

**Smartphones in Sports
and Physical Activities
of Adolescents**

Štefan Adamčák – Pavol Bartík

2021

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Activities of Adolescents**

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PREFACE

Nowadays, mobile technologies considerably affect everyday life. The use of digital technologies brought changes which influenced every aspect of human life. They replaced or significantly made some human activities easier. These facts have led to discussions on what competencies a 21st century person should possess. The definition of new skills, needed for the survival of human descendants in the society of the 21st century, must be urgently reflected in teaching innovation. The introduction of new forms of education where digital technologies will become integral part of teaching has become a priority. Nowadays, digital technologies form an important part of pedagogical skills. The use of mobile technologies in education has positive and negative aspects. Perhaps the most significant negative aspect of mobile technologies is the fact that the time spent on smartphones and computers has increased at the expense of children and young people's activity. Exercise and physical activities positively affect physical health and condition. They also have very important social, communicational, psycho-regenerative, and psycho-relaxing benefits. These benefits positively affect the mental state because they prevent stress, negative emotions, and more undesirable phenomena. Because of these reasons, the survey focused on the use of smartphones during sports and physical activities performed by adolescents. This scientific monograph shows the results of the survey, which might contribute to solving the problem of lack of sports and physical activities in adolescents' lives.

Authors

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INTRODUCTION

This monograph deals with sports and physical activities in adolescents' lives with the use of modern technologies, specifically smartphones. In the field of physical activities, the applications considered are those which are appropriate, financially undemanding, and user-friendly, which allow evaluation and monitoring of individual or group activities, as well as sports activities in a very simple way. The applications discussed offer, in addition to monitoring, also the option of creating various goals or challenges – competitions with the possibility of comparing participants (pupils) with each other, for example number of steps in a selected period, distance covered, burnt calories, etc. The theoretical part of monograph is focused on the problematic period of adolescence. It is characterized in terms of physical, motor, emotional, psychological, and social changes. The next part deals with modern digital and mobile technologies in terms of their use in the educational process. The content of the next chapter on the theoretical analysis of the issue is the importance of sports and physical activities for adolescents, and the quantitative and qualitative aspects of physical activities. The second chapter defines the aim and function of the survey. The third chapter covers the survey methodology. The core of monograph is in the fourth chapter, where the results of the survey are presented. Figures and tables with comments were used for better clarity. The important part of this monograph is the conclusion and recommendations.

1 THEORETICAL FRAMEWORK

1.1 Characteristics of the adolescent period

Human's personality development is an uninterrupted, continuous process which several authors have dealt with and is the most discussed topic in the field of developmental psychology, that studies a human being from birth until death. This whole process is formed from a sequence of qualitatively different developmental stages, which may be psychologically and reasonably described and characterised (Šimíčková–Čížková et al., 2010). As Gáborová–Porubčanová (2017) state, human development is affected by genetic factors – which can develop to their potential, while also being affected by people who surround them, the social and cultural environment in which they live, as well as their own actions that use, develop or even suppress these influences.

Baštecká–Goldman (2001) state that nowadays, every person and thus every developmental period is perceived in a bio-psycho-socio-spiritual context. This concept points to 4 basic levels on which a human can be observed, which shape and affect them during certain years of their life. The first level is biological, which defines basic constitutional factors – it concerns genetic factors and body composition, including all the physiological characteristics. The second is the psychological level, which points to a human's psyche, i.e. to an individual's personality, their behaviour, and emotions. The third is the social level, which perceives a human as a being living in a certain environment, in a certain culture and country, while simultaneously describing a human's relationships with other people. The fourth and last is the spiritual level, which is distinguished in a human's faith in the widest sense.

Klíma (2016) divides childhood into seven periods – these include the prenatal, new-born, infant, toddler, preschool, school-aged and adolescent periods. Klíma also adds that during all these seven periods, the development of postural activity occurs, while the extensive knowledge available on kinesiology in individual periods can allow a classification of deviations from physiological development and at the same time study the quality of physical activity.

The word adolescence comes from a Latin word “adolescere”, which can be translated as ‘to mature, to grow up’ or ‘to get bigger’ (Macek, 2002). The term adolescence can be defined in many ways based on various psychological theories which specialize in a certain field. Vágnerová (2012) offers several definitions in her publication.

It is a period of searching, reassessing, managing one’s own transformation, the goal of which is to achieve an acceptable social status as well as to create a subjectively satisfying, more mature form of one’s own identity (Vágnerová, 2012). This period lasts from the ages of 10 to 20 and the author herself divides adolescence into early adolescence, i.e. pubescence, which lasts from around the ages of 11 to 15. She then calls the second phase of maturing late adolescence, lasting between the ages of 15 to 20. According to Merrick et al. (2014), adolescence is a period in a human’s life where the transition from a child to an adult takes place during the course of roughly one decade and the beginning of puberty, between the ages of 10 to 13, is considered to be the beginning of adolescence.

Pavlas–Vašutová (1999) state that it is a period lasting from the ages of 11–12 to 20–22 and apart from early and late adolescence, they also describe middle adolescence which they specify as the ages between years 13–14 and 15–16. Macek (2002) also divides the adolescent periods into 3 intervals: early adolescence (ages 10 to 11–13), middle adolescence (ages 14–16) and late adolescence, taking place from age 17.

Gáborová–Porubčanová (2017) state that in accordance with Slovak laws, an individual becomes legally an adult upon reaching 18 years of age. According to cited authors, maturity is marked by definitive criteria: selecting an occupation (studying at a university or getting employed), choosing a life partner, gaining independence, independent decision-making, emotional balance, rational assessment of life situations, targeted problem solving, forming one’s own opinions and stances, moral code, value orientation, social integration, and critical thinking. An adolescent becomes an adult and reaches full development not just from a physical point of view, but also in the psychological and social areas. Even according to Vágnerová (2012), finding and developing one’s own identity, as well as finding one’s place in society

happens during the last phase of adolescence. According to Šimíčková-Čížková et al. (2010) the transition into adulthood can shift a few years later based on the difficulty of the requirements of adulthood. An adolescent can become an adult from a legal point of view (by reaching 18 years of age) or by becoming independent from their family (by having their own job, by having their own financial resources).

1.1.1 Physical and motor changes during the period of adolescence

During the period of adolescence, the adolescent's body undergoes physical transformation, which tends to be strongly experienced because radical changes in appearance take place (Vágnerová, 2012). This "appearance" is a social representation of their own identity, it is the initial information which any other human acquires from the said individual, which eventually changes the behaviour of the people whom an individual is in contact with. An adolescent individual will also look at themselves based on how their community reacts to an adolescent individual's physical changes.

According to Jánošová (2016), biological changes are usually common for early adolescence. Its inception begins with the arrival of physical maturity and its end is set by reaching biological adulthood. Girls generally reach this period sooner than boys.

Noticeable differences in height have been discovered around the age of 13, when growth spurt in boys starts taking place (Kopecký et al., 2014). From the point of height, they start to tower over girls in this age category. This growth superiority in favour of boys continues until the age of 18, and the researched differences have been statistically significant. Říčan (2014) states that an average boy, whose height is 171cm at the age of 15, will grow to 178cm at the age of 18. For girls, the growth in the same age category is less, from 164cm (age of 15) to 165cm (age of 18).

As for individual body parts, their growth is uneven – their upper and lower limbs initially grow faster, which causes physical imbalance – adolescents seem clumsy and awkward (Langmeier-Krejčířová, 2006).

As for body weight, significant differences have been recorded from the period of age 13 based on gender, while these changes had an increasing tendency. Kopecký et al. (2014) states that while the body weight difference between boys

and girls was only 0.47kg at age 6, at age 13 it was 3.44kg and at age 18, this difference reached 12.47kg. Stated differences in body weight of boys and girls are caused by different body compositions.

Boys have an increased growth of skeletal muscle and an overall increase in skeletal size, which causes a decrease in the fat component. Girls, on the other hand, experience an increase in body weight caused primarily by a rise in the body fat percentage. Janda–Šafářová–Vechtová (2011) describe that the adolescent period is also very prone to weight extremes – on one hand 13% of adolescents were overweight and on the other hand 21% of adolescents were underweight, according to research. Hirošová et al. (2016) has also discovered in her research a prevalence of overweight and obesity in an aggregate of 2,629 adolescents, from which 30.7% boys (13.1% of them obese) and 22.9% of girls (7.9% of them obese) were overweight. Langmeier–Krejčířová (2006) state in their publication that during the ages of 15 to 22, there is a significant difference in the body composition of girls – their figure plumps up while boys' muscle mass becomes more prevalent. These differences contribute to boys' and girls' interest in their appearance.

Jansa (2000) describes the differences between girls and boys during this age period as follows:

- ✓ girls – women have narrower shoulders and wider hips, body fat is distributed into buttocks and thighs, their walk is typical for being light and flexible, but their ligament system becomes weaker
- ✓ boys – men's musculature is stronger and more developed; their figure is bigger and taller with wider shoulders and narrower hips. Fat is mostly distributed around the abdominal region

Within the increase of muscle mass, the development and performance of heart and lungs occurs, while bones and tendons strengthen.

From the developmental point of view, motor activity during the ages from 11 to 14 is considered to be the most turbulent phase of a child's transformation into an adult. It clearly manifests in uneven development, while motor activity is being affected by all the growth unevenness in the organism. This phenomenon manifests especially in coordination skills. Negative effects in

motor activity reach their peak on average at age 13 for girls and one or one and a half years later for boys. Individual developmental differences are considerable during this period. It turns out that in girls, negative effects in coordination are not as large as in boys (Laczo, 2013). In the second phase – after the age of 14, the accentuation of male and female anatomical features occurs and the specifics of male and female motor activity manifest. More considerable differences between girls and boys in all the motor performance indicators start manifesting.

During the pubescent period (Hrabinec et al., 2017), a decrease in coordination performance occurs in girls (ages 11–13), as well as in boys (ages 13–14). At the same time, balance skills tend to worsen as a result of fast and uneven bone growth. This causes the deterioration of joint and muscle elasticity. On the other hand, a high level of learning ability occurs during the ages of 11–12. Towards the end of pubescence, during the ages of 12–14, the disharmony in motor activity development is not yet completed.

Čelikovský et al. (1981) states that in terms of motor development of adolescents during the second phase (after the age of 14), the movements, compared to the previous developmental period (ages 10–13) are overall smoother, more accurate, more economical, and more aesthetic. Adolescents also reach relatively higher levels of performance. At the end of this period, the highest development of speed abilities, fitness and agility occurs. The author also adds that the differences in motor activity of boys and girls significantly deepen during the adolescent period. These come from anatomical, functional, and psychological distinctions.

According to Měkota (1988), through regular stimulation, adolescents practicing sports can achieve additional intensive growth in coordination abilities between the ages of 16–18. The number of difficult motor skills from a coordination view and their degree of learning them depends on the rise of the level of static strength skills, whose intentional stimulation should start after pubertal acceleration. Strength skills in boys develop relatively quickly until the age of 18, after which their development is a little slower, while in girls this development is intense in the first adolescent phase, which is when they usually reach their maximum and in the next phase a decrease may occur

(Bursová–Rubáš, 2001). Boys can reach their maximum speed performance between the ages of 18–22, girls between the ages of 17–20. Around the age of 20, maximum individual stamina may culminate – although it is more common around the ages of 25–30.

In summary, Měkota (1988) defines this adolescent period as an integration stage of motor activity and the conclusion of motor development. It is a period of intense development of all the fitness and coordination skills. For the population not practicing sports, this period is a culmination of lifelong motor development. It marks the end of the differentiation of motor skills, with significant differences conditioned genetically and by an exercise regimen. Sak–Saková (2005) state that the peak of motor performance in the untrained population is reached relatively often.

1.1.2 Emotional and psychological changes during the adolescent period

For adolescents, significant changes also occur on an emotional level – a gradual “crystallisation” and stabilisation of character traits occurs (Vágnerová, 2012). A great number of hormonal changes occur in this period, the consequences of which are changes in the field of emotional experience. In many cases, adolescents cannot explain these changes and thus they perceive them primarily as negative and unpleasant. Compared with the previous life stage, their emotional reactions are of a far more intense, but shorter-lived and more changeable nature.

The adolescent period is oftentimes defined as a period of emotional instability, negative moods, and a period of crises. This is connected not just to hormonal changes, but also to a significant degree of self-reflection and self-evaluation (Vágnerová, 2012). Macek (2002) states that emotional instability usually occurs in individuals who have shown emotional instability as early as during childhood and their problems continue to “follow” them. This phenomenon is especially typical for boys.

Vágnerová (2002) is of an opinion that emotional deviations and fluctuations in behaviour are caused by an instability in the activation level. This alternates between excitement and passivity towards any activity. Differences in experiencing emotions may manifest in a more intense impulsiveness and a

decrease in self-control. Low tolerance, frequent mood swings and hypersensitivity have countless times contributed towards creating conflicts with their community. For the community itself, however, the behaviour related to frequent mood swings, impulsiveness, hypersensitivity and apathy is often unacceptable. Adults, parents, or teachers at school often feel as though the individual is ill-mannered, spoilt or that they have a need to provoke or bother others with their frequent moods. A fact which often confirms adults in this assumption is that adolescents do not have any good reason for their deviations in behaviour or their emotional instability. Adolescents are usually misunderstood, rejected and met with negative reactions from adults, which clearly lowers their sense of confidence (Vágnerová, 2012).

According to Vymětal (2004), boys tend to be louder, they try to be the centre of attention and their aggressiveness increases. Their interest in sex starts manifesting and their sexual tension increases. Girls shut themselves off, they are sensitive, their speech is sometimes louder too, and they love creating conflicts between themselves. Some friendships between girls and boys oftentimes have an erotic subtext as well. They indulge in dreams, where they play the role of a hero or a heroine and they wallow in their own experiences, their erotic and sexual fantasies. They are susceptible to “a black and white world view” and extreme conclusions. They tend to be extremely critical of their parents. During the adolescent period, the cognitive egocentrism and reductionism as a form of defence mechanism is strengthened. Vágnerová (2012) articulates it in the following points:

1. Adolescents have a tendency to polemise and be overly critical. These tendencies arise from a need to train and show their abilities and skills. They perceive a dispute with their argument as a sign of reluctance or limitedness, though not from a rational, but from an emotional aspect.
2. Adolescents succumb to the impression that their reflections are absolutely extraordinary and that they contemplate in a different way than others. It should be pointed out here that it is rather easy to influence an adolescent’s thinking in both positive and negative aspects.

3. Adolescents are oversensitive and touchy. In this way, adolescents feel as though they are constantly the centre of attention and criticism as well. These feelings are caused by immaturity, mental imbalance, and finally, the adolescent realises that in the end they are not so special as to be given an excessive amount of attention.

4. Adolescents reject exceptions and compromises. They are aware that general rules and principles exist, but they do not accept that these might not have to hold true in every situation. The abovementioned rejection comes from a need for cognitive certainty. If actualities are valid under any circumstances, they can bring reassurance to adolescents.

5. Radicality – for adolescents it serves as a mechanism against ambiguities, when they are not willing to respect the uncertainty of knowing as a stable and permanent state.

6. Adolescents are prone to rash action – these reactions can be wrong or illogical and the results of these actions are definite and affect the way adolescents think and act. They are not willing to admit that these actions might not be right. Tendencies towards these reactions are caused by inexperience, emotional imbalance, or an inappropriate emotional bias (Vágnerová, 2012).

Quality improvement occurs in the emotional area in relation to an adolescent's personality and with their social status. Deepening emotions manifest especially in feelings associated with love, aesthetics and morality (Kuric, 1986). Formulating the feeling of well-being during the adolescent period is a huge support for the adolescent not just during the currently experienced emotional crises, but also later in successfully managing difficult life situations (Komárik, 1999).

1.1.3 Social changes during the adolescent period

Growing up from the point of social integration tends to be defined as a period of a second social birth. Pavlas–Vašutová (1999) perceive two milestones in adolescence:

- ✓ the first milestone is finishing compulsory education,
- ✓ the second milestone is seen as finishing vocational training (with the exception of adolescents studying at a university).

Langmeier (1983) confirms this concept in his book and states that during adolescence, the individual's place in society changes, since the adolescent transitions from elementary school to high school or to a secondary vocational school. Heřmanová (2004) states that it is a period of an adolescent's gradual integration into occupations and of them gradually becoming independent. At the same time, they should learn how to carry out their civic duties and utilize their civil rights. Even Macek (2003) says that the adolescent period is also characterised as a change in stances and relationships as a consequence of a change in cognitive processes, a new way of thinking and emotionality. The relationship not just with oneself but also with other people and the world itself changes significantly. Even if the process of becoming independent and the differentiation in relationships is smooth during socialisation, the adolescent period is in many ways significant for acquiring later adult roles – the roles of a partner, a family member, a friend, and a worker.

A turning point in social status is mainly marked by finishing compulsory education and taking further professional education. It is a deciding factor in the subsequent choice of an individual's life and their social status. Social development is influenced by an individual's social spheres, which are connected to acquiring or developing roles, which can be both developing or endangering for the individual. It can be the role of a member of a group which an individual associates with, the role of a friend, the pre-professional role, or the role of a partner (Vágnerová, 2012).

A greater designation of gender roles also occurs in adolescent period. The society places different demands on adolescents based on their sex. Adolescents themselves are aware of this pressure, which is why they are trying to take up their role in society based on that. The development of these roles is greatly affected by media and culture itself. In media, male and female roles are presented according to societal standards, which should be adopted by an individual and they should abide by them. Stereotypical behaviour of gender roles set in advance can be seen quite often in advertisements (Thorová, 2015).

Vágnerová (2012) is of the opinion that the following roles are generally important for the adolescence age:

- ✓ pre-professional roles of a student or an apprentice, which lead to achieving a certain social position. If it is aligned to an adolescent's skills, it can have personal significance too
- ✓ professional roles, which are prerequisites in achieving both economic and social independence
- ✓ member's role in a group, which the adolescent associates with and thus gains a certain social identity, usually losing its significance towards the end of adolescence
- ✓ close friend's role, whom one can rely on and with whom one may share many adventures and experiences
- ✓ partner's roles, which satisfy the needs of a close, emotional, and sexual relationship, though they oftentimes saturate into self-realisation as well

These roles (Jánošová, 2008), however, are not yet set in stone. Roles acquired in adolescence can be of different importance, value, or, on the contrary, they can be rejected for being acquired too early or for being restricting. In the beginning of adolescence, the first significant change already takes place, when an adolescent leaves their familiar social group of peers and finds themselves in a new and unknown social group. They arrive in a new social environment, they have to become accustomed and adapt to it, while new social roles, as well as new experiences come with the new social environment. The development during middle adolescence between the 15th and 16th year forces an adolescent to cope with the given roles by themselves.

The process of creating one's own identity represents an adolescent's individualisation and Vágnerová (2012) divides it into four phases:

- ✓ The differentiation phase – in this phase, relationships with adults and especially with parents change. The adolescent doubts their opinions and values, the need to distinguish oneself from previous experiences is strengthened by the fact that they no longer see their parents as “omnipotent” as before.
- ✓ The experimentation phase – typical of early and late adolescent period. This period is characterised by experimenting with one's own emancipation, rejecting excessive subordination towards

adults and a gradual deepening of relationships with peers. Adolescents reject parents' advice and warnings and find the truth in their peer group.

