39,7 % ujutro teško prati nastavu. Izračunata je matrica korelacije između varijabli Koristim pametni telefon neposredno prije odlaska na spavanje i Tijekom noći pametni telefon nalazi se u mojoj neposrednoj blizini ($r = .544$, $p = .000 < .01$); Tijekom noći ponekad me probudi zvuk poruka, obavijesti na društvenim mrežama i Kada se probudim tijekom noći, pregledavam sadržaje na pametnom telefonu ($r = .489$, $p = .000 < .01$ ) i između*

*varijabli Često se ujutro probudim umoran i Ujutro teško pratim nastavu. Uporaba pametnih telefona neposredno prije spavanja i tijekom noći remeti san, a ujutro se javlja umor. Moguće je zaključiti da je praćenje nastave otežano, a samim time i koncentracija studenata je lošija.*

**Ključne riječi:** *digitalna tehnologija, pametni telefoni, studenti, učenje.*

## Uvod

Komunikacija se sve češće, posebno tijekom pandemije virusa COVID-19, odvija u virtualnom prostoru uz korištenje različitih aplikacija, najčešće uporabom pametnih telefona, ali i ostalih elektroničkih uređaja poput prijenosnih računala, tableta i dr.

Tijekom 2020. godine u Hrvatskoj je bilo 66,13 % korisnika mobilnih telefona (Statista, 2021). Mnogi ljudi pametne telefone koriste za zadatke i aktivnosti koje su ranije obavljali koristeći se drugim elektroničkim uređajima. Na uzorku istraživanja (Hina, Masterindex, 2019) od 1000 ispitanika u dobi od 18 do 55 godina života u Hrvatskoj dobiveni su podatci pokazali da gotovo svi ispitanici koriste mobilni telefon u prosjeku 4,7 sati dnevno, 84 % ispitanika koristi ga za *online* razgovore, 82 % za pristup e-pošti, 81 % za *online* kupnju, 79 % za pretraživanje interneta, 74 % za društvene mreže te 64 % za mobilno bankarstvo. Mobilni telefon u prosjeku od 5,5 sati dnevno koriste ispitanici u dobi od 18 do 29 godina života.

Ukupno 183 ispitanika (Yeh,Chang,Ting,Chen, 2020) u dobi od 20 do 30 godina života provodi 3,45 sati dnevno u učenju, a 2,75 sati provodi na društvenim mrežama koristeći se pametnim telefonima.

U radu je naglasak na uporabi pametnih telefona kod studenata prije odlaska na spavanje, korištenje pametnih telefona tijekom noći te uporabi pametnih telefona neposredno nakon buđenja. Korištenje pametnih telefona tijekom noći može štetiti čovjekovom biološkom ritmu te su mogući poremećaji ritma spavanja (MSD, 2014) koji mogu biti vezani uz poremećaje cirkadijalnoga ritma spavanja i posljedica su desinkronizacije unutarnjega i vanjskoga ritma budnosti i spavanja. Desinkronizacija shodno vanjskim utjecajima mijenja dnevni ritam drugih bioloških funkcija u tijelu kao što su tjelesna temperatura, lučenje hormona, nesanica, slabost, depresija, iritabilnost i dr. Izloženost prirodnom Sunčevu svjetlu ubrzava ponovno podešavanje organizma.

Rezultati istraživanja provedeni na reprezentativnom uzorku od 91 105 ispitanika u razdoblju od 2013. do 2015. godine među ispitanicima u UK životne dobi od 37 do 73 godine života (Lyall, Wyse, Graham i sur., 2018) pokazali su da su cirkardijalni poremećaji povezani s različitim negativnim ishodima mentalnoga zdravlja i dobrobiti, uključujući veliki depresivni poremećaj i bipolarni poremećaj. Niža relativna amplituda mogla bi biti povezana s povećanom osjetljivošću na poremećaje raspoloženja.

Sunni (2020) u svojem istraživanju ukazuje da svjetlo ima vrlo važnu veliku ulogu u regulaciji cirkardijalnoga ritma i utječe na proizvodnju melatonina esencijalnoga hormona koji potiče spavanje. Dostupna električna energija (ulična rasvjeta, uredska rasvjeta, svjetlo na mobilnim telefonima…) omogućuje osvjetljenje 24 sata dnevno te je umjetno svjetlo postalo stalnim dijelom modernoga života pojedinca.

