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**The Use of Information and Communication Technologies and  
Their Impact on Communication and Learning Process**  
Bachelor Thesis

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I declare that I carried out this bachelor thesis independently, and only with the cited sources, literature and other professional sources.

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## **Annotation**

### **Title: The Use of Information and Communication Technologies and Their Impact on Communication and Learning Process**

This paper aims to explore the current trends in the use of information and communication technologies (ICT) in the educational context, as well as to assess their impact on learning and communication. Concepts relevant to the topic are explored with the use of previous research in the fields of educational psychology and ICT. Then, the findings of a study conducted to discover students' in-depth perspectives on their use and relationship with ICT in the learning process are presented and discussed.

The methodology selected for this paper was the qualitative method, specifically focus group interviews with a semi-structured interview protocol. Maximum variation strategy was implemented to form the focus groups. The obtained data was then analyzed with the use of inductive analysis to reveal the overarching themes.

The findings of the study reveal that generally, students respond well to the use of ICT in learning. Use of ICT and distance learning do not have a significant impact on students' motivation. However, student engagement was found to be negatively affected by technology use, as well as students' focus and communication.

Key words: ICT in education, e-learning, ICT & communication, communication & learning

## **Anotace**

### **Název: Využití informačních a komunikačních technologií a jejich dopad na komunikaci a proces učení**

Tato bakalářská práce je zaměřena na výzkum aktuálních trendů v oblasti použití informačních a komunikačních technologií ve vzdělávacím kontextu. Dalším předmětem výzkumu je to, jak jsou v tomto kontextu propojené procesy učení a komunikace, a jak technologie mohou tyto procesy ovlivňovat.

V teoretické části práce jsou představeny základní pojmy z oblastí komunikace, ICT a e-learningu. Pak následuje výzkum faktorů, které mají dopad na učení, komunikaci a využití technologií za účelem zefektivnění těchto procesů ve vzdělávacím prostředí. V poslední kapitole teoretické části jsou představeny často používané technologie v oblasti vzdělávání a jejich potenciální dopady na procesy učení a komunikace, a také na duševní zdraví studentů. Osnovou zpracování teoretické části slouží odborná moderní literatura, především vědecké články z databází Web of Science a Science Direct.

Praktická část je zpracována v podobě vlastního výzkumu, který slouží k získávání informací o zkušenostech studentů s použitím technologií při studiu na vysoké škole a jejich vnímaného vlivu technologií na učení a komunikaci. Vzhledem k cílům práce byla použita metoda kvalitativního výzkumu v podobě rozhovorů s použitím polostrukturovaného seznamu otázek, což umožnilo získávání základních dat ve stejném rozsahu od každého respondenta a zároveň ty rozhovory prohloubit do určité oblasti v závislosti na odpovědích studentů. Data byla analyzována pomocí induktivní analýzy, jejíž výsledkem byla tři hlavní témata: vnímané výhody použití technologií ve výuce, vnímané výhody distanční výuky, vnímané nevýhody distanční výuky. V rámci průzkumu bylo zjištěno, že studenti obecně vnímají použití technologií ve výuce pozitivně. Jako hlavní výhody uvádějí flexibilitu a dostupnost studijních materiálů. Vliv použití technologií na motivaci studentů nebyl výrazný, ale velká část respondentů oznámila negativní dopady technologií na svůj zájem o výuku a schopnost soustředění. V rámci diskuze výsledky byly porovnány oproti existujícím nálezům v dané oblasti, dále byly uvedeny strategie zapojení technologií do vzdělávání považované studenty za nejúspěšnější.

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# 1 Introduction

Information and communication technologies (ICT) are ever-present in our daily lives. Work, leisure, communication, knowledge - in all these areas and in many more, people rely on technology to support their activities. The educational environment is not an exception. Technology is becoming an integral part of today's learning environments day by day, and both researchers and practicing educators are constantly exploring new ways in which technology can help facilitate learning, as well as contribute to a higher quality of education and higher levels of student satisfaction. Many studies talk about the benefits of such integration, as will be discussed in the following chapters. It has been associated with higher student engagement, better academic performance, and a rise in collaboration between students. However, some research also reveals that those benefits can be hindered by a variety of mediating factors that will also be discussed further in this paper. As Wahlstrom (1992) states, "The quick pace at which new technologies emerge makes it challenging to adequately assess their quality as well as predict their effect on learners and society as a whole". What this paper aims to achieve is to present both sides of the academic debate, investigate the real perspectives of the current generation of university students, and provide recommendations that could potentially enable the teachers and university officials to integrate ICT in class effectively while mitigating some of its negative effects.