- ✓ The gradual stabilisation phase – during late adolescent period, the relationships with parents are being resolved and stabilised. It is a display of a certain independence and maturity when the adolescent does not have the need to oppose. It can alternate between rejecting and binding oneself back to family. In the end, the situation during this phase calms down and the adolescent eventually finds a way to get along and communicate with their parents.
- ✓ The psychological independence phase – breaking free from dependency on family occurs. The transformation into complete independency and the particular shaping of one's own identity confirms the uniqueness of their personality and the development into an almost adult individual.

According to Thorová (2015), peers are very important for the adolescent. Rivalry, as well as better understanding of each other occurs between them. Adolescents desire their peers' acknowledgement, closely observing how others are evaluated and they control their next behaviour according to their feedback. An adolescent succumbing to the influence of their peers at an increased rate is considered to be one of the typical signs of this period. At the same time, they are very sensitive to rejection. Group identity plays a more important part here. Through its already defined features, it helps adolescents in overcoming "the insecurity period" and indecisive personal identity.

An adolescent's success in interpersonal relationships is the cornerstone of their self-confidence, their feeling of autonomy, as well as a standard for independence during their decision-making (Macek, 2003). Communication skills play an important part here. Their development is a strategic aspect of interpersonal relationships. If an adolescent learns these skills, they have no problem with internal tension, because they vent it during activities with their peers and they do not fall into conflict with authorities as much. They are

more confident in starting close relationships, which leads to greater self-assurance, emotional support, and consciousness regarding social prestige.

At the end of the adolescent period, distancing from the peer group occurs, the individual has their own opinions and norms and no longer accepts everything uncritically which is expected in the group or party (Skorunková, 2008).

Adolescents' relationships towards adults (Gáborová–Porubčanová, 2017) are significantly affected by whether they gained economic independence. If they have not, these relationships are usually quarrelsome.

According to Thorová (2015), parents are needed even during the adolescent's development, while gradual development towards autonomy and gradual emancipation takes place. It is mainly about explaining boundaries, sharing values and support in decision-making. The core aspect of social development is the transformation from a child-parent relationship, while the vertically arranged relationship moves into a horizontal position. The relationship based on dependency and orders transforms into a relationship of mutual support, respect, and cooperation. An adolescent often tries to gain independence despite parents' protests, who have more and more requirements and demands on an adolescent. On the other hand, they are unwilling to give them more rights and independence, all the while treating them as children. For parents, it is easier to forbid and order around rather than to have an adult discussion.

Vágnerová (2012) states that during the adolescent period, the relationship with parents is developing when an individual undergoes a distancing from being bound to family. This process is considered to be difficult not just for parents, but for adolescents themselves. Adolescents resist being manipulated and dictated to by their parents. They work towards removing this restricting tie and start making their own decisions. Thanks to this unbinding from family, the individual has a chance to start new relationships, which will later become the foundations of their new environment. Gaining independence is also tied to a change in the feelings towards parents. However, this change does not usually lead into a destruction of emotional ties, as many parents fear. Mutual dependency is compensated by a more mature emotional

relationship. Distancing from family is not always easy. According to Langmeier–Krejčírová (2006), emancipation from family is easier if the relationships between adolescents and parents are surer and less quarrelsome.

During the adolescent period, an interest in the opposite sex increases as well (<http://cloud5e.edupage.org>). At first, the adolescent is unwilling to start relationships, it is a time of first playful contacts, when erotic fantasies and platonic loves are at the fore, which bring strong internal experiences. “True” loves are preceded by love focused on idealised people, such as singers, actors, and sportspeople. Adolescents are interested in questions concerning how to kiss, how to “pick up” a boy or a girl and when to have sex for the first time. Serious sexual relationships are even more special in this.

Jedlička (2017) states that the existence of a positive role model or models is an important source for positive socialisation. Adolescent should have a person in their life who would guide them through important stages of life. A person who would show them how they should act in certain situations and how to resolve interpersonal conflicts and crises. An adolescent should have this “guide” as early as from birth. Their presence and preparation in adult life should help the adolescent in integrating themselves into the social role of an adult and well-rounded human.

1.2 MODERN DIGITAL AND MOBILE TECHNOLOGIES

1.2.1 Basic characteristics

The term **modern technologies** covers information and communication technologies as well as the use of their specific options and procedures. Information and communication technologies that appeared in the second half of the twentieth century differ from the previous technologies in the following points:

- ✓ digital information coding
- ✓ using the same communication channels to transfer information of different purpose and nature
- ✓ using computers for automated information processing

Průcha et al. (2013) state that modern technologies can be understood in relation to education as the modern means of didactic technique, didactic programmes and the forms of teaching inspired by them. Riedl (2003) holds the opinion that the young generation takes the speed of information and communication technologies development for granted – and Prens ký (2005), considers the young generation to be the so-called digital natives. Nowadays, it is necessary for pupils and students to use modern technologies – e.g., distance learning. (Adamčák-Marko, 2021). It means that pupils and students must acquire a lot of information and will have to continue educating themselves in this field or possibly work in an online work team after graduating. Various publications – like Stoffová (2000), Stoffová-Tóth, and others point out that using these technologies is spontaneous, motivating and entertaining for children.

Kalaš et al. (2013) understand **digital technologies** in relation to education as an extensive set of means, tools and procedures coming from the field of computers and communication which are used to help with teaching, learning, communication, collaboration, expression, or creation. They classify digital technologies in two ways:

- ✓ standard (which distinguishes hardware, software and their subcategories)
- ✓ purpose of the digital technologies

Based on their purpose, they further divide digital technologies into tools focused on these areas:

- ✓ research and exploration
- ✓ construction
- ✓ recording
- ✓ communication
- ✓ role-playing
- ✓ supporting special educational needs (Kalaš, 2011).

Neumajer et al. (2015) state that digital technologies brought changes that affected all the areas of human life. It significantly facilitated or replaced some human activities, and for that reason, some of them stopped being relevant or they don't meet the requirements of the modern world anymore. This led to speculations on what skills a 21st-century person should possess. Acquiring new skills necessary for the survival of our descendants in the 21st-century society should also be reflected in the innovation of education. From this aspect, the introduction of new forms of teaching using digital technologies as an integral part has become a priority.

Göksu-Atici (2013) define the term **mobile technologies** as an extensive spectrum of continuously evolving digital devices. Laptops, tablets, smartphones, netbooks, e-book readers, GPS devices, smartwatches, and others can be included in this category. Online communication with other devices via Wi-Fi or Bluetooth is the central function of all the devices.

According to Veřmiřovský (2015), in theory, it is possible to consider all portable devices as mobile devices. They are relatively small and light for a person to carry easily. Laptops, tablets, mobile (smart) phones, MP3 and MP4 players, USB flash drives, e-readers and other devices can be included in this category. Techopedia website (www.techopedia.com) defines mobile devices as follows "a mobile device is a pocket-sized tablet or other device designed for portability and therefore is compact and lightweight. It includes new and innovative technologies for storing, processing, and displaying data in a small, portable design, which has allowed these small devices to manage almost everything that had been traditionally possible only with large personal computers. Mobile devices are also known as pocket PCs. Nowadays, mobile

technologies significantly affect our everyday life. Mobile technologies help us with these daily activities (www.bbonline.sk):

- ✓ **mobile payments** - despite the majority of Slovaks paying with a debit card, more and more innovative people are starting to use their mobile phones or smartwatches. Mobile payments require three things: a smartphone with an NFC chip, a suitable application depending on the operating system, either Apple Pay or Google Pay, and a bank account which supports this type of payment. The payment itself is comfortable, practical, and safe. It is possible to turn off the NFC chip when not making a payment to avoid possible theft.
- ✓ **online shopping** – nowadays, the majority of people prefer to use a mobile phone versus a desktop to browse the internet. This fact was observed by almost everyone concerned. Therefore, it is not surprising that more and more Slovaks place their orders using only their smartphone instead of visiting e-shops via smartphones and placing an order on the desktop. E-shops are not the only place where we make purchases via mobile phones. It is also possible to buy a train ticket online, book a plane ticket, hotel room or pre-order a concert ticket. All you have to do is visit the right website or download a suitable application.
- ✓ **navigation** – mobile technologies facilitate our everyday life also while travelling. Nowadays, barely anyone navigates an unknown region using a paper map. Options provided by navigation are often used. Navigation applications are also often used to find an address. Navigating using a mobile phone is much easier than asking strangers for directions. Navigation is also used by individuals during different types of hiking (Adamčák et al., 2016) to determine:
 - ❖ coordinates and altitude of an outpost
 - ❖ azimuth to the destination
 - ❖ distance and time needed to reach the target
 - ❖ travelled distance and time of the march

- ❖ other data depending on the device used
- ✓ **learning-education** – education was also positively affected by mobile applications. Schnierer (2020) states that during Covid 19, when it was clear that forced holidays will take more than two or three weeks, online classes have been slowly integrated by almost every school. Teachers connected with and taught students online. They were meeting with students via various communication platforms like Skype, Teams or Zoom.
- ✓ **entertainment** – one of the most affected areas of our lives affected by mobile phones is entertainment, which can be divided into different areas. The first area is games – there are thousands of them from the simple to the difficult ones, free, paid and of different characters. Watching TV via mobile is becoming more and more popular. All you have to do is to pay for a service that allows you to watch TV on a smartphone and download a suitable application. Mobile technologies also offer playful activities related to physical activity. These include e.g., Geocaching, Graffiti, Challenges and many more.
- ✓ **social network-communication** – does not belong to mobile technologies, but without the smartphone boom, they would not be as successful as they are now. Their undeniable advantage is that they combine almost every aforementioned field. We use social networks for entertainment, shopping, learning and we spend a lot of our free time there.

We need enough mobile data and adequate speed to secure flawless functioning of all these possibilities. It depends on the operator, service pack, but also location, type of mobile phone, weather conditions and obstacles (buildings, etc.).

Nowadays, the most used mobile devices are GPS devices, laptops, tablets, smartphones, but also smartwatches, which are not only used in free time, but also in classes and for education (Adamčák-Marko, 2021).

1.2.2 Utilization of modern digital and mobile technologies in an educational process

According to Fedork (2013), digital technologies are an important part of pedagogical skills. They have a big impact on the quality of the teaching and support of innovations in education. The educational system was characterised by oral and written forms for hundreds of years. This type of education is still present, but it is supported by other tangible and intangible assets needed to fulfil the teaching goals.

Sak-Mareš (2007) state that the integration of digital technologies into classes is affected by many factors:

- ✓ according to the authors, state policy on IT in education is one of the limiting elements
- ✓ integration of information and communication technologies into the curriculum, the approach of the school towards information and communication technologies and how well the school is equipped with modern technologies (including connection to the internet)
- ✓ the approach, interest, and willingness of teachers in information and communication technologies and their ability to work with them
- ✓ availability of programmes and applications that can be used in teaching (Neumajer, 2008)

Mišút-Pokorný (2015) have proved that appropriate utilization of information and communication technologies increase the efficiency of learning. According to their research, around 22% of the students prefer traditional lectures, 20% prefer online classes and 58% prefer a combination of both.

The main question in terms of digital technologies utilization in education is developmental adequacy, suitability, and applicability of the digital product (Koreňová, 2016).

Implementation of new, modern forms of teaching, more suitable for the goals and requirements of education has opened a discussion related to the "new literacy" problem. The traditional term literacy, which includes basic skills like

reading, writing, and counting, is not sufficient in today's world. According to the author, functional literacy is also not a solution for this problem. Digital technologies demand new specific, so-called digital literacies.

Digital literacies are:

- ✓ Information and communication technologies literacy – technical knowledge and the ability to operate computers and computer programmes
- ✓ internet literacy – orientation and meaningful use of the internet and complex approach to digital networks environment
- ✓ informational literacy – obtaining information, navigating through it and its processing
- ✓ medial literacy – knowledge and the ability to interpret, use and create medial announcements. This is closely related to their application in practical life, whereby a critical approach must also be considered (Neumajer et al., 2015).

When it comes to digital technologies, Moravec (2015) puts the emphasis on creativity at work and informal learning. Digital technologies should be invisible at school, which means they should be an integral part of the environment for pupils and students to discover their way to education.

In the publication *Učme sa s tabletom (Let's learn with a tablet)* (Neumajer et al., 2015), he argues that it is imperative to perceive digital technologies as a product of human culture and technology. They contribute greatly to the nature of our society and the lives of all the people – school life included. He also states that technologies are not neutral, because they have been the cause for a whole range of changes in education and have allowed activities that otherwise would not have been possible without them.

Bobot-Jakubek-Rurák (2012) state that pedagogical practice, just like any other practice in the national economy, cannot do without information and communication technologies. Initial enthusiasm, leading to the notion that it is a panacea for all kinds of difficulties related to education, has already waned. In the research, they add that even the biggest sceptics do not deny the contribution of information and communication technologies in education. First of all, information and communication technologies are tools that

facilitate obtaining, processing and presenting information while constantly evolving. Nowadays, they are everyday means for pupils to communicate, but also tools to process information, they are becoming a part of families and public life, and it is up to educators to effectively utilize this advantage.

Plowman-Stephen in their research (2007) point out that the effect of digital technologies in the teaching process can only be discussed if other types of active learning are applied with them.

Lynch-Varga (2016) state that digital technologies have found their position also in nursery schools over time. Children come in contact with them both in the family and their surroundings after being born, e.g., baby monitors, which transmit sound, and the more expensive ones also video images. The authors add that despite digital technologies playing an important part in contemporary society, it is strategic to critically consider their application in the upbringing and education of children.

According to Burger (2003), the application of modern, digital technologies in the school system means that students, as a part of the information society, will contribute to these areas:

- ✓ a society with a significantly higher quality of life
- ✓ the application of education trends presenting, e.g., cultural traditions
- ✓ providing more effective and transparent information from different scientific disciplines
- ✓ new management possibilities and more effective organisation of independent student and teacher activity within the educational environment and beyond
- ✓ cooperation with experts without their physical presence, distance cooperation, without the need for personal contact
- ✓ an economic evaluation of the educational process, e.g., terms of mutual contacts (travel, postal etc.)
- ✓ a more open society with support for democratisation and humanisation
- ✓ contact via videoconferences, cooperation in the exchange of information

- ✓ the transformation of education with an emphasis on interactive distance learning, online access to materials, virtual environments, etc

De Witt - Sieber (2013) state that it is possible to implement mobile learning through mobile technologies. Mobile learning represents educational processes implemented through portable technical devices that use a wireless network like Wi-Fi, Bluetooth, etc. Non-deterministic and flexible access to educational content and the possibility for mutual communication between all learners are considered an undeniable advantage.

Mobile technologies in education have many positive, but also negative aspects, which have been the subject of several professional or scientific studies.

Chromý (2007) considers the fact that mobile technologies help to develop the creativity and visual and communication skills of pupils a clear advantage. For that reason, new goals are emerging in the teaching process that were impossible to achieve using the old methods. This type of teaching supports the demonstrative transfer of ready-made knowledge. It develops cooperation and independence, initiative, critical thinking, creativity, communication, or empathy which are a priority in education.

Neumajer et al. (2015) state that mobile technologies may greatly impact:

- ✓ personalisation of learning
- ✓ higher engagement and participation of pupils and students
- ✓ satisfaction of pupils and students
- ✓ higher digital literacy
- ✓ the efficiency of teaching
- ✓ a change or redefinition of the curriculum
- ✓ cost reduction
- ✓ help in employability

The most significant **negative aspect of mobile technologies** is the fact, that the average time spent on smartphones and computers has increased at the expense of physical activity, which has also been recorded in children under the age of two (Mitchell, 2020). Kanálik (2020) states that Slovak parents let their children play on mobile phones for two to three hours a day. This has

been recorded in 28% of respondents. Almost 20% of school-age children spend over four hours a day on the internet and playing games. Parental control on electronic devices is an important factor used by 57.2% of Slovaks. He further states that the time spent on mobile phones or tablets by children has increased significantly, especially during the pandemic. Because of online classes, notebook or personal computer has become an essential means of communication with classmates and teachers for 78% of the surveyed students, and 56% of them use a smartphone, tablet or even TV as a tool for homework.

1.2.3 Smartphone, mobile application, characterisation and history

A **smartphone** in the IT dictionary is defined as "smart" because it is equipped with an operating system which allows users to use various features (<https://it-slovník.cz>). According to Neumajer et al. (2015), it is controlled primarily through the integrated display by fingers or by a stylus. The operating system (OS) allows users to install a variety of applications designed for immediate use and providing direct user interaction. The interaction takes place by using the touchscreen display or by many integrated sensors like a camera, microphone, accelerometer, gyroscope, compass, etc.

The history of mobile phones goes back to 1908 in Kentucky, USA. The idea came from a farmer-electrician, Nathan Stubblefield. His was a wireless phone station with a limited signal range. The station was the size of a garbage container with a signal range of about 800 metres (Vnuk, 2020). In 1979, the first automated cellular network was created in Bell's labs. Cellular network = division of the area covered by the signal into smaller units - cells in charge of stations and which use the same frequency at the same time (repeatedly by several stations). In this period, in 1981, the first 1G networks are created in Japan, Sweden, Norway, Finland and Denmark. The first mobile phone in the cellular network was the DynaTAC from Motorola.

The first GSM public network was created in 1992 in Germany - D2. This network was characterised by a more reliable system allowing automatic localisation, automatic call forwarding and data transfer rate speed of 9.6kbit/s. The GSM system uses a system of SIM cards. This means the

network accepts the SIM card even when moved to another phone and the user can keep his phone number.

In the 1990s the age of SMS (Short Message Service) began that are still used today. The first SMS was sent in Finland in 1993 (Vnuk, 2020). The next evolutionary stage in GSM technology (Doboš et al., 2002), after data transfer by GPRS (General Packet Radio Services) introduced, was the EDGE technology. The EDGE technology offers several methods and upgrades that allow achieving efficient data transfer and high spectral efficiency in a narrowband cellular system. With the development of more efficient networks, mobile phones manufacturers tried to miniaturise them - a trend to shrink mobile phones slowly started to emerge and, with the advent of colour displays, the trend of discovering new possibilities of the device e.g., to store memories of everyday life with the arrival of cameras.

The abbreviation WAP represents Wireless Application Protocol which originated in 1997. It allows for connecting mobile phones to the internet. The era of WAP lasted for a short time period and the 3G network took its place after 2000. The abbreviation 3G (Hrubý, 2006) represents the third generation of mobile phones. Services related to this generation represent the ability to transfer a voice (phone call) and data (downloaded data, e-mail, messages). Japan was the first country to implement the third generation of mobile phones, while 40% of users in Japan used third-generation mobile phones in 2005. The network of the fourth generation (Džula, 2020) – 4G network and LTE (Long Term Evolution) was first launched into commercial use in 2009 in Oslo, Sweden. This network expanded the possibilities of use – VoIP calls (voice calls through the internet), gaming services, 3D, and HD TV for mobile phones. The youngest member of the mobile network family, introduced at the end of 2018, is the 5G network. This network focuses on the connection of a high number of devices (internet devices) and in a low latency (in reality, 8-12ms). The network's speed should potentially reach 3Gbit/s, but currently, it only runs at around 400Mbit/s. Adoption of 5G throughout the world is fast. The whole USA is already covered. The sixth generation of the network is not official but should reach the data transfer speed of about 1Tbit/s. According

to available information, it will take almost ten years to make the sixth generation a reality.