Iako su istraživanja (Gooley, 2008; Bassa, Canazei, Hinterhuber,Weiss, 2013; Leger, Duforez,Gronfier i sur., 2018) Clevland Clinic, 2020) dokazala da se problemi cirkadijalnoga ritma mogu uspješno riješiti i izloženošću jakom umjetnom svjetlu, preporuka je svakako da pojedinac bude izložen jakom i kratkovalnom svjetlu tijekom dana zbog podržavanja cirkadijalne funkcionalnosti (Knoop i sur., 2020) te da izbjegava svjetla tijekom noći.

Hormoni (Gnocchi, Bruscalupi, 2017) poput melatonina, kortizola, gonadal steroids, prolaktina, hormona štitne žlijezde i hormona rasta imaju dnevne oscilacije. Također, hormoni koji su osjetljivi na nutrijente kao što su inzulin, leptin, grelin i adipnektin, osciliraju na cirkadijalnoj bazi te je njihovo oslobađanje, barem djelomično, regulirano podražajima iz okoline za vrijeme jela i izmjene ciklusa svjetlo-tama. Tijelo prirodno proizvodi hormon melatonin (Suni, 2021) čija je proizvodnja usko povezana sa svjetlom. Kao odgovor na tamu, epifiza u mozgu pokreće proizvodnju melatonina, ali izlaganje svjetlu usporava ili zaustavlja tu proizvodnju. Za mladu odraslu i odraslu osobu preporučeno je sedam do devet sati sna (Suni, 2020). Postavlja se pitanje koliki utjecaj na san i zdravlje ima uporaba pametnih telefona i ostalih elektroničkih uređaja neposredno pred odlazak na spavanje?

## Utjecaj elektroničkih uređaja na kvalitetu sna i zdravlje odrasle populacije

Istraživanje u kojem je sudjelovalo 450 studenata dodiplomskoga studija medicine (Krishnan, Sanjeev, Latti, 2020) pokazalo je da je izloženost ekranima tijekom vremena koje je predviđeno za spavanje povezano s povećanom latencijom sna, smanjenim trajanjem spavanja te povećanim smetnjama tijekom dana. Studenti provode mnogo vremena za svojim pametnim telefonima u vrijeme kada bi trebali spavati. Ležeći položaj tijekom korištenja pametnoga telefona i svijest o aktivnosti tijekom noći također su parametri koji su povezani s lošom kvalitetom sna.

Exelmans i Van den Bulck (2016) proveli su istraživanje kod 844 odraslih Flamanaca (18 – 94 godina) o uporabi elektroničkih medija i navika spavanja. Dobiveni rezultati istraživanja pokazali su da polovica ispitanika posjeduje svoj pametni telefon te da šest od deset ispitanika uzima sa sobom mobilni telefon u sobu gdje spava. Slanje poruka i razgovori kada je svjetlo u sobi ugašeno, pokazalo je dužu latenciju sna, lošiji san, više poremećaja spavanja i više disfunkcija tijekom dana.

Od 1508 odraslih ispitanika u Americi (Chang, Aeschbach, Duffy i Czeisler, 2015) njih 90 % koristi neki elektronički uređaj najmanje nekoliko noći u tjednu, sat vremena prije spavanja. Ispitanicma koji su čitali knjigu na elektroničkom uređaju prije spavanja, trebalo je više vremena da zaspe, imali su smanjenu pospanost tijekom večeri, smanjeno lučenje melatonina, kasnije vrijeme cirkardijalnoga sata te smanjenu budnost tijekom jutra za razliku od ispitanika koji su čitali tiskanu knjigu.

Istraživanje koje su proveli Jniene, Errguig, El Hangouche i sur. (2019) među 294 studenata medicine i farmacije na Fakultetu medicine i farmacije u Rabatu, Maroko u emitiranju plavoga svjetla pametnih uređaja neposredno pred spavanje, dobili su

rezultate da je kvaliteta spavanja bila lošija kod ukupno 35,3 % studenata. Ukupno 60,6 % studenata stavlja svoj uređaj pod jastuk te im elektronički uređaj tijekom noći remeti san zbog pregledavanja poruka.