## **2 Purpose of the paper & methodology**

### ***2.1 Purpose of the paper***

This research aims to present students' perspectives on their relationship with ICT in the educational context as well as their experience with using ICT in their learning and teaching practices respectively. Also, the study is aimed at exploring students' experiences with distance learning and its effect on their learning and communication.

### ***2.2 Methodology***

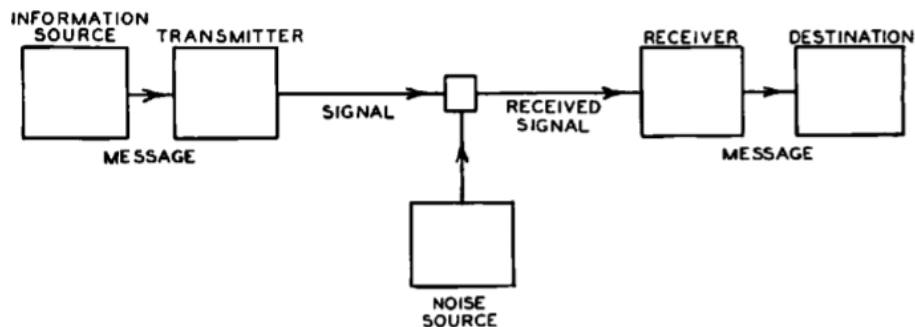
The theoretical framework for the paper was outlined with the use of both printed and online sources, which mainly included articles from the ScienceDirect and Web of Science databases. Then, the qualitative method was used in the study itself. Specifically, focus groups interviews conducted with students and teachers were conducted with a semi-structured interview protocol used as the foundation (see Appendix A). The data was then analyzed using the inductive analysis method, and three main themes emerged related to students' experiences and relationship with ICT in their learning process.

### 3 Communication & ICT

#### 3.1 Communication

Communication can be understood as a series of signals that are sent, encoded, transmitted via a channel, decoded and received. It can be verbal, nonverbal, and textual (Wahlstrom, 1992). It is an integral skill of every individual that enables us to interact with other people and media in a meaningful way. Communication is the central part of the learning process: it encompasses the majority of activities and tasks that students and teachers are faced with in their academic lives. Moreover, it is beginning to play an even more crucial role as new innovative learning models, more student- and collaboration-centered, emerge and are being implemented in the classroom (Long and Neff, 2018). Students are more and more often expected to participate in collaborative activities such as classroom discussions and presenting in front of the class (Rossa, 2010).

One of the earliest linear models in communication theory is the Shannon and Weaver Model that makes it possible to measure the amount and the quality of information passing through communication channels.



**Figure 1. The Shannon and Weaver communication model**

Source: Shannon (1948)

In this model, the information source produces a message or sequence of messages directed at a certain destination. Then, the transmitter adapts and transforms the message so that it can enter the communication channel (for instance, how sound pressure is transformed into electric current in telephony). The channel is essentially the medium used to carry the message over to the receiver. After that, the receiver reconstructs the message from the signal, and it is finally handed over to the intended destination. A noise

source is anything that can distort the original message (Shannon, 1948). As this model represents a mathematical perspective on communication, it might not comprise the real-life communication in its full complexity.

In the same year, Harold Laswell presented his own communication model. Its idea is that the process of communication is defined by the following parts (Laswell, 1948):

- Who (the communicator);
- Says What (content);
- In which channel (the environment/context);
- To whom (the audience);
- With what effect?

Laswell's model can be applied to education and e-learning specifically, as it emphasizes the effect of the audience, the environment, and the effect of the communication process: the channel is the internet or an online application, the audience are the students, and the desired effect is knowledge construction (Popescu, Buluc and Crăciun, 2014).

### **3.2 Information and communication technologies (ICT)**

The emergence and rapid development of ICT has brought about a massive shift in the way people meet, interact, make connections, create communities, and so much more. Due to the growing accessibility and popularity of mobile devices and the Internet, technology has dramatically changed the ways organizations and individuals communicate and exchange content, also creating an environment of extreme hyper-interconnectivity (Leung, 2013). That has caused both positive and negative influence on human interactions and mental health (as discussed in the *Social media* chapter).