With an increasing number of mobile phones and smartphones sold, there is also a growing interest and need for applications development (application software) for these devices. Website www.managementmania.com describes the application software (shortly known as application) as a summary term for software with which a user works and which needs system software (operating system) for it to run. According to www.pixelfield.cz, a **mobile application** is software (or a programme) that runs on a mobile phone. It is designed to operate on phones and tablets. Nowadays mobile applications run on operating systems Android and iOS. Especially manufacturers like Apple with their iPhone supporting the iOS operating system and Samsung with support of the Android operating system are the deciding factors for application development nowadays. Even though the Android operating system significantly outperforms iOS, applications developers often design applications for both of these two most frequently used mobile phones platforms.

Hrabčák (2019) states that the differences, advantages, disadvantages, or firsts in several areas are always the subject of endless discussions on the Android vs iPhone topic. According to Herodek (2013), each smartphone operating system has some pre-installed basic applications. This means a user can find essential applications that the manufacturer installs into all the devices of the same type without buying them separately. The most common are office packages, internet browsers, maps, navigation, social services applications, weather, music player, gallery, applications using sensors and more. These applications sometimes do not meet the user requirements – such as their design, application tools, expansion options, updates and more. For this reason, the operating systems leading manufacturers developed their App Stores.

According to Paroubková (2016), mobile applications can be classified into several categories. Since 2012, the most popular mobile applications have been announced annually on the internet. According to Google Play, applications can be classified into these categories:

- ✓ educational
- ✓ lifestyle
- ✓ entertainment
- ✓ business
- ✓ personalisation
- ✓ tools
- ✓ media
- ✓ social networks and communication

Considering the facts above, it is clear that the mobile app market is a very interesting place. It evolves over time, accepting new sellers while others leave. The market is analogous to others, where it is necessary for the seller to know the customers and competitors, and at the same time, it is necessary to keep track of who is doing best and how the results are changing over time.

Nowadays, some companies track data about mobile applications and offer regular users information about what the market currently looks like and who are some of the biggest players. On the other side, these services allow applications developers to obtain information about the market need for the development of their applications (Kapusta, 2017).

In the area of physical activities, the most acceptable, cheap and user-friendly are considered applications that can evaluate and monitor individual or group physical and sports activities e.g., in a group of pupils. Among these are Samsung Health, Strava, Garmin Connect, MapMyRun, Polar Beat, Fitbit, SportsTracker, and Adidas Running by Runtastic. These applications offer not only monitoring but also options to create various goals or challenges, competitions with the option of inter-comparison of participants (pupils) e.g., number of steps during a specific time, distance travelled, burnt calories, fastest kilometre. (Adamčák-Marko, 2021).

1.3 PHYSICAL ACTIVITY

1.3.1 Characteristics and classification

Today, we often encounter the term physical activity. In today's hectic world, it is becoming increasingly difficult for anyone to maintain a healthy lifestyle, especially due to the lack of awareness of the importance of physical activity.

Bad habits from an early age, which intersect into adulthood, are cited as a problem for children in relation to physical activity. The first impulse to physical activity always comes from the parents. They are the ones who have to lead their children to spend their free time in a meaningful way (Cihlář et al., 2017). Machová-Kubátová et al. (2015) perceive the movement and physical activities not only as a means of physical health and fitness but are also aware of their other benefits – socialization, communication, psycho-regeneration, and psycho-relaxation. These have a significant positive effect on mental health, as they prevent stress, negative emotions and many other unwanted phenomena.

According to Mužík and Süß (2009), physical activity is one of the general terms most used in kinanthropology. It is defined as a category of physical movement of a person, characterized by internal determinants – physiological, mental, neuromuscular coordination, but also requirements for muscle fitness, i.e., higher caloric consumption. In this case, energy expenditure is greater than in quiescent state. Zvonař-Duvač (2011) states that physical activity is characterised by human characteristics such as determination, communication, and social conditionality. Šimonek (2000) understands physical activity as any physical activity that sufficiently increases the demands on body functions, requiring energy expenditure greater than while resting. He also includes work activities, including housework, recreational activities such as gardening, fishing, hunting, beekeeping, carving, picking berries and medicinal plants, as well as organized physical education and sport activities practiced individually or collectively (without or under the direction of a teacher). In general, we can say that physical activity takes place in all areas of our life, such as work, housework, active leisure, planned exercise, etc. (Adamčák-Nemec, 2020). Mužík and Süß (2009) describe the basic distinction between two subsets of physical activities:

(a) structured physical activities – intentionally planned and targeted physical activities within specific time and areas. They can be generally described by duration, exact rules, intensity, required equipment, protective clothing, etc. These are, for instance, running, basketball, ice hockey, etc.

(b) unstructured – these are the natural daily activities of a person, which are usually not described by units of time, intensity, frequency, or rules. This includes working in the garden, climbing the stairs, moving loads, etc.

In general, during adolescence, boys are more physically active than girls, but on the other hand, with age, their interest in physical activity diminishes. (Kopčáková et al., 2017) Williams-Krane (2020) claim that several tries on adopting and maintaining an active lifestyle show insignificant results – on the one hand, people fully understand the urgency to move and do physical activities in their free time, but on the other hand, it is often difficult to convince themselves to accomplish anything beyond their daily tasks.

1.3.2 The importance of physical activities for the adolescent population.

Physical activity in the development of an individual is related to the stages that the individual goes through in their development. As the human body develops, so does the psyche of the individual (Adamčák-Nemec, 2020). Each phase of personality development has its own characteristics and some changes are typical for it. However, each individual is unique and their development need not follow exactly the known patterns.

According to Viličus-Brandejský-Novotný (2004), adolescence is a critical period. Due to hormonal changes, other interests arise, the restriction of physical activity and the decline of physical form. In the author's view, particularly, spontaneous physical activity is decreasing, and at least should be replaced by a controlled activity, both at school and during leisure time. Therefore, it is appropriate to support and strengthen the interest in exercise, physical activity, or regular sports at this time.

The pupil's position at school, family and social group has a great influence on the development of an individual's personality (Peráčková, 2008). According to Šimonek (2006), Romanová-Sollár (2015), one of the problems in establishing a relationship with physical activity during adolescence is the level of motivation. Adolescents perceive stimuli from the family or school environment only sporadically. Especially those that demand a higher level of effort from them. The possible motivation could come from the immediate

environment of the young people themselves, especially their peers, but currently also from social networks.

Based on the above-mentioned, we can consider the period of adolescence a key period in which young people's relationships and attitudes towards physical activity can be significantly stabilized. Studies e.g. both Kraut-Melamed-Gofer-Froom (2003) and Malina-Bouchard-Bar-Ora (2004) state that, for example, young people's regular participation in organized and non-organized physical activity will positively influence their relationship with it and its implementation in adulthood.

Šimonek (2006) sees the importance of physical activity for humans in general in the following points:

- ✓ strengthen or maintain health
- ✓ reduce body weight
- ✓ shape or maintain body proportions
- ✓ extend the length of active age
- ✓ increase or maintain adequate physical performance
- ✓ slow down the course of involution processes

The World Health Federation (WHF) has described 10 reasons why physical activity should be addressed regularly (http://www.who.int/features/factsamples/physical_activity/en/) (Adamčák, et.al. 2015):

1. Insufficient physical activity is the fourth most common risk factor for mortality worldwide. 6% of deaths happen due to this factor. (Blood pressure ranks first with 13% of deaths, smoking second with 9%, and high blood sugar third with 6%.)

2. Regular physical activity reduces the risk of cardiovascular diseases, stroke, mellitus (diabetes), colon cancer, and depression. Reduces the risk of falls associated with hip and vertebral fractures. Regular physical activity helps maintain body weight.

3. People should not confuse physical activity with sport. Physical activity includes all activities in which skeletal muscles expend energy. This includes not only sports, but also walking, housework, and many other activities that involve exercise. (*Note: In contrast, according to Sekota (2009), sport is defined as an institutionalized physical activity that requires systematic*

effort motivated by a desire to improve physical appearance, to achieve a specific personal experience, or to achieve intended results, accomplishments, victories, and rewards both in and out of competition).

4. Not only intense but also normal physical activity is beneficial.

5. People should not try to do only intense physical activities at any cost. It depends on the condition of every individual. It is important to adapt your physical activities to your abilities.

6. Children and young people aged 5 to 17 should engage in at least 60 minutes of moderate-intensity physical activity on a daily basis. Increasing this time will increase the health benefits.

7. Adults aged 18 to 64 should engage in at least 150 minutes of moderate exercise per week or 75 minutes of vigorous physical activity (per week). The shortest activity time recommended is at least 10 minutes. The recommendations for seniors do not differ in time recommended. Seniors with limited mobility should perform exercises to improve balance to reduce the risk of falls. These exercises should be performed at least 3 times a week. In this age group, however, the state of health should always be considered and an activity should be chosen which can be safely managed by the person concerned.

8. These recommendations apply to all healthy people. Unless there is a specific medical reason that restricts physical activity, these recommendations apply to everyone – regardless of gender, social group, or ethnicity. They also apply to people with diseases of civilization, such as increased blood pressure, heart attack or diabetes mellitus (diabetes). If individuals suffer from vascular, cardiac, or joint disease, it is always advisable to consult the chosen physical activity with a doctor or physiotherapist.

9. Doing something is still better than doing nothing. If not accustomed to exercise, it is necessary to begin gradually, at first with small doses of lesser intensity, and only after adaptation, increase the frequency and intensity. If a person has a disease that may limit or pose a risk to exercise, they should always consult a physician.

10. The environment affects us. The environment in which we exercise every day should provide opportunities for appropriate physical activity. Closely related are the questions: can children exercise at school? Can we ride a bike safely in our city? Do we have a place to go jogging? Do your supervisors address these questions?

Charvát (2002) does not question the positive effects of physical activity on the overall development of personality. In his opinion, their influence is strengthened especially in the period of adolescence, that is, in the process of forming personal habits and value structure at the level of adolescent lifestyle. An active lifestyle offers people many social and psychological benefits – there is a direct correlation between physical activity and average life expectancy. For this reason, more physically active people tend to live longer than inactive people.

Telama (2005) states that the positive effect of the level of physical activity in adolescence on physical activity in adulthood has been demonstrated. Tammelin et al. (2003) believe that adolescence is a crucial period for the subsequent implementation of physical activity in adulthood. They believe that youth participation in intense endurance sports is most beneficial.

Nešpor-Csémy (2006) states that physical activity is not only direct prevention but also has a very positive effect on the development of the individual, influencing his behaviour especially in adolescence and later in adulthood. Physical activity leads to a healthier lifestyle free of alcohol, smoking, drugs, and other addictive substances, helping to reduce risk behaviours among adolescents in peer groups. A study by Drobos-Hillman (2012) notes that there is ample evidence of a link between physical activity and drug use.

Metzger-Dawes-Mermelstein-Walkschlag (2011) state that prevention programs based on physical activity help children develop social skills, improve mental health, reduce risks and thus contribute significantly to the prevention of smoking and taking addictive substances. Nešpor (1999) in his publication states there is no drug prevention program based only on physical activity but characterizes it as one of the most effective forms of prevention of drug abuse. Exercise releases endorphins in the body that cause pleasant

feelings. Appropriate exercise reduces anxiety and mild to moderate depression, therefore it is a relatively simple and very safe way to influence your state of mind. Similar statements are made by Skladaný-Feč-Zusková (2002), according to which during intense exercise, the pituitary hormones endorphins are released, which are similar to the effect of morphine. This reduces the sensation of pain and at the same time produces a feeling of well-being that lasts from 30 minutes to an hour, in some cases even longer.

The influence of physical activities performed in adolescence on the physical activities realized in adulthood is further described by Aznar-Lain-Webster (2006) in three points:

- ✓ First and foremost, the health benefits in childhood. These include the prevention of overweight and obesity, lowering blood pressure, etc., which are mentioned several times.
- ✓ Second is the fact that they become addicted to an activity. If a child or a teenager is physically active, they are more likely to stay active in adulthood.
- ✓ Third, all the health benefits carry over into adulthood.

Bebčáková et al. (2010) found that popularity and intrinsic satisfaction from engaging in physical activities are essential for children and adolescents to repeat and build a lasting relationship with them.

Collective sports are considered particularly suitable for this prevention, because of the sense of belonging or commitment to others, but also to the group, experienced by participants during the game are important for mutual reciprocity (Bašková et al., 2009).

According to Stejskal (2004), the benefits of physical activity are also reflected in the improvement of the psychological side – the reduction of depression and stress, mood improvement and a sense of joy is triggered. Great importance is assigned to the experience of doing physical activity because a person likes to do what they enjoy, what makes them happy. This principle is particularly important as a motivator, especially for children (Slepičková, 2000).

Bize et al. (2007), Cerin et al. (2009) state that any physical activity has a positive impact on human mental health. Dementia and Alzheimer's are two rapidly spreading diseases in modern society. Research shows that the

symptoms of both diseases can be alleviated if a person has lived an active life and exercised enough (Reiner-Niermann-Jekauc, 2013). People who are physically active for at least 150 minutes per week have a 33% lower risk of dying from all causes compared to people who are not physically active (CDC, 2021).

Healthy People 2010 stresses the importance of physical activity at this age because of healthier and stronger bones, better cardiorespiratory and muscular condition, reduction of body fat, and reduction of depressive symptoms. Korvas-Kysel (2013) emphasize that the health benefits of physical activity depend on its regularity.

In connection with the ontogenesis of a person, there is a change not only in motivation but also in their preferences for different activities. For this reason, it is necessary to present the necessity and importance of exercise and physical activity to the adolescent very clearly and convincingly. It is obvious that, especially from the point of view of mental development, it is of vital importance to achieve the highest possible level of motivation for useful physical activities during adolescence. This is a time when there is a natural change of interests and there is still some uncertainty about their future. These factors can significantly strengthen motivation, but they can also weaken or disrupt it, and individuals will either fully and enthusiastically engage in physical activity, or they will abandon it and look for other activities that will satisfy them (Adamčák-Nemec, 2020).

Finally, a significant proportion of the adult population in Europe is overweight – 400 million Europeans are overweight and around 130 million Europeans are clearly obese. Developed countries have begun to recognize the effects of physical activity on human health and the economy of the state (Kukačka, 2010). Hainer-Aldhoon (2010) adds that technological progress not only affects the physical demands of many of today's occupations and domestic work, the way food is produced, the way home-cooked meals are prepared (substitution of morning snacks and main meals by the so-called fast food), but also essentially affects interpersonal social relations.

Based on available scientific evidence and several effective strategies, the Centre for Disease Prevention and Control (CDC), 2021) recommends:

- ✓ encourage parents to limit their children's sedentary leisure activities
- ✓ maximize the number of physical education lessons and expand the range of extracurricular physical activities so that they become a fundamental motor component of children's daily lives
- ✓ encourage schools, community organizations and government sport and leisure sectors to do more to promote children's participation in physical activity
- ✓ improve urban planning so that towns and villages are safe for pedestrians and cyclists
- ✓ improve relations between schools and their communities

1.3.3 Quantitative and qualitative aspects of physical activities in adolescents

According to Kudláček (2014), it is desirable that the structure of preferences for sports activities is considered a complex process reflecting the interactions between situational factors (socio-economic characteristics), motivational factors (reasons for participation in sports activities) and the needs satisfied by the activity. He believes that there is no single factor that explains the diversity in the structure of sports preferences. Several previous research studies on physical activity, whether in adolescents or adults, have often focused on quantitative approaches. On a positive note, more qualitative studies have been added recently. There are several complementary components between the quantitative and qualitative approaches (Zitomer-Goodwin 2014). Qualitative research can provide much more information needed to understand the key factors that help professionals identify and understand the barriers that prevent adolescents from participating in physical activity and to help adolescents express their suggestions for implementing a successful intervention to improve their physical activity. Findings from qualitative studies have shown that the key factors influencing adolescents' physical activity must be perceived primarily at the individual level, for example, through positive feelings, experiences, well-being, happiness, satisfaction, but also the perception of benefits and advantages of what they do (Allender-Cowburn-Foster, 2006). The incentives at the

interpersonal and cultural level (e.g. social support in the family, in loved ones, at school, but also gender norms, religious affiliation, etc.) or at the environmental level, where the availability of appropriate opportunities to perform physical activities can play a crucial role, are also very important according to Belanger-Casey-Cormier-Filion-Martin-Aubut et al. (2011). Knowledge of the relationships and interactions between these domains can provide valuable insights through which the mechanisms required to improve the quality of physical activity of young people can be identified to a much greater extent. Such a qualitative approach to researching areas and factors that might shed light on what prevents young people from engaging in appropriate physical activities (especially those that are beneficial to their health) is a great opportunity to move this field in a positive direction. The result could be various intervention programs that would be "tailored" to individuals or selected groups. Interesting qualitative factors influencing adolescents' relationship with physical activity are presented by Van Royen-Verstraeten-Andrade-Ochoa-Aviles-Donoso-Maesetal (2015), who found that competition, i.e. the fact that other, more experienced people also participate in the activities, is often considered a major obstacle, especially for girls who have a lower level of skills or physical abilities. For boys, this is more of a driving force. The participation of others in the activity, competition and comparison motivated them much more than if they had to do the activities alone. Within the social group they enjoyed their course much more. Individual qualitative factors can also include physical activities that develop those physical skills and abilities that we can use for our own protection against imminent danger, such as self-defence, martial arts, and so on. These are triggered by an increasing number of reports of public aggression presented in the media, possible terrorist attacks, but also by common attacks by people who, with their arrogance and rapidly acquired power, reserve for themselves vast areas where they demand obedience and respect. Failure or resistance is often met with violent manifestations, often supported by a physical attack. Another area is the perception of various material benefits resulting from the actual performance of physical and sporting activities. According to Jonsson-Berg-Larsson-Korp-Lindgren (2017), many boys, but

also girls, play football, hockey or tennis not only because the activity gives them positive emotions, but also because of the various possible material benefits in the future, to secure enough financial resources or luxuries, but also to become a celebrity admired by others. The environment is also an interesting area in terms of the conditions for the implementation of healthy activities. The number of stimuli that young people receive from their environment is also related to appearance, functionality, safety, and availability of space to perform physical activities. Not only the participants themselves (adolescents), but also their parents or other responsible people feel that these factors are very important. Currently, it is more acceptable for a child to be active in a school environment where these standards are provided by the founder and the school itself. Safety is significantly higher in the school environment, both in terms of the presence of a qualified person but also in terms of premises, tools, and implements. It is more difficult in an out-of-school environment, where there are several potential dangers. Firstly, abandoned (closed) sports grounds, but also the absence of supervision. A completely different level is the implementation of physical activities in nature, where a person encounters a number of objective as well as subjective dangers. Be it the weather, fauna, flora, but also various undesirable human interventions or physical/mental unpreparedness and health indisposition of the individual to these conditions, the interest in these activities can be significantly endangered.