Što je učinjeno po pitanju zaštite zdravlja pojedinca prilikom uporabe pametnih telefona?

U Republici Hrvatskoj o tom su pitanju objavljeni članci te su dane jasne preporuke o uporabi pametnih telefona, elektromagnetskom zračenju, učincima mobilnih telefona na zdravlje, načinima smanjenja izloženosti zračenju mobilnih uređaja (Lakić, 2011), utjecaju mobilnih telefona na san i mentalno zdravlje, karcinom, korištenje mobitela i prometne nesreće te utjecaj na vid (Hižar, 2018). Svjetska zdravstvena organizacija (WHO, 2006) još je 2006. godine objavila izvješće o kliničkim efektima dnevne izloženosti mobilnim telefonima u općoj populaciji i utjecaju istih na razvoj tumora glave i mozga te ostale ishode povezane s morbiditetom i učincima RF te mikrovalnoga zračenja na pojedinca, a 2014. godine (WHO, 2014) objavljuje „Izvještaj sa sastanka" u kojemu se navode smjernice javnoga zdravstva o prekomjernoj uporabi interneta, računala, pametnih telefona i ostalih elektroničkih uređaja u kontekstu „bihevioralne ovisnosti" povezane s prekomjernom uporabom elektroničkih uređaja. Iako postoji veliki broj istraživanja (European Parliament, 2019) o mogućim rizicima izlaganja pojedinca radiofrekventnim elektromagnetskim poljima koje imitiraju pametni telefoni, znanstvenici su i dalje podijeljeni u mišljenjima između zračenja mobilnih telefona i utjecaja na zdravlje pojedinca. Od velike je važnosti izraditi strategiju, kako na globalnoj tako i na nacionalnoj razini, o pravilnoj uporabi pametnih telefona s jasnim naznakama koje pretjerana i neadekvatna uporaba pametnih telefona ima na zdravlje pojedinca, a posebno na mlade ljude.

## Metodologija

Ovim istraživanjem željela se ispitati učestalost korištenja mobilnih telefona među studentskom populacijom u Hrvatskoj te postoji li povezanost njihove prekomjerne uporabe (posebno u noćnim satima) s praćenjem nastave sljedećega dana.

### *Mjerni instrument*

U istraživanju je korišten anketni upitnik konstruiran  za potrebe ovoga istraživanja. Sastojao se od dvije nezavisne varijable (spol, dob) i devet zavisnih varijabli koje su se odnosile na uporabu pametnih telefona prije spavanja, tijekom noći i nakon buđenja, umoru nakon buđenja te teškim praćenjem nastave.

Anketni upitnik izrađen je pomoću alata Google Forms. Anketa je objavljena u Facebook grupama za studente diljem Republike Hrvatske, a provodila se tijekom akademske 2020./2021. godine. U potpunosti je poštovan etički kodeks: ispitanici su dobili pismene upute o popunjavanju mjernoga instrumenta; zajamčena im je anonimnost i mogućnost odustajanja od daljnjih odgovora; objašnjeno im je da će se podatci dobiveni ovim istraživanjem koristiti isključivo u znanstvene svrhe.

Budući da se anketni upitnik po prvi put koristi u istraživanju, bilo je potrebno utvrditi njegove osnovne metrijske karakteristike. Pouzdanost izjave o ljestvici izražene Cronbachovim alfa koeficijentom pokazala je da ona zadovoljava Nunnallyjev i Bernsteinov unutarnji kriterij konzistencije od 0,70. Naime, dobiveni koeficijent unutarnje konzistencije je = ,807. Alfa je veća od 0,70 te se smatra prihvatljivom.

Obrada podataka dobivenih u ovom istraživanju provedena je pomoću statističkoga paketa IBM SPSS Statistics 20.