The degree of adoption of ICT and the level of expertise with regards to technology varies depending on gender (Cuadrado-García, Ruiz-Molina and Montoro-Pons, 2010), age (Leung, 2013), and other factors such as accessibility of technology in a given environment. Cuadrado-García et al. (2010) made the argument that men and women tend to have differences in their use of technology: men tend to display a higher level of overall proficiency in computers and are more likely to use various online technologies. This gender gap in technology use is still relatively understudied, and existing research has

yielded mixed result, with some studies indicating an ever-present difference in learning styles between men and women that makes bridging this gap unlikely (Van Seters et al., 2012) and others claiming that the differences in technology use and expertise are undergoing a declining trend (Bruestle et al., 2009; Ramírez-Correa, Arenas-Gaitán and Rondán-Cataluña, 2015).

Research on technology use across generations remains somewhat scarce, especially when it comes to social media (Leung, 2013). The research that does exist mainly focuses on Millennials and Generation Z, as they are the ones who experienced the technological boom from a very young age and, essentially, grew up surrounded with modern technology, which makes them in some ways radically different from the generations before them. The categories mainly used to categorize generations are extensively described by Tapscott (2009) in his book *Grown up Digital: How the Net Generation is Changing Your World*. The cohorts he focused on were:

- Baby Boomers - born between 1946 and 1964, after the end of the Second World War, at the time of thriving postwar economy, motorization, and major social shifts;
- Baby Bust (Generation X) - born in the next 10 years, from 1965 to 1976, who are characterized by Tapscott (2009) as feeling excluded from society and less competitive on the job market;
- Echo Boomers (Millennials, Generation Y, Net Generation) - born between 1977 and 1997, the first generation to fully experience the Internet and the first generation to feel completely at ease with computers compared to their parents.

However, it was not the Generation Y but the Generation Z (often categorized as being born between 1994 and 2002 (Delbosc and Nakanishi, 2017)) who experienced the ubiquitous nature of ICT and social media in particular. This immersion in the interconnected world has influenced Generation Z in multiple ways in regard to their communication habits. Despite their strong attachment to digital media, some studies have found that in-person communication is still a preferred method of communication for them in the context of work, especially when it comes to feedback from their supervisor (DiMattio and Hudacek, 2020). This observation may be useful to apply and study in the educational context, as the findings can potentially be used to develop more

effective and motivating communication practices for teachers working with Gen Z students. When it comes to in-person studying, Gen Z have been found to have an appreciation for engaging and passionate lecturers, and to dislike the traditional lecture format (Shatto and Erwin, 2016).

### **3.3 Communication & learning**

Different forms of academic communication, such as help-seeking, question-asking, in- and out-of-classroom communication with fellow students and the instructor have been linked to students' improved academic performance, better learning, and a sense of belonging (Long and Neff, 2018). Students who participate in oral discussions in class tend to show higher academic achievement, and even when comparing classrooms as whole units, those groups where students communicated more frequently on average displayed better results (Sedova et al., 2019).

Research suggests that interpersonal interaction in the educational context impacts the learning effectiveness and student satisfaction in two main manners. Firstly, researchers and practicing educators conclude that building interpersonal connections and relationships in class (even when it comes to distance learning) enables the emergence of a learning community that fosters peer-to-peer learning and knowledge construction, helps learners comprehend the course material on a deeper level and build such indispensable skills as critical thinking, problem solving, and analysis (Friesen & Kuskis, 2013; Moore & Kearsley, 1996; Picciano, 2001; Salmon, 2002; 2004; Scardamalia & Bereiter, 2006). Secondly, communication between the participants of the learning process can potentially intensify students' emotional and psychological connection to the course, thus building up their involvement and engagement in the learning process (Gunawardena & Zittle, 1997; Shearer, 2019; Young, 2006).

A construct that has been claimed to play a significant role in interpersonal communication in the university environment is social capital. Social capital is defined by Ellison et al. (2011) as the emotional support and other psychological resources received from social interactions and relationships. Maintaining an adequate level of social capital has been linked to better self-esteem, higher levels of overall life satisfaction and less psychological problems (Ellison et al., 2007; McPherson et al., 2014). When it

comes to the educational context specifically, enhanced perceived social capital contributes to better adaptation of students to their new learning environment and helps them feel a stronger connection to their educational institution, which has a positive effect on their academic outcomes (Pascarella & Terenzini, 2005).

For students, maintaining relationships with their high school friends and seeking new connections in university is one of the keys to academic success. Students who have tighter social connections with their classmates and communicate a lot with their peers have a higher chance to persist to graduation (Eckles & Stradley, 2012; Pascarella & Terenzini, 2005).