According to Teplý (1988), from the point of view of the evaluation of quantitative indicators of physical activities, it is necessary to consider the following factors:

- ✓ **total amount of physical activity** – time dedicated to movement, energy expenditure
- ✓ **structure of physical activity** – forms, means of physical activity included in the physical regime
- ✓ **frequency** – frequency of physical activity in a given cycle of its implementation
- ✓ **intensity of physical activity**

The issue of physical activities has been studied in the past and is currently the subject of several studies (HHS, CDC, PCPFS, etc.) which are trying to clarify the relationship between the volume of physical activity, intensity, and frequency. As early as 1978, the American Sports Medicine Association concluded that moderate physical activity also improved work capacity (Jonas-Phillips-Ottoet al., 2009).

In 2012, the concept of state sports policy was adopted in Slovakia Slovak Sport 2020 (Government Resolution No. 726/2012). The emphasis placed on the content of the *Sports for All* chapter on the activities of the entire population is an effective tool for the prevention of various diseases. According to Act no. 440/2015 Coll. on sport, as amended, sport for all is conceived as supporting the population to meet the social, cultural and health benefits of sport. On 3 May 2017, the Government of the Slovak Republic approved the National Action Plan for the Support of Physical Activity for the Years 2017 to 2020 (hereinafter referred to as the Action Plan). The initiative of the presented plan was taken by the Public Health Office of the Slovak Republic (Adamčák-Nemec, 2020). In addition to national documents, the Action Plan is also based on the Strategy for Physical Activity for the WHO European Region for 2016-2025, adopted at the 65th meeting (2015) of the WHO Regional Committee for Europe in Vilnius. The strategy is based on a multisectoral approach that goes beyond the health sector, with the aim of creating coordination mechanisms with several sectors (education, transport, culture, etc.). The strategy recommends that activities be undertaken at an early age with the intention of providing information to future parents. The main objective of the action plan is to improve the level of public health by promoting intersectoral physical activity, supporting the training of physical activity professionals and reducing risk factors influencing the inadequacy of physical activity related to non-communicable chronic diseases by supporting the maintenance of adequate physical activity throughout life. The National Action Plan contains an overview of physical activity in relation to strategic documents, definitions, current state of the level of physical activity, international and national recommendations, benefits, and specific tasks of certain state administration bodies.

The Eurobarometer survey on sport and physical activity conducted by the European Commission in 2013 revealed that up to 60% of Europeans exercise rarely or never, with 41% exercising at least once a week. The survey revealed that 6% of people in Slovakia are sports-active (EU average is 8%), 28% of the population practice sports less regularly (the EU average is 33%), 21% practice sports occasionally (the EU average is 17%) and up to 41% of the Slovak population do not practice sports at all (EU average is 42%). In 2014, nearly half of the population aged 15 or over (47.7%) did not participate in any healthy aerobic exercise activities in their free time. Girls and women were worse than boys and men. Regarding the volume of physical activity, the WHO Global Recommendations on Physical Activity for Health (2010) are as follows: people aged 18 to 64 should perform at least 150 minutes per week of moderate aerobic exercise or an equivalent combination of moderate and intense physical activity. WHO recommends that this target group undertakes activities aimed at strengthening the major muscle groups at least twice a week (WHO – Action Plan for the Implementation of the European strategy for the prevention and control of non-communicable diseases 2012-2016). The EHIS survey (2014) shows that the proportion of the Slovak population responding to WHO recommendations for physical activity for health is very low. Less than 30% of the population aged 15 or more practised aerobic exercise for at least 150 minutes per week, and only about 13% spent at least two days per week doing muscle strengthening activities. In both cases, fewer women than men were able to meet WHO's global recommendations. According to an international longitudinal cross-sectional study HBSC (2014), which monitors the health-related behaviour of 11, 13 and 15-year-old schoolchildren, in which more than 40 countries in Europe and North America cooperate, a comparison of the 2009/2010 and 2013/2014 studies found a statistically significant decrease in the incidence of regular physical activity among 15-year-old boys. Although the European Union Directive on Physical Activity (WHO) is considered important in practice, so far little has been applied in this regard, where the following quantitative indicator appears: the European Union and its Member States recommend a minimum of 60 minutes of moderate daily physical activity for children and young people and a

minimum of 30 minutes of moderate physical activity per day for adults, including the elderly.

Historically, it is necessary to specify that quantitative data related to the recommended amount (volume) of physical activity are already indicated, e.g., Čelikovský et al. (1981), who consider an interval of 3 hours per week with an intensity of 60% of the maximum performance as the minimum amount of physical activity required to create active healthy lifestyle. In 1995, the American College of Sports Medicine and the American Heart Association published national guidelines on physical activity and public health (Pate-Pratt-Blair, et al., 1995). They make recommendations on the amount of physical activity required for the health of adults to improve and maintain the health of all healthy people aged 18 to 65 in the following volume – moderate physical activity for 30 minutes, 5 times a week or intense aerobic physical activity for 20 minutes, 3 times a week.

Based on multiannual surveys and the implementation of the results of research conducted in our country and abroad, Šimonek (2006) recommends the following amount of physical activity for adolescents aged 10 to 17 years – at least 3 hours per day, totaling at least 20 hours a week. From the point of view of the proportion of individual types of physical activities, it is considered the most appropriate 50 to 60% of aerobic activity; 15 to 20% of strength training; 10 to 15% of coordination activities and 10-15% activities affecting flexibility.

According to Frömel-Novosad-Svozil (1999), daily energy expenditure during physical activities should be at least $11 \text{ kcal} \times \text{kg}^{-1} \times \text{day}^{-1}$ for boys and $9 \text{ kcal} \times \text{kg}^{-1} \times \text{day}^{-1}$ for girls. Boys should exercise for at least 75 minutes and girls for 65 minutes per day. The number of steps per day should not be less than 11,000 for boys and 9,000 for girls

According to Healthy People 2010, adolescents should perform continuous intense physical activity for at least 20 minutes at least 3 times per week and moderate physical activity for at least 30 minutes 5 times per week (USDHHS, 2000).

Haskell et al. (2007) recommend moderate physical activity for at least 30 minutes 5 times a week. The Australian government, in turn, recommends

that children and young people engage in moderate to vigorous physical activity for at least 60 minutes per day (Better Health, 2015).

According to the findings of Naderet al. (2008) children at the age of 15 reach only 49 minutes of physical activity per weekday, and during the weekend even less than 35 minutes per day.

Sigmund-Sigmundová (2015) also recommend minimal physical activity for Czech adolescents aged 11 to 18. The authors recommend moderate physical activity for at least 60 minutes per day with the following rules:

- ✓ at least 30 minutes of moderate or walking physical activity at least 5 times a week
- ✓ at least 20 minutes of high-intensity physical activity at least 3 times a week
- ✓ distribution of these physical activities in sections within at least 10 min

The Yang study (2019) states that moderate exercise activity should be at least in the range of 150 minutes per week or physical activity in high exercise intensity for at least 75 minutes per week. To clarify this, Yang (2019) also mentions the possibility of combining physical activity and their frequency – as an example for meeting the recommended weekly dose of physical exercise, a combination of 50 minutes of intense physical activity and 60 minutes of moderate physical activity.

According to CDC (2021) in the United States, it is recommended that people between the ages of 6 and 17 exercise for at least 60 minutes a day to maintain their health. This physical activity should consist of a variety of activities, among which we can include aerobic and anaerobic activities that strengthen the musculoskeletal system, muscles, and bones.

Tudor Locke-Craig-Aoyagi et al. (2011) also addressed the study of quantitative data on physical activities, where they focused on the number of steps. They found that the daily step count for adolescents aged 12-19 reaches an average of 12,000 steps, which is approximately 8-8,500 meters, and recommend that the step count for teens be over 10,000- 11,700 steps per day. The Czech Republic recommends that boys aged 14-18 take 11,000 steps per day and girls in the same age 9,000 steps a day (Frömel-Novosad-Svozil,

1999). According to Sigmund-Sigmund (2015), boys must take at least 13,000 steps and girls 11,000 steps at least 4 times per week.

Results from another international study HBSC (The Health Behaviour in School) conducted by Currie et al. (2012) highlight the fact that many children in compulsory school are not active enough. According to the study, almost 50% of girls between the ages 12 -15 move intensively for less than 5 days and their activity decreases with age. We also learn interesting data from Bouchard's work (2015), which states that the population using walking and cycling as a transport activity to work has 30 to 60 minutes more movement per week than people living in suburban areas.

In this context, it is important to consider the fact that the number of children who do not walk to school has increased rapidly in the last 10 years. Of course, the number of children brought to school by their parents has increased in direct proportion (Chillón-Evenson-Vaughn-Ward, 2011).

Riegrová and Ulbrichová (1998) see the problem in determining the minimum level of physical activity, which is necessary to achieve and maintain the optimal level of development of the organism as well as to meet the needs of daily routine and work activities. Furthermore, it is necessary to determine the maximum physical activity to avoid damage to the organism.

Sigmund-Frömel-Chmelík-Lokvencová-Groffik (2009) look at the quantitative characteristics associated with the performance of a physical activity in adolescents from a different angle. They claim that the active energy expenditure of 16-year-old girls is higher on weekdays than on weekends. The above facts show that if girls engage in any physical activity, it is mainly in their free time during the week, i.e., in the afternoon after school. Bakalár (2016) found that during the work week, high school students actively engage in physical activity an average of 3.1 hours per day. Kalman et al. (2011) claim that, based on his results, only 14% of 15-year-old girls engage in physical activity for at least one hour per day. Skalík-Lokvencová-Frömel (2009) report that 34% of girls in Polish secondary schools complied with the USDHHS (United States Department of Health and Human Services) guidance published in 2008, according to which they should do moderate physical activity 7 times a week for 60 minutes and intense physical activity should be performed 3

times per week for 20 minutes. Kalman et al. (2011) state that only 20% of 15-year-old girls do physical activity 3 times a week, while 19% do it 4 times a week.

In his study, Frömel (2004) found that Czech girls in high school had higher energy expenditure on school days than on weekends. The author adds that boys of this age engage in more intense physical activity than girls of the same age. Similar results have been reported by Pastucha (2011), with girls aged 15 to 18 showing almost 20% less participation in sports and physical activity than boys.

Adamčák-Nemec (2020) state that when evaluating the most popular leisure activity used to fill the free time in a group of high school students, physical activity accounted for 42.85% of the answers. Regarding gender differences, boys (46.52%) were more prone to physical activity than girls (39.23%). Responses from adolescents dominated by physical sports activities have shown that this is a recreational form of realization of physical-sports activities 61.37%, mostly done with friends – 53.12% of responses. The authors also point out that the strongest motivations for boys are entertainment, health, and appearance, 20.85% to 25.93%. The girls prefer the same reasons – 20.60% to 29.65%, but in a different order (looks, fun and health).

From the point of view of the nature of the physical activities, Rychtecký (2006) summarizes in his publication and then compares the results with the year 2000, noting that:

- ✓ Participation in specific physical and sporting activities is relatively stable among young people.
- ✓ In all age groups, cycling, which became one of the most dynamic youth activities of recent times, was present.
- ✓ Boys prefer football, basketball, volleyball, swimming and tennis. Girls prefer aerobics, volleyball, swimming, tennis, and basketball.
- ✓ In comparison with 2000, the author records the biggest changes in floorball, athletics, ice hockey, home exercise, weight training, triathlon, football tennis and bodybuilding.

- ✓ Apparently, the choice of sports for girls is more stable than for boys compared with 2000. The greatest increase in popularity among girls can be observed in soccer.

In terms of sport preferences in the category of individual sports, Kudláček-Frömel (2012) found that girls prefer badminton, skating (figure skating, speed skating) and gymnastics more than boys. On the contrary, the boys prefer golf (minigolf), shooting, archery and table tennis more than girls. In the field of team sports, there was a more significant difference in football (futsal), ice hockey (in-line) and rugby, which are more significantly preferred by boys. On the other hand, girls prefer frisbee to handball. Significant differences have been observed in physical fitness activities i.e., if girls prefer yoga, taekwondo (boxing, aerobics) and sport aerobics more than boys, then boys prefer nordic walking, bodybuilding and taichi. From the point of view of the most popular sports activities, modern dances are clearly in the first place among girls (13%). This is followed by cycling (8%) and cyclotourism (7%). Among boys, sports games are clearly the most popular: football (33%), floorball (11%) and tennis (8%).

Adamčák-Nemec (2020) found by examining the physical and sport activities of high school youth, that boys prefer a collective, 40.65% and girls an individual sport, 42.33%. In the group of boys, these are mainly traditional team sports (football, basketball, etc.) – 50.62%.

According to Kalman-Vašíčková (2013), an important factor promoting physical development is well-managed physical education at school. At the same time, physical education helps to balance the negative effects of the static nature of other subjects. Nevertheless, experts agree that two physical education and sports classes a week is not enough. However, the solution is not only to increase the number physical education and sports classes, but also change the approach to the lesson itself. Emphasis should be placed on enjoying the movement and not on mere performance. Slepíčková (2000) also states that entertainment is important in the implementation of physical activities. Furthermore, she recalls that exercise should be integrated into our daily regime in the form of active sport and should not pose an extreme

burden. Physical activities should be adapted to age, abilities, needs and possibilities, both in terms of time and money.

2 RESEARCH OBJECTIVE AND TASKS

2.1 RESEARCH OBJECTIVE

As a part of **KEGA 012UMB-4/2019** *The Application of Modern Information and Communication Technologies to the Positive Stimulation of the Adolescent's Relationship to the Realization of Healthy Physical Activities in School and Leisure Time* grant task, the partial objective was to find out, via a survey, the level of usage of smartphones in sports and physical activities in a group of high school students. Two approaches were the main criteria of the research evaluation:

- ✓ **Gender differences**, where the opinions of students – boys and girls – were compared.
- ✓ **The type of school the students attended**, where differences in opinions of the students (boys and girls) depending on the type of school they attended – grammar school and vocational school – were identified.

2.2 RESEARCH TASKS

To fulfil the partial objectives, the following tasks were set:

- ✓ **Task 1:** Obtain and synthesize elementary information on the issue by studying domestic and foreign literary sources.
- ✓ **Task 2:** Create and distribute a survey for high school students (grammar schools and vocational schools) from different cities and areas of Slovakia.
- ✓ **Task 3:** Analyse the survey results from the perspective of gender differences as well as the type of school the students attended, focusing on the type of mobile device, accessibility to the Internet and the time spent on smartphones.
- ✓ **Task 4:** Analyse the survey results from the perspective of gender differences as well as the type of school the students attended, focusing on the usage, and monitoring of sports and physical activities with a smartphone.

- ✓ **Task 5:** Analyse the survey results from the perspective of gender differences as well as the type of school the students attended, focusing on awareness of and experience with apps that monitor sports and physical activities and playful activities with a smartphone.
- ✓ **Task 6:** Compare (discussion) the obtained results with studies based on similar objectives.
- ✓ **Task 7:** Compile outcomes and suggestions for theory and practice.

3 RESEARCH METHODOLOGY

According to Greger (2006), the selection of research methods depends on the perspective and purpose of the research. In terms of fulfilling the set objectives, the following methods were used – methods of obtaining factual material (chapter 3.3) and evaluation of the research results (chapter 3.4.). Since the research was carried out on a sample of 4,125 students, the characteristics (chapter 3.1.) and format of the research (chapter 3.2.) are a part of this chapter.

3.1 CHARACTERISTICS OF THE STUDENT RESEARCH SAMPLE

4,125 students took part in the research and 3,933 correctly filled out survey forms were included in the evaluation. The research mainly concentrated on 4th grade high school students (grammar school, vocational school). Given the focus and specifics of the research that mainly aimed at the usage of smartphones in sports and physical activities of high school students, only the answers of the students that own a smartphone were evaluated (n=3745). Their partial number is stated in Figure 1 and 2.

From the perspective of Slovak areas, or cities, the research includes survey forms from: Banská Bystrica Region – cities of Banská Bystrica, Zvolen, Rimavská Sobota, Lučenec; Košice Region – city of Košice; Nitra Region – city of Nitra; Prešov Region – cities of Poprad, Humenné; Trenčín Region – city of Trenčín and from the Žilina Region – cities of Žilina, Martin, Dolný Kubín, Čadca, and Liptovský Hrádok.

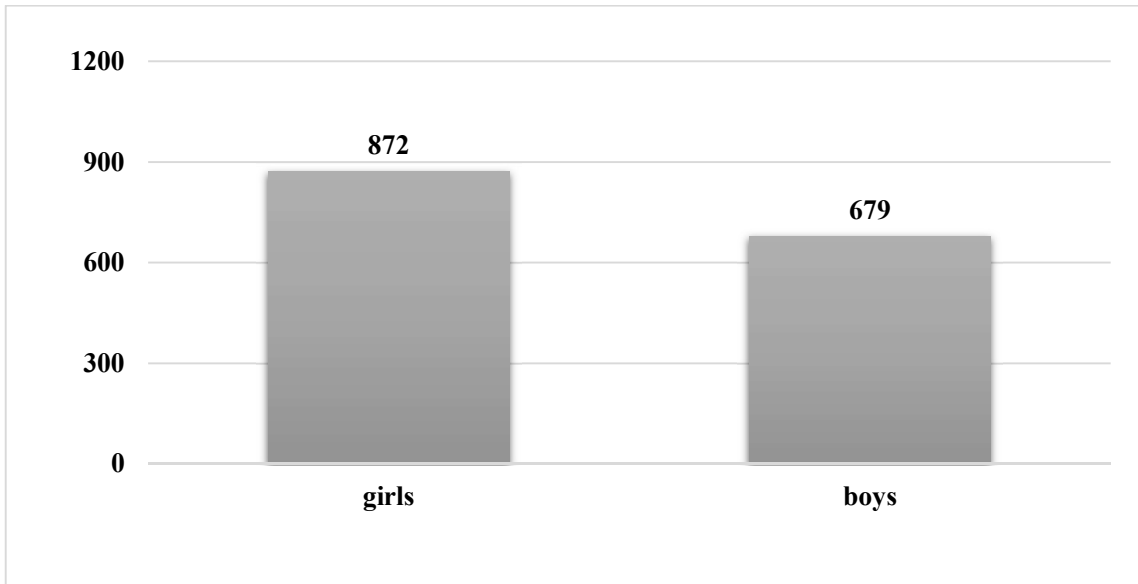


Figure 1 *Numeric characteristics of the sample by gender grammar school students, only students that own a smartphone (n=1551)*

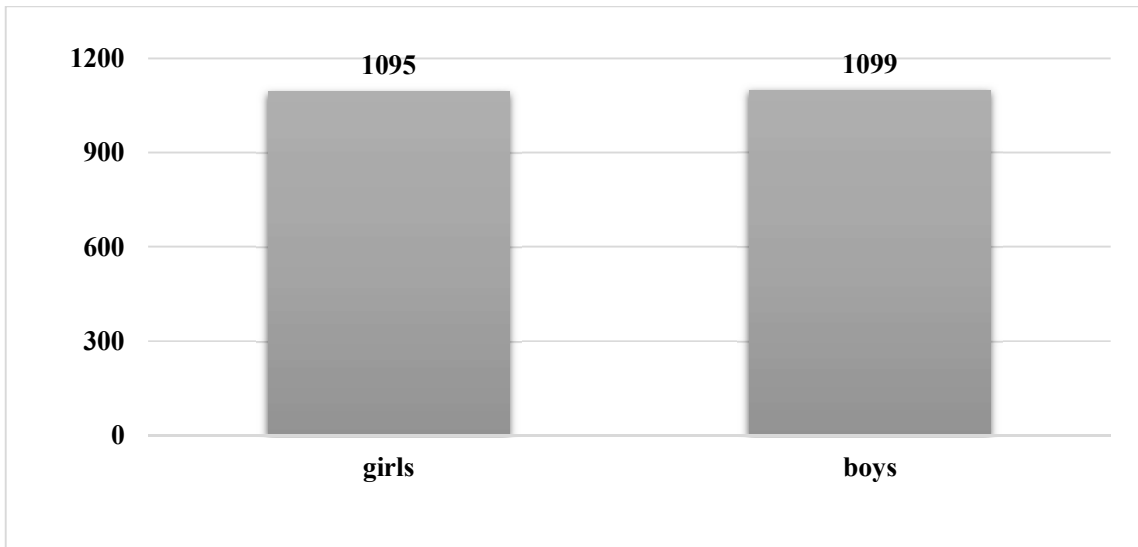


Figure 2 *Numeric characteristics of the sample by gender vocational school students – only students that own a smartphone (n=2194)*

3.2 TIME PERIOD OF THE RESEARCH

Distribution and collection of survey forms was carried out, in accordance with the ethical code, from February 2019 until February 2020. Members of the

research team notified the school authorities of selected high schools of the requests resulting from the cooperation on the research project. Administration of the survey was executed only with the members of the research team in the form of “a pencil and a reply form” – the so-called group administration. Reply forms – survey forms were created and evaluated by the TAP3 programme by Gamo Banská Bystrica. The participation of students was not compulsory. All students were informed about all the important information about the research and their rights – including the right to refuse to fill out survey forms. No identification data were required from the students and the survey forms were anonymous (Annex 1).