Tablica 1

### *Uzorak istraživanja*

Uzorak istraživanja čini 267 studenata koji studiraju u Republici Hrvatskoj te se sastoji od sljedećih jedanaest varijabli:

1. Spol
2. Dob
3. Koristim pametni telefon neposredno prije odlaska na spavanje.
4. Tijekom noći ponekad me probudi zvuk poruka, obavijesti na društvenim mrežama.
5. Kada se probudim tijekom noći, pregledavam sadržaje na pametnom telefonu.
6. Tijekom noći pametni se telefon nalazi u mojoj neposrednoj blizini.
7. Nikada neću odustati od korištenja pametnoga telefona, čak i kada to utječe na moj svakodnevni život.
8. Koristim pametni telefon kao budilicu.
9. Neposredno nakon buđenja pregledavam obavijesti, sadržaje, poruke na pametnom telefonu.
10. Često se ujutro probudim umoran.
11. Ujutro teško pratim nastavu.

## Rezultati

Karakteristike uzorka s obzirom na spol prikazane su u Tablici 2. Ukupno 90,6 % sudionika istraživanja bile su žene, dok su samo 8,6 % bili muškarci.

Tablica 2

Karakteristike sudionika istraživanja s obzirom na dob pokazuju da je najveći broj ispitanika, njih 80,9 %, u raspon od više od 20 godina i niže od 25 godina, ukupno 9,4 % je niže od 20 godina te 6,4 % ispitanika je više od 25 i manje od 30 godina, a svega 3,4 % je više od 30 godina.

Testiranje normalnosti distribucije (uz homogenost varijance) neizostavan je parametar u odgojno-obrazovnim istraživanjima pri izboru pojedinih statističkih parametarijskih ili neparametrijskih testova za provjeru hipoteza.

Tablica 3

Kako bi se utvrdilo postoje li statistički značajne razlike u normalnoj distribuciji sudionika istraživanja s obzirom na dob, primijenjen je Kolmogorov-Smirnov test (Tablica 4).

Tablica 4

Rezultati u Tablici 4 pokazuju da je značajnost manja od .05, pa odstupanje od normalnosti nije statistički značajno, tj. značajnost je u ovom slučaju p = .000 <.05, što znači da je normalnost distribucije potvrđena, stoga je i prihvaćena.

Prije korištenja ANOVA parametrijskoga testa odredili smo pretpostavke za primjenu ovoga testa, a one su se odnosile na:

1. razinu mjerenja: zavisna varijabla mjerena je na intervalnoj skali što znači da udaljenosti između numeričkih vrijednosti odgovaraju udaljenostima između mjerenih karakteristika
2. slučajnost uzorka: iako u stvarnim istraživanjima ova pretpostavka
3. često nije ispunjena, rezultati se dobivaju iz slučajnoga uzorka osnovnoga skupa
4. neovisnost opažanja: dobiveni podatci su međusobno neovisni, tj. ni na jedno mjerenje nije utjecalo drugo mjerenje
5. normalnost distribucije: u društvenim istraživanjima vrijednosti zavisne varijable vrlo često nisu normalna distribucija. Kako je uzorak bio dovoljno velik, 267 ispitanika, znatno više od 30 sudionika istraživanja (Tabachnick i Fidell, 2013.), kršenje ove pretpostavke nije izazvalo veće probleme.

U Tablici 5 prikazana je asimetrija (Skewness) svih zavisnih varijabli. Uočeno je da su vrijednosti asimetrije za četiri varijable bile negativne i po modulu veće od jedan; rezultati su pomaknuti udesno prema višim vrijednostima.

Tablica 5

Nadalje, iz Tablice 5 vidljivo je da su vrijednosti asimetrije za tri varijable pozitivne i veće od jedan, što ukazuje da su rezultati pomaknuti udesno prema manjim vrijednostima.

Tablica 6

Homogenost varijance ispitana je pomoću Levene testa homogenosti varijanci (Tablica 6). Za sedam varijabli Levenov test je dao vrijednosti manje od .05 (stupac Sig,), što znači da pretpostavka o homogenosti varijance ne vrijedi za te varijable. Međutim, kako je analiza varijance prilično neosjetljiva na kršenje ove pretpostavke, to nas ne zabrinjava jer su veličine grupa slične: manje su od 1,5 (Stevens, 1996).

Provedena je analiza varijance i korištena je ANOVA metoda kojom se uspoređuju aritmetičke sredine više uzoraka. Budući da su empirijske razine značajnosti u varijablama 2, 3, 4, 8 i 9 veće od teorijskih, nulta hipoteza ne može se odbaciti te se zaključuje da ne postoji statistički značajna razlika između promatranih skupina.

U Tablici 7 prikazani su podatci za svaku skupinu: broj ispitanika u skupini, aritmetičke sredine, standardna devijacija i drugi podatci.

Tablica 7

Tablica 6 prikazuje rezultate Levenova testa homogenosti varijance. Naime, ispitivala se jednakost varijanci rezultata u svih devet zavisnih varijabli. U stupcu Sig. prikazane

su vrijednosti značajnosti za Levenov test. Kako su veličine značajne za varijable, Često se ujutro probudim umoran i teško mi je pratiti predavanja ujutro veći od .05, p = .140 > .05 i p = .690 > .05, znači da je hipoteza o jednakosti varijance potvrđena.

Međutim, u sedam varijabli narušena je homogenost varijanci pa smo te varijable podvrgnuli Robust Tests of Equality of Means. U Tablici 8 prikazane su veličine Welch testa i Brown-Forsythe testa, čije su vrijednosti pokazatelji koje korigiraju F-omjer u slučaju narušene pretpostavke o homogenosti varijanci.

Tablica 8

Tablica 9 prikazuje sljedeće vrijednosti: zbroj kvadrata, broj stupnjeva slobode i odstupanja rezultata od njihove aritmetičke sredine za analizu različitih skupina (između skupina) i analizu istih ispitanika (sa skupinama). U ovoj nas tablici posebno zanima stupac vjerojatnosti p (u tablici, zadnji stupac, označen sa Sig.). Za četiri zavisne varijable (Koristim pametni telefon neposredno prije odlaska na spavanja; Nikada neću odustati od korištenja pametnog telefona čak i kada to utječe na moj svakodnevni život; Neposredno nakon buđenja pregledavam obavijesti, sadržaje, poruke na pametnom telefonu) vjerojatnost je manja ili jednaka .05, što znači da za ove varijable postoje statistički značajne razlike između aritmetičkih sredina. Da bismo odredili koja se skupina razlikuje od kojih skupina, prikazano je u Tablici 10. Višestruke usporedbe, koje također navode statističku značajnost razlika između svakog para grupa, Stupac Srednja razlika (I-J) navodi te razlike koje su označene sa * statistički značajne.

Tablica 9

U Tablici 7 prikazane su aritmetičke sredine za svaku skupinu ispitanika. U našem slučaju, iz Tablice 9 ANOVA (stupac Sig.), uočeno je da je za četiri varijable vjerojatnost manja od 0,05, tj. pokazuje se da su rezultati u tim skupinama statistički značajni.

Tablica 10

Nadalje, tražila se razlika u odgovoru oko tvrdnji pojedinih ispitanika. To je učinjeno primjenom aritmetičke sredine i standardne devijacije (Tablica 11).

Tablica 11

Osim toga, određen je i hi-kvadrat test. Odnos između dviju varijabli ispitan je primijenjenim hi-kvadrat testom. Temelji se na križnoj tablici u kojoj se kategorije jedne varijable (godina života) križaju s kategorijama druge varijable (svih devet zavisnih varijabli). Dobivene hi-kvadrat vrijednosti prikazane su u Tablici 12.

Tablica 12

Da bi vrijednost hi-kvadrata bila značajna, mora biti veličine Sig. 0,05 ili manje. Donje tablice prikazuju vrijednosti hi-kvadrat testa. Iz tablica 7 – 15 vidljivo je da je samo pet hi-kvadrat vrijednosti značajno za čestice 7, 10, 11 i 14. Ostalih sedam hi-kvadrat vrijednosti veće su od 0,05, na temelju čega se može zaključiti da nisu statistički značajne.

Dobivene su vrijednosti o korištenju pametnoga telefona neposredno prije spavanja (Tablica 13) prema dobi i sljedeći podatci koji pokazuju da prije spavanja telefon najviše koriste ispitanici u dobi od 20 do 25 godina (51,7 %). Ukupno 61,1 % ispitanika u potpunosti se slaže, a 26,8 % ispitanika slaže se s tvrdnjom da koriste pametne telefone neposredno prije spavanja. Vrijednost hi-kvadrat testa $\chi 2 = 332{,}345$ df (4), $p = 0{,}000$. Dobiveni podatci mogu se smatrati statistički značajnim.