3.3 METHODS OF OBTAINING FACTUAL MATERIAL

Literary method – the crucial part of planning the research was systematic selection and analysis of the accessible literature which helped with getting acquainted with the topic. The literary method was mostly used to create the theoretical framework of this monograph and discussion of the researched topic. This monograph drew from scientific and professional sources in the form of domestic and foreign articles, research, scientific, and professional studies, literature reviews, abstracts and monographies, books, electronic media, and internet sources.

Survey method – according to Kohoutek and Mareš (2012), survey is an evaluation tool for obtaining feedback. The final version of a survey suitable for a specific piece of research is created by adequate editing, selection of the suitable topics for evaluation, and formulation of questions. This survey was created to be completely anonymous, and its processing and evaluation corresponded with the general requirements for scientific and sport research of similar nature based on the research requirements of the TAP 3 programme by Gamo Banská Bystrica.

Based on the research objective, the students’ answers were analysed from two perspectives:

1/ From the perspective of gender differences (boys and girls)

A justification for this division is the fact that adolescence is a transitional stage of life, when a person is not a child anymore but is

not an adult yet. In the adolescent period, increased genuine interest and confrontation with existential life questions are clear, with significant differences dependent on gender (Macek, 2003). Many of these differences are primarily biological but are greatly influenced by psychological and social factors and they are dependent on economic, cultural, and social conditions in which one lives (Machová, Kubátová et al., 2015).

2/ From the perspective of the type of school the students attended (grammar school and vocational school)

The reason for this division is the fact that grammar schools are considered a general education type of school. This type of school prepares students in a four-year, five-year or eight-year educational programme. It gives the students a complete general high school education and it focuses on theoretical subjects. Grammar school education programmes are mainly focused on student preparation for broad focus universities. Today, not only grammar schools but also vocational schools prepare students for universities. In the case of technical high schools, more than 80% of their graduates continue their studies at technical universities (<https://strednapremna.sk>). The main difference between grammar school and vocational school is that the vocational schools prepare their students in two to five-year study programmes in relevant fields. Another important difference is the fact that vocational schools prepare their students for employment – i.e. during their studies, students spent much more time on vocational training or practice in workshops, at the employer's workplace or at the practical training workplace – some fields of study spend up to 50% on job practice (<https://strednapremna.sk>). Simply put, the education of the students is done by both theoretical and practical forms of education.

3.4 EVALUATION METHODS

The research results were evaluated by using the following qualitative, quantitative, and graphical methods:

- ✓ **qualitative methods:** analysis, synthesis, induction, deduction, comparison
- ✓ **quantitative methods:** methods of descriptive statistics; while evaluating the survey forms the following mathematical-statistical qualities were used: arithmetic mean, percentage, standard deviation, Pearson's chi-squared test at the P-value < 0.01 and at the P-value < 0.05
- ✓ **graphical methods:** tables and figures

4 RESULTS AND DISCUSSION

The basis for the division and format of the results part of this publication were the monograph tasks set out by us. That is why the results part is divided into three subchapters:

- ✓ The first subchapter focuses on the evaluation of the students' responses concerning the type of mobile phone they own, accessibility to the Internet and the time spent on smartphone activities.
- ✓ The second subchapter focuses on the usage and monitoring of the sports and physical activities of high school students with a smartphone.
- ✓ The final (third) subchapter surveys opinions, awareness, and experience of high school students with apps that monitor sports and physical as well as playful activities with a smartphone together with the interest of doing such activities during regular teaching process – during physical and sports education lessons.

As it was stated in the methodological part of this publication, the students' results are analysed in two ways in all three subchapters:

- ✓ By gender of high school students (boys vs girls).
- ✓ By type of school the students attended (grammar school vs vocational school).

Given the above-mentioned, it is believed that the findings can help reveal the main impulses, cues and factors that predominantly influence the usage of smartphones with sports and physical activities of high school students, and based on which, this publication proceeds in fulfilling the main purposes of the grant project.

4.1 EVALUATION OF THE STUDENTS' RESPONSES CONCERNING THE TYPE OF MOBILE DEVICE, ACCESSIBILITY TO THE INTERNET AND THE TIME SPENT ON SMARTPHONE ACTIVITIES

As mentioned in the previous chapters, smartphones became a phenomenon of this age, and are considered a common device owned by almost every household (Voštinár, 2017). This can be seen in the results of this publication, where in the beginning of the survey, students were asked what type of mobile phone they own (Figure 3). Figure 3 clearly shows that more than 93% of the students own a mobile device in form of a smartphone. The highest number is seen in the girls' sample – 97.04% and in the sample of grammar school students – 96.58%. A higher number of students without mobile phones were registered in the boys' sample– 1.42% and by the type of school the students attended, a higher number of students without mobile phones were seen in the vocational school students' sample – 1.46%. The Figure 3 further shows that approximately 1.55% of the students stated that they do not know what type of mobile device they own, even though information literacy is considered to be one of the most decisive competences of the 21st century that is important for effective functioning in society filled with and controlled by information (Brdička, 2015). The above-mentioned results are interpreted as inadvertence, rather than ignorance, while filling out the survey – checkboxes. According to the findings, a smartphone became in a way a “member”, a part of the life of the majority of high school students, while according to statistics (www.statista.com), 37% of the population will have owned a smart device by the end of 2021. Gogová (2011) stated a decade ago, that 73% of people between the age of 20 and 22 own a smartphone or a tablet, while also stating that it is suitable to focus on using this potential to direct young people toward healthy lifestyle. Owning a smartphone is undeniably connected to the fact (Gáliková, 2018) that Slovakia has the second highest index of smartphone penetration to market in Central Europe (65%), the index is higher only in Austria (66%). Palička, Jakubec, Knajf, Maněnová (2017) did similar research in the Czech Republic, and they found that from the total number of 976

students (aged 9 to 15; pubescence) 79.8% own a smartphone and from the total number of 329 students (aged 16 to 20; adolescence) 95.4% own a smartphone, which corresponds with the results of this publication.

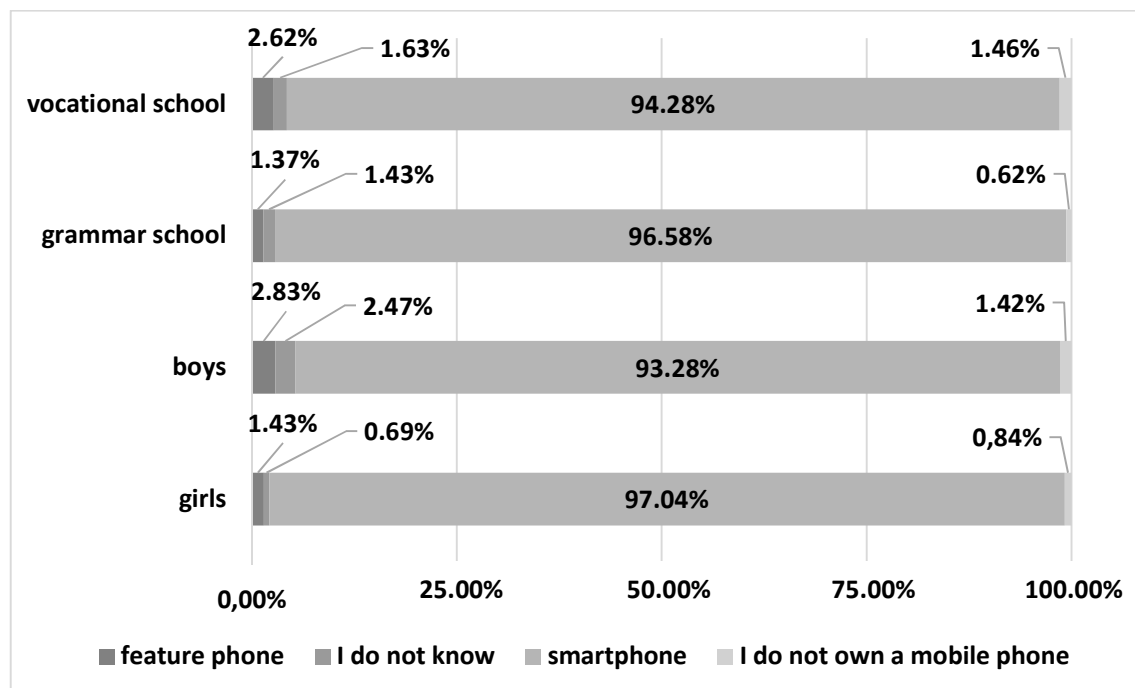


Figure 3 Type of mobile phone owned by the students (n=3933)

During the statistical evaluation, it was found (table 1) that the students' responses by gender and by the type of school students attended were statistically significant at the P-value < 0.01. Incorporating this question into the survey helped select the sample for the next questions, which were intended for the students who owned a mobile device in the form of a smartphone, n=3745.

Table 1 Statistical evaluation of the type of mobile device owned by the students (n=3933)

item	boys/ girls	grammar school/ vocational school
statistical significance	**	**
chi-square test (P-value)	p= 2.522 E-07	p= 0.00319

Explanatory notes: statistical significance – $p < 0.01 = **$, $p < 0.05 = *$, si = statistically insignificant

Subsequently, the survey was used to find out how and/or whether the students usually connect their mobile devices to the Internet. Vokáč, (2015) states that according to GlobalWebIndex (GWI), which conducted a survey on 170,000 respondents in 32 countries of the world in the third quarter of 2014, up to 75% of population is constantly online. According to the findings, almost 50% of the students usually use the combination of Wi-Fi and mobile data. Connecting to the Internet solely by mobile data is preferred mostly by vocational school students – 20.28% and regarding gender by boys – 19.69%. On the other hand, connecting to the Internet solely by Wi-Fi is preferred by almost the same % of the students in all of the observed samples – i.e. at the level of 33%. The results further point to the fact that on average only 0.44% of the students do not connect their mobile devices to the Internet. According to Palička, Jakubec, Knajf, Maněnová (2017), mobile connection to the Internet is used by 48% of the students aged 9 to 15 and 62.9% of the students aged 16 to 20. And the findings of Urbanová-Holubíčková (2019), that 6% of girls aged 15 admitted to not eating or sleeping often and very often due to the Internet in the last 12 months, are highly alarming. Based on the research conducted by CVTI SR (Slovak Centre of Scientific and Technical Information) on the usage of the Internet in home environment (www.minedu.sk) which was publicised in 2020, up to 96.6% of the students have access to the Internet in the home environment. The research further shows that up to 93.6% of the students have Internet connections available directly in their mobile device. Here, it is important to point out that according to the analysis of the European Commission, which focused on the phone and mobile data packages as well as separate data packages in the countries of the EU, Slovakia ranked among the countries with the highest prices of mobile data and the Internet in Europe. Slovaks pay at least two times more for mobile services than the European Union average and have the most expensive excess data volumes from the EU-28 (Klonker, 2020).

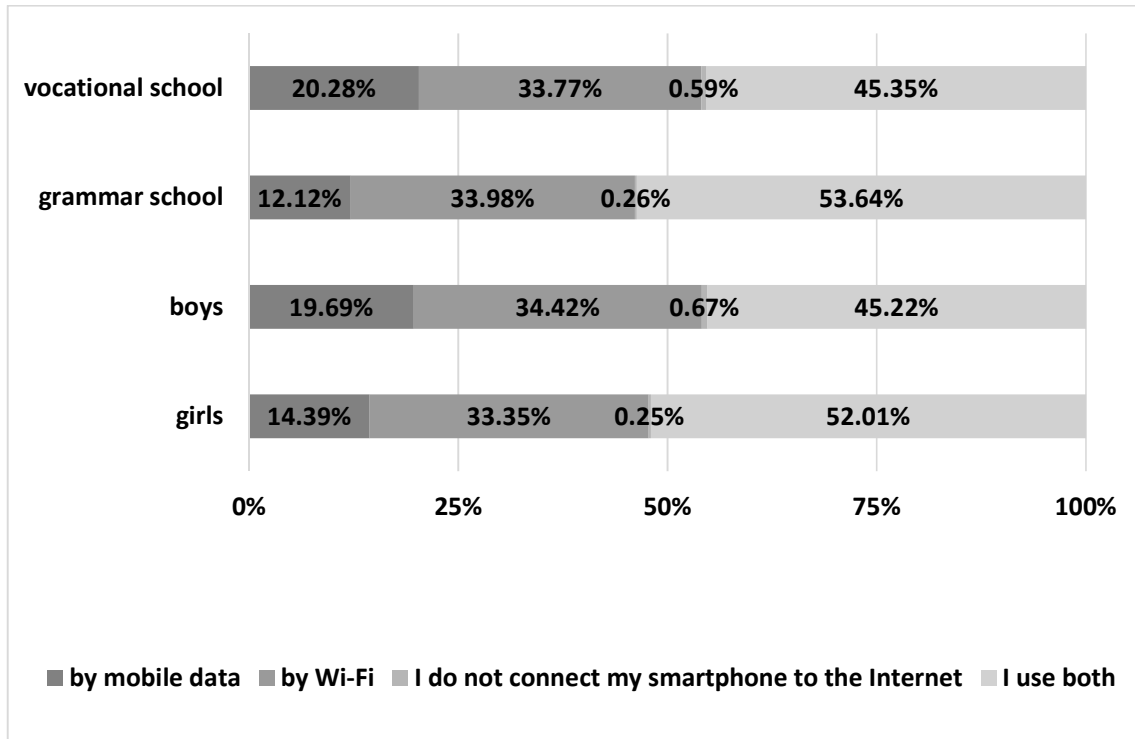


Figure 4 Type of the students' mobile Internet connection

In the statistical evaluation, while evaluating this question, significant differences between the observed samples of the students were noticed both by gender and in the type of school the students attend at the P-value < 0.01 (table 2).

Table 2 Statistical evaluation of the type of Internet connection of the mobile device owned by the students (n=3745)

item	boys/ girls	grammar school/ vocational school
statistical significance	**	**
chi-square test (P-value)	p= 3.163 E-06	p= 5.224 E-11

Explanatory notes: statistical significance – $p < 0.01 = **$, $p < 0.05 = *$, $si =$ statistically insignificant

Gáliková (2018) states that people aged 18 to 33 check their mobile phone 85 times a day, or every 10 minutes without realizing it. The research also surveyed how much time the respondents spend on mobile phone activities (Figure 5).

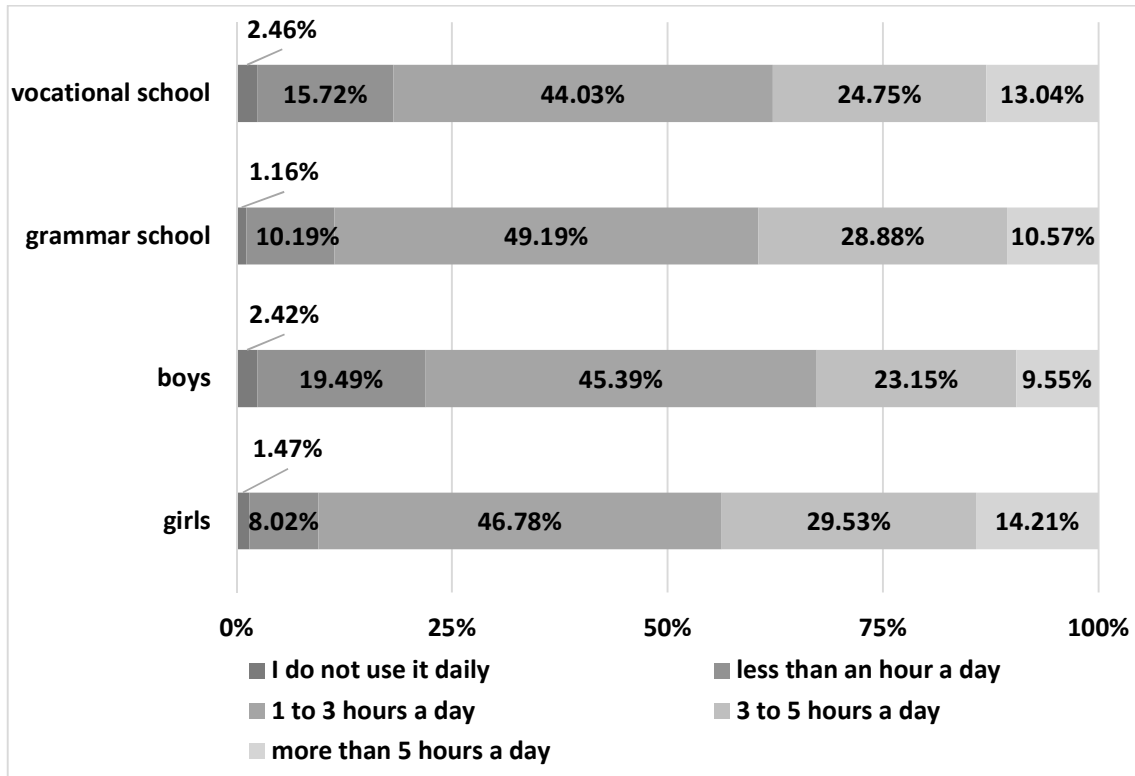


Figure 5 Time spent on activities connected to smartphone

As for the time spent on activities connected to smartphone, it was noted that students in every observed sample to a large extent – i.e. from 44.03% (high school students) to 49.19% (grammar school students) spent approximately 1 to 3 hours a day on activities connected to the smartphone. The results further show, that most grammar school students spent from 3 to 5 hours a day on activities connected to the smartphone – 28.8% of responses, and by gender, mainly girls – 25.53% of responses. On average 11.84% of the students fall into the category of more than 5 hours a day smartphone usage. Less than 2.5% of the students do not use their smartphone daily, and in the range of 1 to 3 hours a day, a smartphone is used mostly by boys – 19.49% of responses. According to Wurmser (2018), the users spend approximately 3 hours and 35 minutes a day on their mobile devices, and the annual increase is more than 11 minutes.