Tablica 13

Podatci dobiveni na temelju tvrdnje da ispitanike tijekom noći budi zvuk na pametnom telefonu, ukupno 4,5 %, odnosno 7,5 % ispitanika u potpunosti se slaže te slaže da ih tijekom noći budi zvuk pametnoga telefona, a od toga je najviše ispitanika u dobi od 20 do 25 godina. Više od polovice ispitanika (59,6 %) odgovorilo je da ih zvuk na pametnom telefonu budi tijekom noći, a to se također najviše odnosi na ispitanike u dobi od 20 do 25 godina (49,1 %). Bez obzira na niži postotak od ukupno 12 % svih ispitanika koje pametni telefon budi tijekom noći, treba uzeti u obzir da im on remeti san i kvalitetan odmor tijekom noći. Vrijednost hi-kvadrat testa $\chi 2 = 285{,}341$ df (4), $p = 0{,}000$. Dobiveni podatci mogu se smatrati statistički značajnim.

Ukupno 16,2 % svih ispitanika pregledava sadržaj na pametnom telefonu tijekom noći kada se probudi, a to u potpunosti čine ispitanici od 20 do 25 godina, 7,0 %. Vrijednost hi-kvadrat testa $\chi 2 = 117{,}775$ df (4), $p = 0{,}000$. Dobiveni podatci mogu se smatrati statistički značajnim.

Tablica 14

Pametni telefon tijekom noći u svojoj neposrednoj blizini ima ukupno 44,4 % ispitanika (Tablica 14). Više od polovice (52 %) ispitanika mlađih od dvadeset godina u potpunosti se slaže s tvrdnjom. Vrlo je mali postotak svih ispitanika (6,8 %) koji se u potpunosti slažu s tvrdnjom. Vrijednost hi-kvadrat testa $\chi 2 = 168{,}000$ df (4), $p=0{,}000$. Dobiveni podatci mogu se smatrati statistički značajnim.

Tablica 15

Ukupno 22,7 % ispitanika odgovorilo je na pitanje da se nikada ne bi odrekli pametnoga telefona čak ni kada im je već uvelike utjecao na život (Tablica 15), dok se 19,2 % ispitanika u potpunosti ne slaže s ovom tvrdnjom. Utvrđeno je da je 27,9 % ispitanika dalo neutralan odgovor, što može ukazivati na nesigurnost ili možda nedovoljnu svjesnost o utjecaju pametnih telefona na njihov svakodnevni život. Vrijednost hi-kvadrat testa $\chi 2= 48{,}412$ df (4), $p=0{,}000$. Dobiveni podatci mogu se smatrati statistički značajnim.

Tablica 16

Ispitanici, njih ukupno 74,3 %, naveli su da im pametni telefon služi kao budilica (Tablica 16) pa se može zaključiti da ovi ispitanici ne koriste analogne ili digitalne budilice, što također može ukazivati na to da je pametni telefon u njihovoj neposrednoj

blizini. Kao budilicu pametne telefone najviše koriste ispitanici mlađi od 20 godina (92 %), zatim ispitanici stariji od 20 godina i mlađi od 25 godina (73,8 %). Najmanje ga kao budilicu koriste ispitanici stariji od 30 godina, iako dobiveni podatci pokazuju da ga koristi više od polovice ispitanika te dobi. Može se zaključiti da sve mlađe generacije koriste pametne telefone umjesto budilica. Vrijednost hi-kvadrat testa $\chi2 = 505{,}041$ df (4), $p = 0{,}000$. Dobiveni podatci mogu se smatrati statistički značajnim.

Tablica 17

Odmah nakon buđenja 78,5 % svih ispitanika (Tablica 8) pregledava obavijesti, sadržaje, poruke na pametnom telefonu. To većinom čine mlađi ispitanici (manje od 20 godina), od kojih se ukupno 40,0 % ispitanika slaže s tvrdnjom, a 56 % se u potpunosti slaže. Ukupno 22,2 % ispitanika starijih od 30 godina slaže se u potpunosti s tvrdnjom. Vrijednost hi-kvadrat testa $\chi2 = 36{,}119$ df (12), $p = 0{,}000$. Dobiveni podatci mogu se smatrati statistički značajnim.

Ujutro se često budi umorno 19,6 % ispitanika, a najviše se bude umorni ispitanici koji imaju manje od dvadeset godina (28 % se u potpunosti slaže s tvrdnjom te 20 % se slaže s tvrdnjom). Mogli bi se zaključiti da se bude umornima upravo iz razloga jer imaju pametni telefon pokraj sebe, noću pregledavaju poruke te ih budi zvuk određenih aplikacija što može rezultirati umorom, neadekvatnim snom, prekidom sna… Iako dobivene vrijednost hi kvadrat testa iznose $\chi2 = 16{,}498$ df (12), $p = 0{,}169$ te se podatci ne smatraju statistički značajnima, trebalo bi svakako voditi računa te educirati mlađe populacije da tijekom odlaska na spavanje i barem dva sata prije ne koriste pametni telefon te da ga tijekom noći ne drže u neposrednoj blizini, a ako ga već moraju koristiti kao budilicu, iako bi bilo bolje nabaviti budilicu, neka stave postavke na zrakoplovni način rada.

Ukupno 22,9 % ispitanika se u potpunosti i 16,8 % ispitanika se slaže s tvrdnjom da ujutro teško prate nastavu. Dobiveni podatci mogu ukazivati da bi jedan od razloga mogao biti vezan za uporabu pametnih telefona tijekom noći. Nedovoljno sna utječe na raspoloženje, koncentraciju, a samim time moguće je da je i kod pojedinih ispitanika upravo to razlog za teže praćenje nastave u jutarnjem terminu. Vrijednost hi kvadrat testa $\chi2 = 5{,}191$ df 42), $p = 0{,}268$.

## Diskusija i zaključak

Jedan je od zahtjeva uporabe ICT-a (Ružić-Baf, Kadum, Damić, 2020) da čovjek ubrzava određene radne procese i pritom dobije na vremenu, tj. ostaje mu sve više slobodnoga vremena. Međutim, nažalost, kod mnogih je pojedinaca suvremena tehnologija učinila upravo suprotno.

Neprimjerena uporaba mobilnih (pametnih) telefona za posljedicu ima i negativne implikacije na zdravlje pojedinaca. Vezu između nesanice i uporabe mobilnih telefona proučavali su autori koji su došli do zaključka da nesanica (Fossum, Nordnes, Storemark i sur., 2014; Exelmans i Van den Bulck, 2016 ), dnevna pospanost, jutarnja pospanost i kronotip spadaju u najčešće neželjene učinke korištenja elektroničkih uređaja.

Učestala uporaba digitalnih tehnologija i mobilnih telefona utječe i na mentalno zdravlje studenata, depresiju, anksioznost, stres i dr. (Thomée, Härenstam i Hagberg, 2011; Matar Boumosleh i Jaalouk , 2017; Višnjić, Veličković, Sokolović i sur, 2018; Liu, Wing, Hao i sur., 2019; Kang, Liu, Yang i sur., 2020; Islam, 2021). Small, Lee, Kaufman i sur., (2020) navode da prekomjerna uporaba digitalne tehnologije utječe na funkciju mozga i ponašanje, te osim što ima posljedice na spavanje, očituje se i u nedostatku pažnje, ovisnosti o digitalnoj tehnologiji, poremećenom razvoju mozga i društvenoj izolaciji.

U istraživanju čiji su rezultati prikazani u ovom radu moguće je zaključiti da 87,9 % studenata koristi pametne telefone neposredno prije odlaska na spavanja, što su u istraživanju dokazali i Saling i Haire (2016) te da ukupno 75 % ispitanika na uzorku od 397 odraslih ispitanika barem jedanput mjesečno koristi pametni telefon nakon što su svjetla ugašena.

Kod 77,9 % studenata pametni se telefon tijekom noći nalazi u neposrednoj blizini, dok njih ukupno 12 % tijekom noći probude obavijesti na pametnom telefonu što se može povezati s remećenjem sna i utjecajem na cirkadijalni ritam te rezultirati jutarnjom pospanošću i težim praćenjem nastave u jutarnjem terminu.