By evaluating this question, significant differences in responses by gender differences were noted at the P-value < 0.01 (table 3). However, no statistically significant differences were noted by the type of school the students attend.

Table 3 Statistical evaluation of time spent by the students on activities connected to smartphone (n=3745)

item	boys/ girls	grammar school/ vocational school
statistical significance	**	**
chi-square test (P-value)	p= 1.0464E-05	p= 0.322825154

Explanatory notes: statistical significance – $p < 0.01 = **$, $p < 0.05 = *$, $si =$ statistically insignificant

Subsequently, the aim of the following question was to find out how the students themselves evaluate the amount of time spent on activities connected to mobile devices (Figure 6).

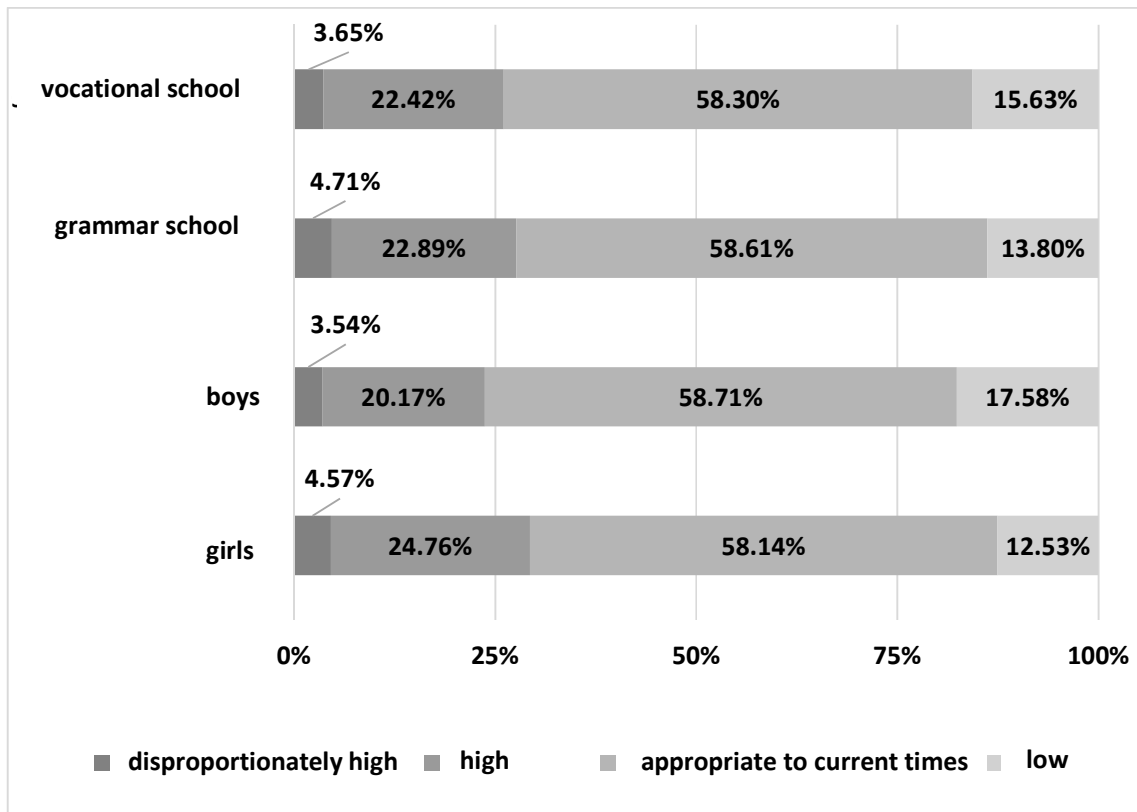


Figure 6 Evaluation of the amount of time spent on activities connected to smartphone from the students' perspective

The students had four options to choose from: disproportionately high, high, appropriate to current times, low. As Figure 6 shows, the responses of the students from the type of school they attend were very similar, without any

notable differences in the partial responses. The majority of the students – approx. 58% – considers the time spent on smartphone to be appropriate to current times. Similar results were also noted when assessing this item by gender. Only less than 5% of the students from the observed samples considered the amount of time spent on mobile activities to be disproportionately high. When assessing this question, the most significant differences were noted by gender, where the partial responses of the options “high” and “low” showed a 5% difference.

The findings also mirrored in the statistical evaluation of this question. No significant differences were noted when looking for differences in the type of the school the students attended (table 4). Differences looked at by gender were statistically significant at the P-value < 0.01.

Table 4 Statistical evaluation of the evaluation of the amount of time spent on activities connected to a smartphone from the students’ perspective (n=3745)

item	boys/ girls	grammar school/ vocational school
statistical significance	**	si
chi-square test (P-value)	p= 3.22184E-06	p= 0.198331385

Explanatory notes: statistical significance – $p < 0.01 = **$, $p < 0.05 = *$, si = statistically insignificant

The following question was intended to identify which activity is most connected to the time spent on a smartphone, since according to Vadaš (2003), IT technology affects all activities not only at school, while studying, or self-studying, but also during free time. As expected, while examining the preferred activities connected to mobile devices, it was found (Figure 7) that mainly in the girls’ sample (65.18%) and grammar school students’ sample (64.67%) the most preferred activity is social media.

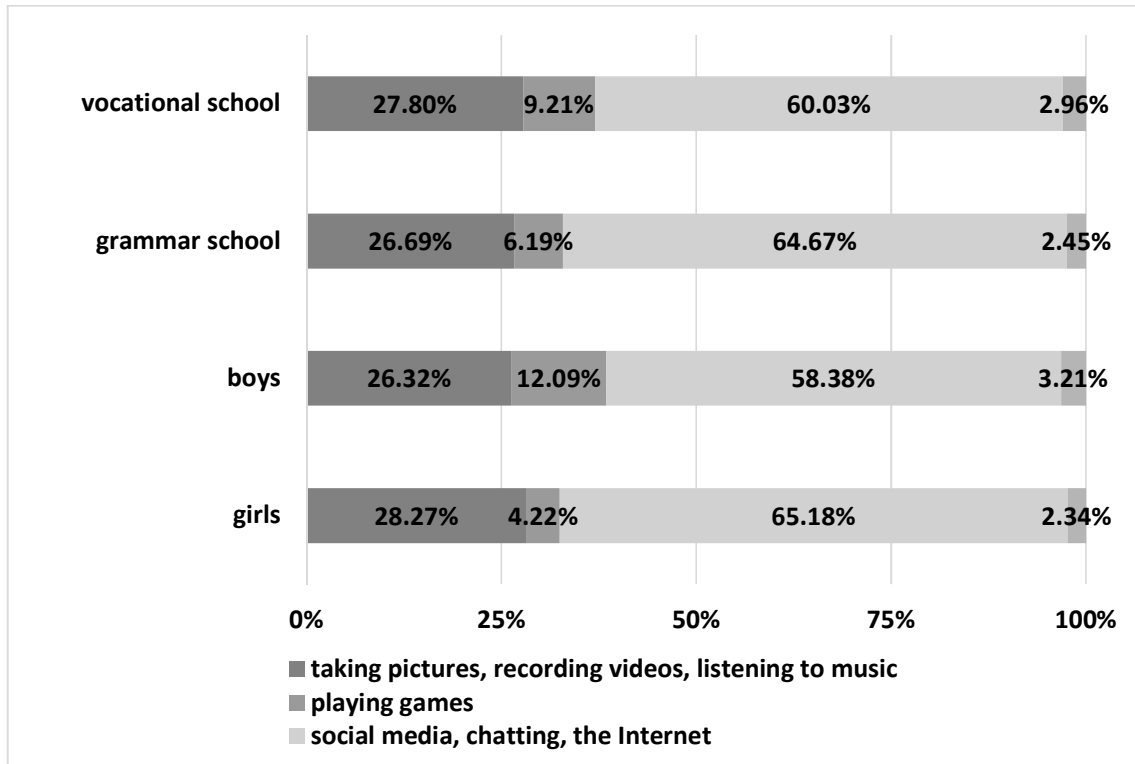


Figure 7 Preferred smartphone activities from the students' perspective

The above-mentioned activities are also preferred by the boys' sample, but the frequency of responses in this item was the lowest in all the samples studied, reaching 58.38%. However, in the "playing games" option, the frequency was highest in the boys' sample – with 12.09% and the lowest in the girls' sample – only 4.22%. In general, the option of taking pictures, recording videos, and listening to music was marked as the second most frequent mobile device activity, with the response frequency being higher than 26% (average in all the observed samples was 27.27%). Using a mobile device to monitor sports and physical activities is preferred on average by 2.67% of the students, with the highest response frequency in the boys' sample – 3.21% and in the vocation school students' sample – 2.96%. This may indirectly point to the fact, that health problems may arise in this age group in the future. According to Svačina (2010), this may be a factor that is significantly connected to obesity and its negative health consequences in the future. Fišer (2017) states in his study, that according to Counterpoint statistics, the most frequent activity

performed on smartphones is searching the Internet – 64%. It is followed by playing games (62%) and making phone calls (56%). Chatting and sending SMS ranked fourth (54%). Wurmser (2018) states, that listening (music, radio) is the most frequent app activity, where an average adult citizen of the United States listens to them more than 50 minutes a day. It is followed by social media (more than 40 minutes), mobile games and SMS. The results of this publication correlate with the U&A Study survey, performed for O2 by Ipsos. This survey shows, that more than 50% of the US citizens mostly “surf” on their mobile phones – mobile phones are dominated by Internet search (74%), e-mail (74%) and social media (73%). Another survey performed in Slovakia looking at usage by region states that the highest amount of mobile data is used in Bratislava County, followed by Košice and Prešov County (<https://strategie.hnonline.sk>). From the activities done on smartphones, Banská Bystrica County is dominated mainly by the usage of the Internet (Euractiv.sk, 2018).

From the perspective of statistical evaluation, the responses from compared by gender and the type of school the students attended were significant at the P-value < 0.01 (table 5).

Table 5 Statistical evaluation of the time spent on activities connected to smartphone from the students’ perspective (n=3745)

item	boys/ girls	grammar school/ vocational school
statistical significance	**	**
chi-square test (P-value)	p= 5.33022E-18	p= 0.001964812

Explanatory notes: statistical significance – $p < 0.01 = **$, $p < 0.05 = *$, $si =$ statistically insignificant

4.2 EVALUATION OF THE STUDENTS' RESPONSES CONCERNING THE USAGE AND MONITORING OF SPORTS AND PHYSICAL ACTIVITIES WITH SMARTPHONE

Smartphones are mostly used for communication and fun, but they can be also used as a camera, a music player, a calendar, or a TV. However, not many people realize the presence of different sensors in these devices (Kopecká, Slobodník, 2018). Figure 8 presents the opinions of the students on the amount of their usage of mobile devices with sports and physical activities. Palička, Jakubec, Knajf, Maněnová (2017) found, that from perspective of the usage of apps aimed at sports and physical activities, their usage was between 2.9% (pubescence) and 3.2% (adolescence).

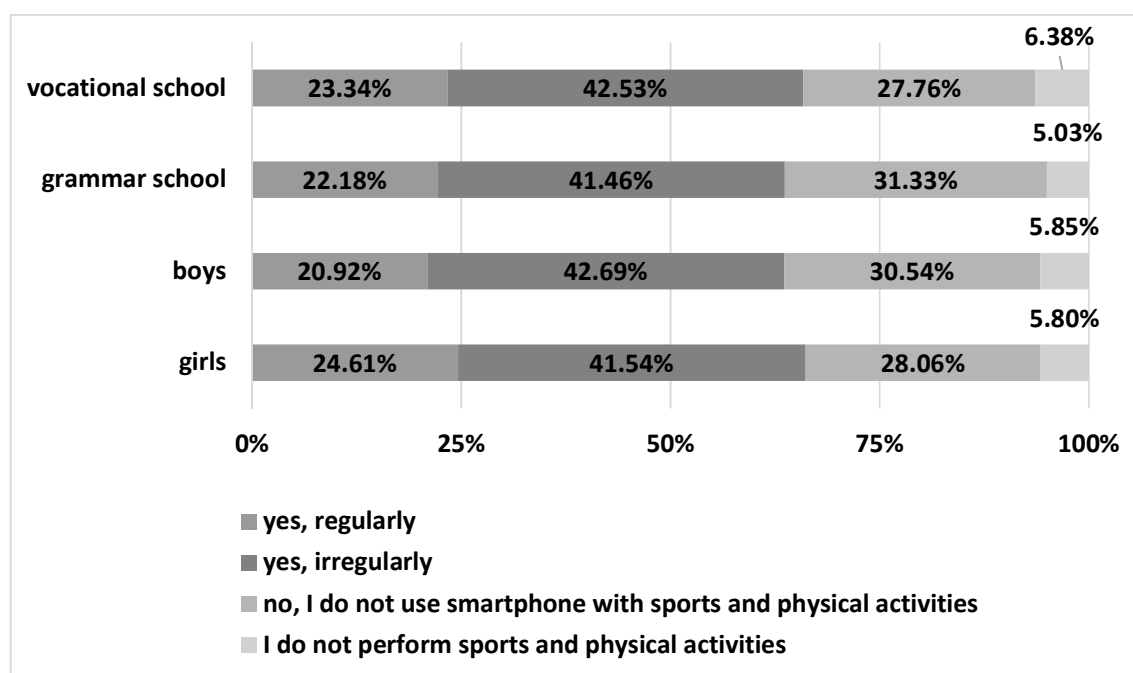


Figure 8 *The students' usage of smartphone with physical activities*

These findings show that the partial responses in all the observed samples were very similar. A smartphone is regularly used for monitoring of sports and physical activities on average by 22.76% of the students, with partial differences being lower than 4%. The most frequent response in all the studied samples was the option “yes, irregularly” which was marked by approximately 42.05% of the students. The second most frequent response was the option

“no, I do not use a smartphone in sports and physical activities”, which was marked by 1/3 of the students and on average, 5.76% of the students stated that they do not do sports and physical activities. These findings are undeniably related to the fact, that according to Bendíková (2014), that 39% of high school girls do not do any sports or recreational activities.

As it was suggested in the text of the previous response, responses to this question from the perspective of partial responses were very similar. During the statistical evaluation, no significant differences were noted by gender or by type of school the students attended (table 6).

Table 6 Statistical evaluation of the usage of smartphone in sports and physical activities from the students’ perspective (n=3745)

item	boys/ girls	grammar school/ vocational school
statistical significance chi-square test (P-value)	si p= 0.050264213	si p= 0.054837731

Explanatory notes: statistical significance – $p < 0.01 = **$, $p < 0.05 = *$, $si = statistically\ insignificant$

According to the Strategy Analytics survey, the smart watch market grew considerably in the past few years (Biznár, 2019). This survey shows, that in 2019, sales grew by 56% and reached 18 million units sold in the fourth quarter of 2018. In total, 45 million units were sold in 2018. From these sold units, the Apple Watch represents 51%, Fitbit watch ranked second, Samsung watch third, and the fourth place belonged to the Garmin watch. Nowadays, not only smartphones, but also fitness trackers are a part of our everyday lives. They monitor movement, sleep, sports activities and depending on their options and types, they also collect other valuable information. This information can be easily saved into mobile phones, keeping track of your activities. Modern trackers even notify people to increase their activity or notify them when the activity is too high and suggest resting and regeneration. Smart fitness trackers became the assistants of not only sporty people, but everyone who wants to keep track of their physical activities and sleep. The following question of the survey, given the above-mentioned facts, was meant to

determine, if the students use in addition to a mobile device other monitoring devices to monitor their sports and physical activities, e.g. heart rate monitor, fitness tracker, smart watches, etc. (Figure 9).

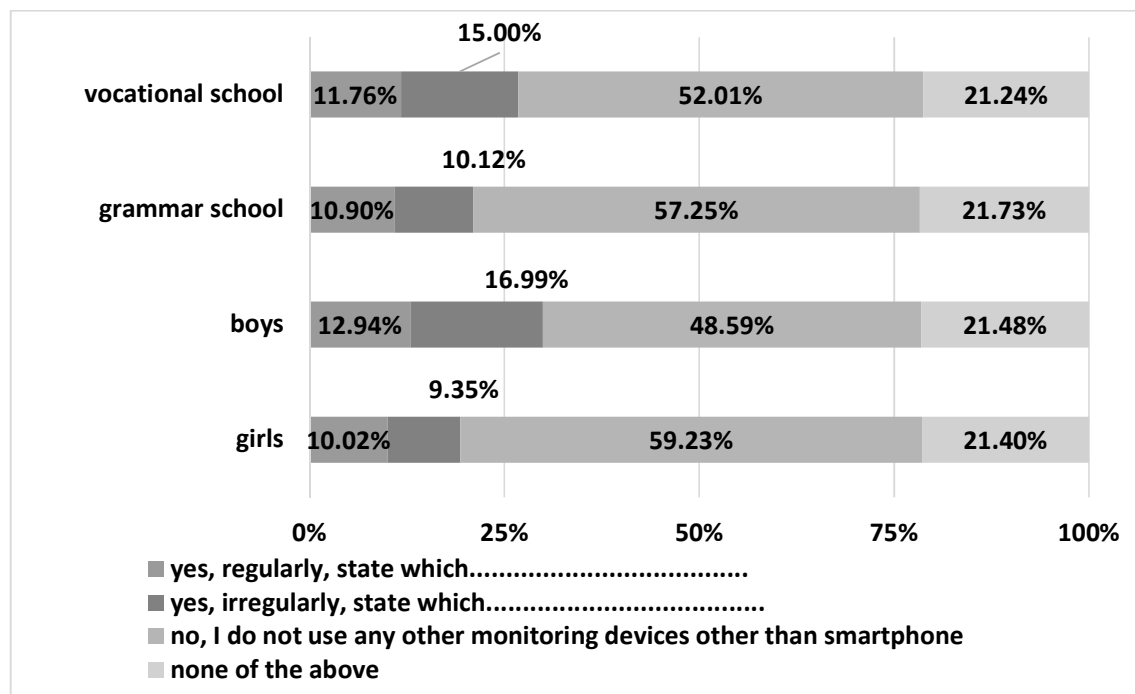


Figure 9 Usage of monitoring device other than smartphone with the students’ sports and physical activities

The Figure 9 shows, that monitoring devices are used to a large extent either regularly (12.94%) or irregularly (16.99%) by the boys’ sample and regarding the type of school the students attended, by vocational school students – 11.76% regularly and 15% irregularly. Devices used to a large extent by the students which dominated in the responses are fitness trackers and smart watches. These devices are used to a lesser extent by the girls’ sample (10.02% regularly and 9.35% irregularly), while almost 60% stated that other than a smartphone, they do not use any other monitoring device with sports and physical activities. The alternative “none of the above”, was marked in all the observed samples by 21% of the students.