Rafique, Al-Asoom, Alsunni i sur. (2020) također su dobili podatke koji pokazuju da 70 % ispitanika studenta na reprezentativnom uzorku od 1925 ispitanika mobilni telefon drži uključen pokraj jastuka, a svega 19,7 % ispitanika tijekom noći koristi zrakoplovni način.-

Kod 44,4 % ispitanika mobilni se telefon tijekom noći nalazi u njihovoj neposrednoj blizini. Kada se tijekom noći probude, 16,2 % studenata pregledava sadržaje na mobilnom telefonu. Abdalqader, Ariffin Ghazi i sur. (2018) navode da su faktori koji utječu na nesanicu kod studenata vezani uz učestalost pristupa društvenim mrežama, vremenu provedenom na društvenim mrežama posebno tijekom večeri i prije odlaska na spavanja te uporabi ostalih elektroničkih uređaja prije odlaska na spavanje.

Većini studenata pametni telefon služi kao budilica te im je ujutro neposredno nakon buđenja prva aktivnost pregledavanje sadržaja na pametnom telefonu. Dobiveni podatci pokazuju da se manji, ali ne i zanemariv postotak (19,6 %) ispitanika budi ujutro umorno, a nastavu ujutro teško prati 39,7 % ispitanika.

Može se zaključiti da je svakako potrebna edukacija na svim stupnjevima odgoja i obrazovanja. Prvenstveno je potrebno educirati roditelje djece vrtićke dobi o mogućim negativnim posljedicama prekomjerne uporabe pametnih telefona. Preporuka bi bila i edukacija koju bi proveo multidisciplinaran tim stručnjaka (pedagozi, informatičari, psiholozi, liječnici i dr.) studentima prve godine studija o mogućim štetnim posljedicama neprimjerene i prekomjerne uporabe pametnih telefona. Trebalo bi upoznati studente s uputama za „pametno korištenje pametnih telefona" (1. Odlaganje mobilnoga telefona tijekom noći u drugu prostoriju, a ako to nije moguće, uključivanje zrakoplovnoga načina; 2. Ne držati mobilni telefon tijekom noći u neposrednoj blizini; 3. Najmanje dva sata prije odlaska na spavanje ne koristiti mobilni telefon i ostale elektroničke

uređaje. Vratiti se navici čitanja, uvesti neke od tehnika opuštanja te pripremiti tijelo za odlazak na spavanje; 4. Umjesto korištenja budilice na mobilnom telefonu, koristiti digitalnu i/ili analognu budilicu; 5. Tijekom dana koristiti mobilni telefon samo kada je to nužno te odvojiti tijekom dana minimalno sat – dva sata bez korištenja mobilnoga telefona; 6. Provoditi što je više moguće vremena na danjem svjetlu, u prirodi, vježbanju i ostalim aktivnostima koje ne uključuju uporabu mobilnoga telefona; 7. Ograničiti i odrediti vrijeme za pregled sadržaja i objavljivanje na društvenim mrežama; 8. Ograničiti i odrediti vrijeme za pretraživanje informacija na internetu; 9. U slučaju „dosade" pronaći aktivnosti koje će zamijeniti uporabu mobilnoga telefona; 10. Voditi se načelom „manje je više", manje uporabe pametnoga telefona i ostalih elektroničkih uređaja, više doprinosimo zdravijem načinu života!

S obzirom na to da je istraživanje provedeno na uzorku studentske populacije, vidljivo je da mlađi studenti učestalije koriste pametne telefone u odnosu na starije kolege, što može dovesti do zaključka da sve mlađa populacija sve više koristi elektroničke uređaje, posebno pametne telefone. Kako je većina ispitanika odgovorila je da se tijekom noći pametni telefon nalazi u njihov neposrednoj blizini, svakako bi bilo mudro uređaj premjestiti u drugu prostoriju i zamijeniti ga digitalnom ili analognom budilicom te bi se upravo tim vrlo jednostavnim i svima dostupnim rješenjem izbjeglo izlaganje svjetlu uređaja neposredno pred spavanje (pregledavanje poruka, društvenih mreža i sl.), buđenje zvukovima aplikacija, poziva, poruka i sl. tijekom noći, ujutro bi se budili odmorniji, a time bi i na jutarnjoj nastavi bili koncentriraniji, no to su svakako implikacije za moguća buduća istraživanja.