In the statistical evaluation, significant differences between the observed samples of the students were noted in the evaluation of this question – meaning both regarding gender and type of school the students attended at the P-value < 0.01 (table 7).

Table 7 Statistical evaluation of the usage of monitoring device other than smartphone with sports and physical activities from the students' perspective (n=3745)

item	boys/ girls	grammar school/ vocational school
statistical significance	**	**
chi-square test (P-value)	p= 9.46948E-15	p= 6.71369E-05

Explanatory notes: statistical significance – $p < 0.01 = **$, $p < 0.05 = *$, si = statistically insignificant

As Figure 10 shows, the students mostly use smartphone with activities done in nature, where the frequency of the responses in all the observed samples was higher than 37%. A smartphone is used to a large extent by girls – 44.09% and grammar school students – 43.58%. Monitoring sports and physical activities inside with a smartphone is preferred by up to 18.15% of boys and 18.09% of vocational school students. Monitoring sports and physical activities outside and inside is done on average by 18.46% of the students. Almost 1/4 of the students marked the option “none of the above”.

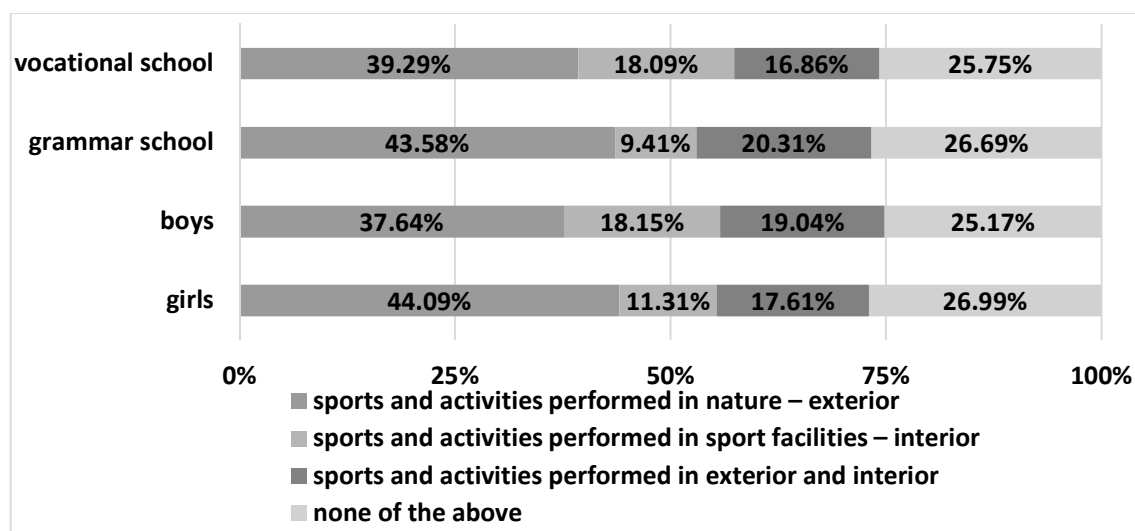


Figure 10 The nature of sports and physical activities with which the students most often use mobile devices

During the statistical evaluation, it was found that responses regarding gender and by type of school the students attended were significant at the P-value < 0.01.

Table 8 Statistical evaluation of the nature of sports and physical activities with which the students most often use mobile devices from the students' perspective (n=3745)

item	boys/ girls	grammar school/ vocational school
statistical significance	**	**
chi-square test (P-value)	p= 4.01155E-09	p= 1.9906E-12

Explanatory notes: statistical significance – $p < 0.01 = **$, $p < 0.05, = *$, si = statistically insignificant

It is generally known that modern smartphones have different sensors, such as accelerometer, gyroscope, compass, camera, etc. This wide variety of sensors was ensured by the fast technological development connected with minimisation, and faster and more precise processing of acquired data (Priyadarshini, 2018). That is why the following question was aimed to find out which sport and physical activity the students most often monitor with a smartphone (Figure 11).

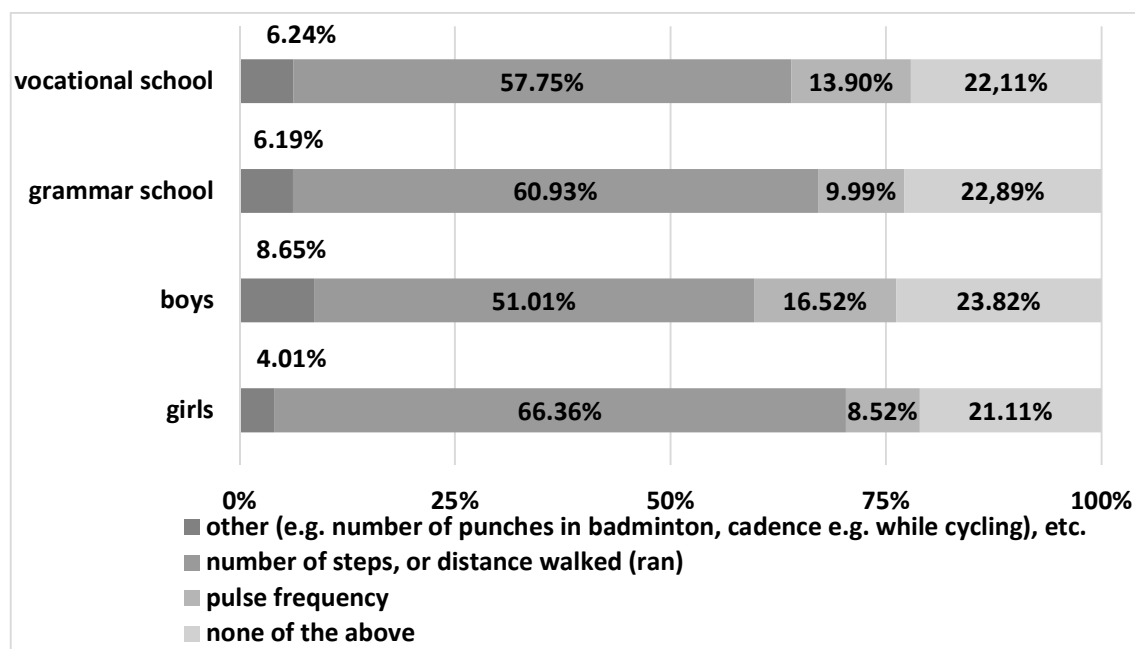


Figure 11 Most frequent activity monitored by the students with a smartphone

The results show that it is the number of steps, or distance walked/ran that was marked in the response sheet by more than 51% of the students. These activities were monitored to a large extent in the girls' sample – 66.36%, and the grammar school students' sample, where the response frequency was 60.93%. They were monitored to a lesser extent in the boys' sample – 51.01% of responses. The second most monitored activity in all the observed samples is the heartrate (in the boys' sample up to 16.52% and in the vocational school students' sample up to 13.90% of responses). Kompán (2003) states, that monitoring exercise with a heart rate monitor is a particularly suitable accessory for evaluation and the overall monitoring of the exercise load. Monitoring of other activities with a smartphone was used mainly in the boys' sample – 8.65% of responses. As with the evaluation of the previous question, on average 22.48% of the students marked the option “none of the above”. In the statistical evaluation of this question, significant differences were seen not only regarding gender, but also in the type of school the students attended, and were noted at the P-value < 0.01 (table 9).

Table 9 Statistical evaluation of the most often monitored activity by the students with smartphone (n=3745)

item	boys/ girls	grammar school/ vocational school
statistical significance	**	**
chi-square test (P-value)	p= 1.79309E-26	p= 0.004412488

Explanatory notes: statistical significance – $p < 0.01 = **$, $p < 0.05 = *$, $si =$ statistically insignificant

4.3 EVALUATION OF STUDENTS' RESPONSES CONCERNING THE AWARENESS AND EXPERIENCE WITH APPS THAT MONITOR SPORTS, PHYSICAL AND PLAYFUL ACTIVITIES WITH SMARTPHONE

Kadlec (2019) states, that manufacturers of wearable fitness devices use their own apps to synchronize the tracker or watch with a mobile phone. Our data can be later checked in a mobile app, but fitness apps bring other functions and can, in a way, affect our decision when buying a smartphone. Apps that monitor sports and physical activities are a relatively new tool for interventions related to health, and very little professional and scientific works have been published concerning their usage or impact (Palička, Jakubec, Knajf, Maněnová, 2017). Given the enormous number of sport and physical activity apps which overlap multiple functions and focuses, it is impossible to classify and characterize each category. Given the above-mentioned, this publication aimed to find out if the observed sample prefers apps installed by the manufacturer or the apps available at internet stores (Figure 12). The results show that the students in all the observed samples predominantly prefer apps that monitor sports and physical activities that are installed by the manufacturer (Figure 12). The frequency of answers was from 31.29% in the boys' sample to 35.46% in the girls' sample. The second most frequent response was identical in all the samples, i.e. "I prefer to install apps on my own." The boys' sample (29.94%) and the vocational school students' sample (28.67%) install them on their phones to a greater extent. The combination of both options shows on average 26.99% of the students, and 19.85% of the students marked the option "none of the above".

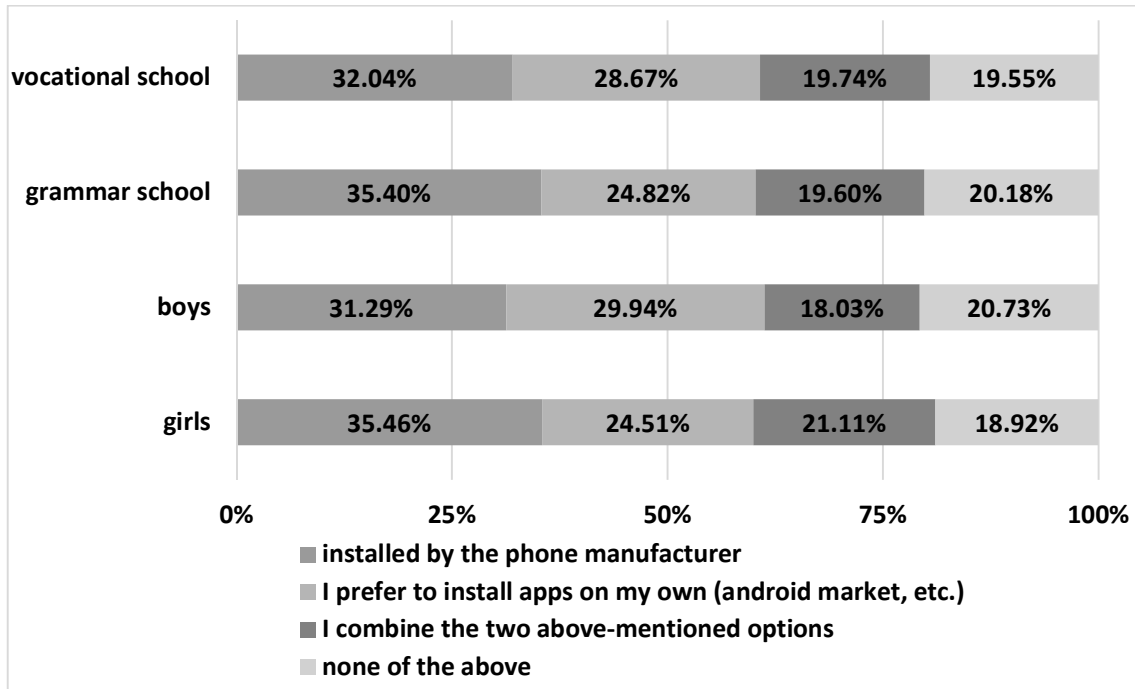


Figure 12 Preferred type of apps used by the students to monitor sports and physical activities

When evaluating this question, it is important to note that according to Valo (2005), the right way of doing physical activity (from the perspective of reaching its highest effect) is very important for monitoring the intensity of the performance load.

By the statistical evaluation of the results, it was found that responses compared by gender were statistically significant at the P-value < 0.01 and the differences by the type of school attended by the students were statistically significant at the P-value < 0.05 (table 10).

Table 10 Statistical evaluation of the preferred type of apps used to monitor sports and physical activities from the students' perspective (n=3745)

item	boys/ girls	grammar school/ vocational school
statistical significance	**	*
chi-square test (P-value)	p= 0.0001103	p= 0.041818658

Explanatory notes: statistical significance – $p < 0.01 = **$, $p < 0.05 = *$, si = statistically insignificant

As Štubniak (2018) states, designation of the load in the adequate energy zone is available in multiple paid or free apps such as Strava, Runtastic, etc. That is why this publication was interested in the students' opinion on the selected apps: Samsung Health, Endomondo, Google Fit, Runkeeper, Runtastic, Sports tracker, Map My Run or Strava. More specifically, it was interested in the students' usage and the awareness (or lack thereof) of these apps (Figure 13).

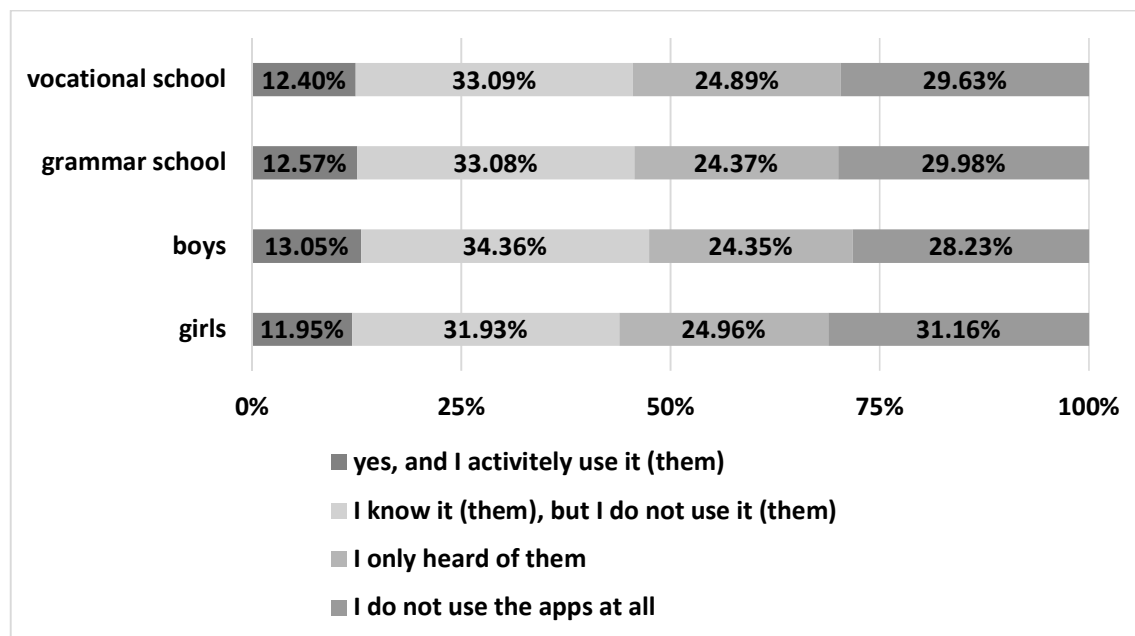


Figure 13 Awareness and experience of the students with Samsung Health, Endomondo, Google Fit, Runkeeper, Runtastic, Sports tracker, Map My Run or Strava

The results show that responses in all the observed samples were very even – similar. The most frequent response in all the observed sample was the option “apps - I know the apps, but I do not use them” which was marked on average by 33.11% of the students. The second most frequent response was the option “I do not know the apps at all”, which was marked by 29.75% of the students and on average, 24.64% of the students stated that they only heard of the apps. Even though the app (apps) is used actively to a large extent by the boys' sample – 13.05% of responses, the results of these partial responses were even (approx. 1% difference), i.e., the lowest rate of responses was noted in the girls' sample, with the frequency of responses being 11.95%. As the text of the

previous response to this question states, the responses to this question were similar, and no significant differences in the partial responses were noted – neither by gender nor by the type of school the students attended (table 11).

Table 11 Statistical evaluation of awareness and experience of the students with Samsung Health, Endomondo, Google Fit, Runkeeper, Runtastic, Sports tracker, Map My Run or Strava (n=3745)

item	boys/ girls	grammar school/ vocational school
statistical significance	si	si
chi-square test (P-value)	p= 0.143568998	p= 0.984024568

Explanatory notes: statistical significance – $p < 0.01 = **$, $p < 0.05 = *$, si = statistically insignificant

The following question also concerned the apps chosen by us, which were: Najdi kopec, PeakFinder, Vypadni.sk, Turistické atrakcie Slovensko, Hradý a zámky.sk. Figure 14 presents the results of the findings, which show that the most frequent response was “I do not know the apps at all”, which was on average marked by 38.15% of the students. Its highest frequency was noted by the grammar school students’ sample and the girls’ sample.

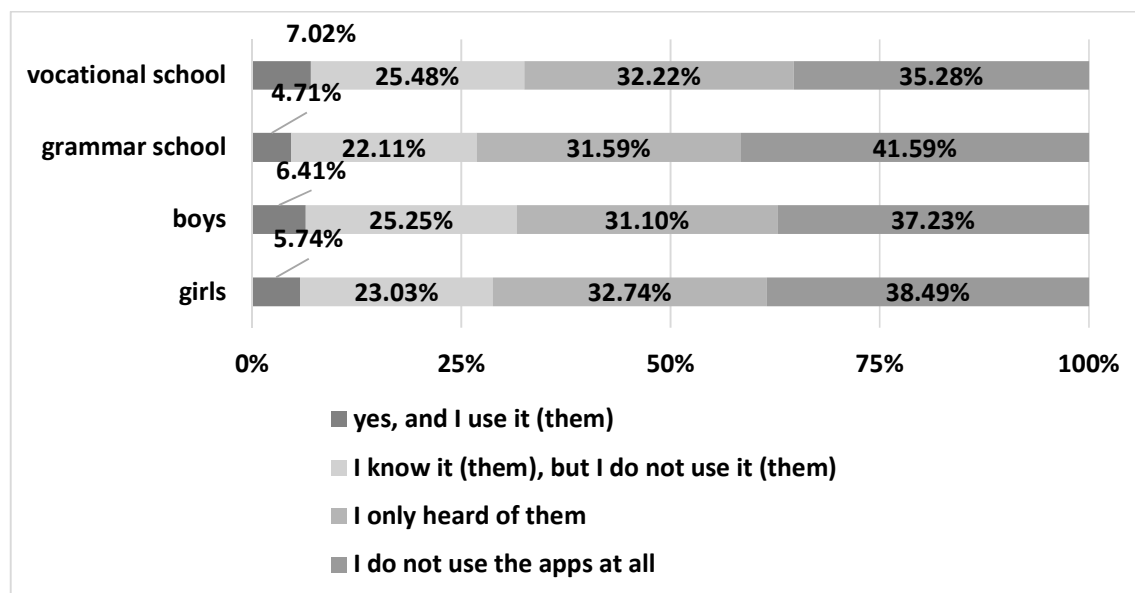


Figure 14 Awareness and experience of the students with apps Najdi kopec, PeakFinder, Vypadni.sk, Turistické atrakcie Slovensko, Hradý a zámky.sk.

The second most frequent answer was “I only heard of them”, with responses on average being 31.91% – while responses from in the individual observed samples were almost identical (Figure 14). “I know the app (apps), but I do not use it/them” was marked on average by 23.97% of the students (to a large extent in the boys’ sample – 25.25% and vocational school students’ sample – 25.48%). The option “I know the app (apps), and I actively use it/them” was marked by the students to a lesser extent, where the average reached only 5.97%. The vocational school students’ sample – 7.02% and the boys’ sample – 6.41%, had the biggest experience with the apps.

From the perspective of statistical evaluation, the following was found – significant differences were noted at the P-value < 0.01 (table 12) by the type of school the students attended. No statistically significant differences were noted by gender.

Table 12 Statistical evaluation of awareness and experience of the students with the apps Najdi kopec, PeakFinder, Vypadni.sk, Turistické atrakcie Slovensko, Hradý a zámky.sk (n=3745)

item	boys/ girls	grammar school/ vocational school
statistical significance	si	**
chi-square test (P-value)	p= 0.287198209	p= 6.70968E-05

Explanatory notes: statistical significance – $p < 0.01 = **$, $p < 0.05 = *$, si = statistically insignificant

This research also wanted to find out if the observed sample of the students knew the apps which allow them to do different sports and physical activities, since according to Sládek, Válek (2016), the current generation is characterised by the need to be constantly online, does not know the world without digital technologies, likes to make comparisons, confronts their surroundings, which many apps easily enable (Figure 15). Other than that, Vadaš (2003) states, that using heterogeneous IT technologies, platforms, apps during the teaching process influences all educational activities at school, and significantly influences how young people spend their free time. Dewahl, King, Williamson (2006) state, that the interest of students in physical

activities is intensified by appealing offers and the options of physical activities at school, with which the students should become duly involved.

The results point to the fact (Figure 15), that the awareness of the apps with which sports and physical activities or challenges can be done, is on a low level, since on average 35.66% of the students do not know these games or challenges and 31.98% of the students only heard of these games and activities.

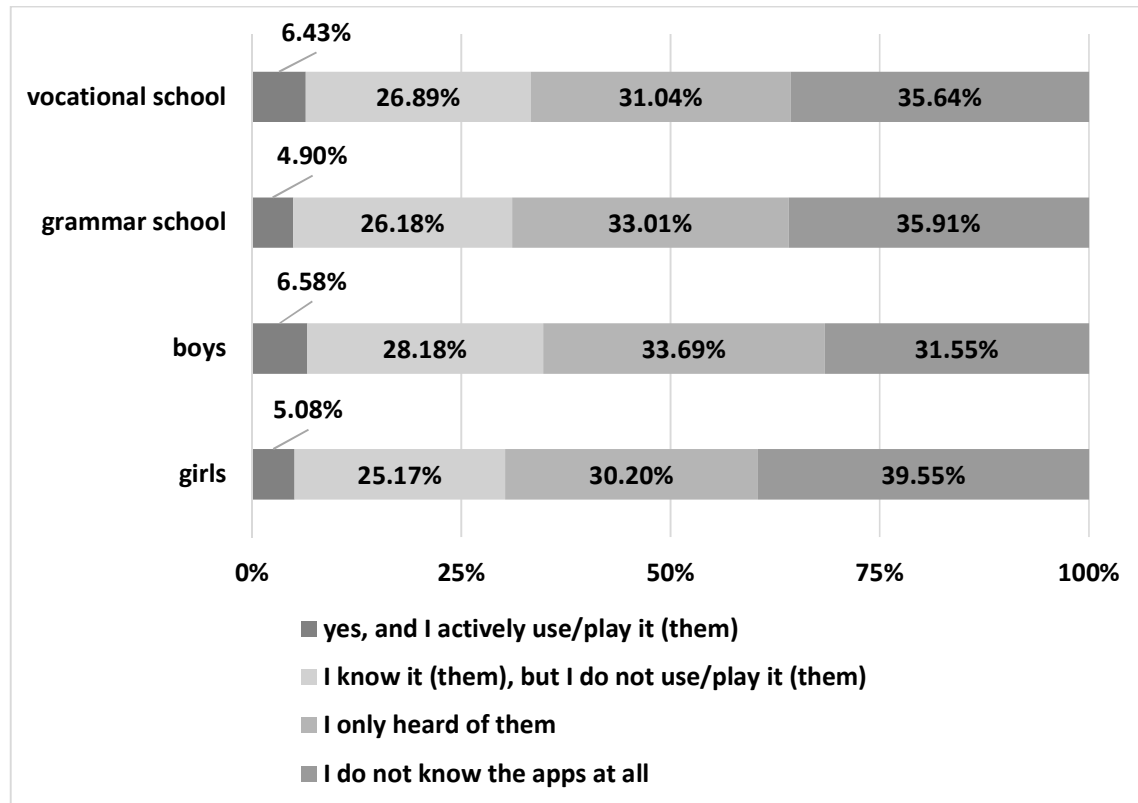


Figure 15 Awareness and experience of the students with smartphone apps with which it is possible to do playful physical activities, or do different challenges (Geocaching, Pokemon, Wherigo, GPS Mission, Challenges, etc.)

On average 26.60% of the students knew the apps, but do not use/play them. We noted the highest frequency of graffiti the responses in the boys’ sample, the amount being 28.18%. While evaluating this question, the highest interest was placed on the response “yes, and I use/play them actively”, which was marked on average by 5.75% of the students. From the observed sample of the students, the highest frequency of

the responses was noted in the boys' sample – 6.58% and in the vocational school students' sample – 6.43%, the lowest frequency was in the grammar school students' sample – 4.9%. The following was found in the statistical evaluation: the responses compared by gender were statistically significant at the P-value < 0.01, however the students' responses compared by the type of school they attended were not statistically significant (table 13).

Table 13 Statistical evaluation of awareness and experience of the students with smartphone apps with which it is possible to do playful physical activities, or do different challenges (Geocaching, Pokemon, Wherigo, GPS Mission, Challenges, etc.) (n=3745)

item	boys/ girls	grammar school/ vocational school
statistical significance	**	si
chi-square test (P-value)	p= 5.6456E-06	p= 0.175016933

Explanatory notes: statistical significance – $p < 0.01 = **$, $p < 0.05 = *$, $si =$ statistically insignificant

Palička, Jakubec, Knajf, Maněnová (2017) state, that multiple pedagogical and educational researches documented software or hardware assets of the digital devices – smartphones can be effectively used to enhance teaching process by way of motivation and increasing of effectiveness of teaching different subjects, including physical and sports education. Although the conditions for use of digital technology during physical and sports education are more limited, teachers nowadays have different options of how to include these assets effectively into the teaching process. Palička (2017) in his paper studied the matter of including modern technologies (mobile phones, tablets, wireless Internet connection, mobile and web apps) into the physical and sports education lessons. His results show that students' inner motivation towards this subject and physical activity increased, mainly in the boys' research sample. His results point to the fact, that the implementation of his program improved the results of the students' motor skills tests. The final question of the survey was concerned with the interest of the students in trying playful physical activities with a smartphone, or other monitoring device during the physical and sports education lessons, since Palička, Jakubec, Knajf and

Maněnová (2017) state, that 36.7% of the students use a smartphone with physical activity apps in their everyday life.

This question was motivated by Gregorová’s paper (2012). In her paper, she states that every student brings to the school environment number of stimuli, experience and mostly expectations that they would use modern technologies at school. Positive responses (“definitely yes”, “yes”) were noted with more than 49% of girls, and more than 47% of boys (Figure 16). Regarding the type of the school the students attended, it was more than 50% of grammar school students and more than 48% of vocational school students. On average, 26.63% of the students could not clearly express their opinions, with the highest frequency of responses in the girls’ sample – 28.87% and the lowest in the boys’ sample – 24.27%.

The results show, that almost 1/4 of the students in all the observed samples are not interested in trying the above-mentioned activities during the physical and sport education lessons – the response “no” and “definitely no”. The highest number of negative responses was marked in the boys’ sample (more than 26% of the responses), which is considered to be a surprising outcome.

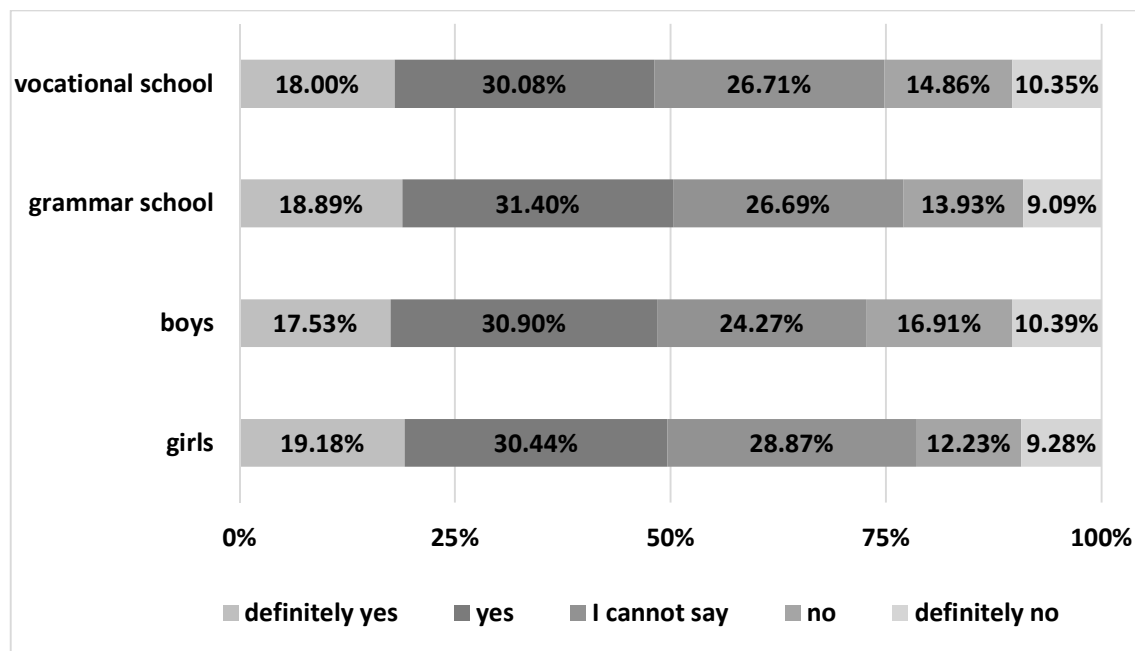


Figure 16 The interest of the students in trying playful sports and physical activities with a smartphone during the sports and physical education lessons

By the statistical evaluation of the results, it was found that responses compared by gender were statistically significant at the P-value < 0.01, and the results regarding the type of school the students attended were not statistically significant (table 14).

Table 14 The statistical evaluation of the interest of students in trying playful sports and physical activities with a smartphone during the sports and physical education lessons (n=3745)

item	boys/ girls	grammar school/ vocational school
statistical significance	**	si
chi-square test (P-value)	p= 7.63887E-05	p= 0.573444621

Explanatory notes: statistical significance – $p < 0.01 = **$, $p < 0.05 = *$, $si =$ statistically insignificant

CONCLUSION AND RECOMMENDATIONS

The partial goal of the grant project **KEGA 012UMB-4/2019** “Application of modern information and communication technologies to positively stimulate the adolescents’ relation with implementation of healthy physical activities in school and leisure time” was to find out the level of use of smartphones during sports and physical activities in groups of pupils attending high schools. A questionnaire was used to collect this information. Two approaches were the main criteria for the survey evaluation:

- ✓ Gender differences, where pupils’ opinions – boys’ and girls’ – were compared.
- ✓ School type attended, where the differences in pupils’ opinions (boys’ and girls’) were observed, in terms of school they attend – grammar school and vocational school.

It follows from the results, that pupils in every observed group prefer applications, used for monitoring sports and physical activities, installed by manufacturer (Figure 13). On average, 23.97% of pupils know the applications but they do not use them (the highest rate was recorded in the group of boys – 25.25% and in the group of pupils of vocational schools – 25.48%). The response “I know the applications and I also use them” was the least likely to be ticked – the average was 5.97% of responses. The group of pupils from vocational schools – 7.02% and the group of boys – 6.41% have the most experience with the applications.

The results point to the fact (Figure 16), that the awareness of the applications which can be used to play various sports and do physical activities or challenges, is very low. On average, 35.66% of pupils do not know these games and 31.98% of pupils only heard of them. When evaluating this question, the response “yes, I also actively use/play them”, which was ticked only by 5.75% of pupils, was the most interesting for the survey. From all observed groups the highest frequency of responses was recorded in the group of boys – 6.58% and in the group of pupils attending vocational schools – 6.43%. The lowest frequency was observed in the group of pupils attending grammar schools – 4.9%. Statistical evaluation revealed the following: pupils’

responses in terms of gender differences were statistically significant at the level $p < 0.01$, but pupils' responses in terms of type of school were statistically insignificant (Table 14).

It was essential to find out the pupils' interest in trying playful sports and physical activities using a smartphone during the physical education and sport classes. More than 49% of girls and 47% of boys ticked positive responses – “definitely yes”, “yes” (Figure 17). In terms of type of school, positive responses were ticked by more than 50% of pupils from grammar schools and more than 48% of pupils from vocational schools.

On average, 26.63% of pupils were unable to give a clear answer, while the highest rate of responses was recorded in the group of girls – 28.87% and the lowest rate in the group of boys – 24.27%.

It follows from the findings that almost $\frac{1}{4}$ of observed pupils have no interest in trying the aforementioned activities in physical education and sports classes – answers “no” and “definitely no”. More than 26% of boys ticked the negative answer, which was very surprising. Based on the findings, it is recommended that physical and sport education teachers play smartphone-based sports and physical activities more often during their classes, as well as during school club activities, and possibly in other organizational forms.

Based on our findings, we recommend:

- In the module Health and its Disorders and Healthy Lifestyle, through physical and sports education teachers, increase students' awareness of the impact and effect of excessive use of ICT technologies on health in the form of emotional and physical symptoms, because as our research showed more than 40% of students use smartphones more than 3 hours a day;

- through pupils of physical and sports education, especially in the thematic unit of seasonal physical activity, to increase students' awareness of applications monitoring physical activities, as well as applications that motivate the implementation of physical activities in a playful, competitive way, as more than 60% applications;

- teachers of physical and sports education are recommended to make more use of playful physical and sports activities with a smartphone in physical and sports education classes and also in circle activities, or in other

organizational forms (courses, walks, etc.), as almost 50% pupils showed interest in such activities.

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ANNEXES

Annex 1 Survey of the use of smartphones in the implementation of physical activities for high school students - assignments

Dear students,

we would like to ask you to fill in the following survey, all information obtained is confidential and will be used only for the scientific purposes of the research team of the KEGA grant task. Your opinion is important, so we ask you for honest and truthful answers. Thank you in advance for your willingness and time.

1. Your gender is: a) a boy b) a girl
2. Your permanent residence in terms of population is: a) city (seat with 5,000 - 10,000 inhabitants) b) city (seat with 10,000 - 50,000 inhabitants) c) city (seat with more than 50,000 inhabitants) d) rural areas (seat with less than 5000 inhabitants)
3. Your permanent residence from the perspective of the region is: a) Bratislava Region b) Trnava Region c) Nitra Region d) Trenčín Region e) Žilina Region f) Banská Bystrica Region g) Prešov Region h) Košice Region
4. The school you attend is: a) grammar school b) secondary vocational school c) conservatory
5. The year you are attending is: a) 1st year b) 2nd year c) 3rd year d) 4th year
6. What type of phone do you own? a) smartphone b) classic push-button mobile phone c) I don't know d) I do not own a telephone
7. How do you connect your smartphone to the Internet? a) via wi-fi b) via mobile data c) I use both options d) I do not connect the smartphone to the Internet
8. How much time do you spend daily on smartphone-related activities? a) you do not use it daily b) less than 1 hour per day c) 1 to 3 hours a day d) 3 to 5 hours a day e) more than 5 hours a day
9. In your opinion, is the time you spend working with your smartphone? a) low b) appropriate to the present time c) high d) unreasonably high

10. What type of activity do you prefer besides calls and text messages on your smartphone? a) taking photos, making videos, listening to music b) social networks, chat, email c) playing games d) physical / sports activities

11. Do you also use a smartphone for your physical / sports activities? a) yes, regularly b) yes, irregularly c) no, I do not use the smartphone for physical activities d) I do not perform physical activities

12. In addition to your smartphone, you use other monitoring activities in your physical / sports activities device (GPS, pulse frequency meter, fitness bracelet, etc.)? a) yes, regularly, state which b) yes, irregularly, state which c) no, apart from my smartphone, I do not use any other monitoring device for my physical / sports activities d) none of the options

13. In which physical / sports activities do you most often use a smartphone to evaluate them? a) sports and activities performed in the natural environment - hiking, biking, running, Nordic walking, golf, swimming on lakes, etc. b) sports and activities performed in sports facilities - tennis, squash, badminton, bowling, swimming in the pool, etc. c) both activities are equally represented d) none of the options

14. Which parameter of physical / sports activity do you most often monitor via your smartphone? a) number of steps, resp. distance traveled b) pulse frequency c) other (eg number of strokes in badminton, squash, cadence, eg when cycling), etc. d) none of the options

15. To evaluate physical / sports activities via a smartphone, you preferably use the following applications: a) installed by the smartphone manufacturer b) I prefer my own installations (android market, etc.) c) I combine both of the above options d) none of the options

16. You know resp. Have you tried any of these apps - Samsung Health, Endomondo, Google Fit, Runkeeper, Runtastic, Sports tracker or Diet? a) yes, I also actively use it (their) b) I know her (them), but I don't use her (them) c) I just heard about them d) I do not know the application at all

17. You know or you tried any of these applications - Find the hill, Peak Finder, Tourist attractions Slovakia... a)yes, I also actively use it (their) b) I

know her (them), but I don't use her (them) c) I just heard about them d) I do not know the application at all

18. You will know the applications with the help of which it is possible to play playful motion games via the smartphone activities resp. implement play various challenges (geoaching, Challenges)? a) yes, I also use it (their) actively, I play b) I know, but I don't use it, I don't play c) I just heard about them d) I do not know the application at all

19. You would like to try physical and sports lessons, playful physical activities using a smartphone, resp. using another physical activity monitoring device? a) definitely yes b) yes c) I can't judge d) no e) definitely not

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