### ***3.4 Factors influencing student communication***

As student-teacher and peer-to-peer communication has been found to positively influence learning (as discussed in the previous chapter), communication avoidance and communication anxiety tend to inhibit learning and academic performance (Weaver and Qi, 2016). Now that it has been established that communication and learning are interconnected and interdependent, it is necessary to look into the ideas, behaviors and aspects of the environment that may have an impact on how communication occurs, specifically in the educational setting.

The factors that come into play as far as communication is concerned are largely individual, but there are some that are related to aspects of the learning environment and other external factors. Both categories are discussed in this chapter.

#### **3.4.1 Individual factors**

Research points to a positive link between higher self-esteem and classroom participation (Rocca, 2010). Some studies revealed that this connection is only true for academic self-esteem specifically (Morrison and Duane Thomas, 2014), and some claimed that students with low self-esteem in general tend to be less active in the classroom (Williams, 2010). Morrison and Duane Thomas (2014) specified the different ways this link presents itself: students with lower academic self-esteem had a tendency to say less in class and sit at the back of the class, thus avoiding communication. Some recent studies argue that this



relationship is reciprocal, that is, self-esteem influences class participation and is also influenced by it in turn (Hernández et al., 2017; Karababa, 2020).

Another reason that students might abstain from communicating in class is concern for their academic image (Long and Neff, 2018). Interestingly, students with an adequate self-esteem are not exempt from those concerns, as claimed by Kennedy (1997). Students who feel the urge to present themselves as competent to their peers and instructors and at the same time feel unable to do so, are less likely to ask the teacher for help and are also more prone to social interaction anxiety (Leary and Jongman-Sereno, 2014). In turn, social anxiety has been found to lead to limited communication, - a strategy implemented by students to escape a situation where they can potentially embarrass themselves (Aamodt & Keller, 1981; Clark & Wells, 1995). A factor sometimes mentioned in literature in connection with self-concept and self-presentation is fear of evaluation (Leary and Jongman-Sereno, 2014). Both negative and positive evaluation can cause students to feel psychological discomfort, which can lead them to avoid participating in classroom activities altogether (Leary, 1983; Weeks, Heimberg and Rodebaugh, 2008). The negative effect of fear of evaluation can be mitigated by self-compassion: when students approach their feelings of distress and failure with self-kindness, and mindfulness instead of judgement and self-criticism, they are more likely to feel connected to others and less worried about their academic image (Werner et al., 2012; Neff, 2016; Long and Neff, 2018).

Factors such as age and gender also influence participation and communication in the academic context. For instance, older students tend to depend less on the approval of their fellow classmates and are more likely to accept responsibility for classroom discussion, which drives their engagement in learning and alleviates the pressure that might inhibit their participation (Weaver and Qi, 2016). When it comes to gender, some studies seem to indicate that female students tend to communicate less in the classroom than their male counterparts (Crombie et al., 2003; Rocca, 2010; Russell and Cahill-O'Callaghan, 2015). This is often linked to lower levels of self-confidence and self-esteem observed in female students (Rocca, 2010). There are, however, findings in other studies that refute this claim and argue that gender does not have any considerable impact on class participation (Cornelius et al., 1990; Ruthotto et al., 2020).

### **3.4.2 External factors**

Class size is often mentioned as a critical factor in student participation in both physical and virtual classrooms: bigger class sizes have been linked to lower levels of in-class communication (Rocca, 2010; Ruthotto et al., 2020). In smaller classes, students are less likely to feel distressed or anxious about communication and taking part in discussions (Smith, 1992; Hsu, 2015; Lee and Martin, 2017), and are less likely to “hide” or resort to lurking behavior (passive learning) (Weaver and Qi, 2005; Ruthotto et al., 2020). Also, smaller classes inhibit the formation of hierarchies and labour division among the students: situations when the students are implicitly divided into “the good ones”, or the active participants; the passive neutral majority, and the “poor performers” who attend classes irregularly and spend their classroom time chatting, reading the news, and other activities not related to the course (Weaver and Qi, 2016).

Course policies on participation and the students’ role in shaping those policies can also influence student activity (Rocca, 2010). When students are graded on the basis of their participation, they tend to engage more in classroom discussions, and this effect is strengthened if they can participate in the decision-making process of what kinds of participation will be considered (Voakley, 1975; Zaremba & Dunn, 2004).

The research surrounding the effect of ICT use in class on participation has produced mixed results and seems to depend on how it is used (Vareberg et al., 2020). It can be used in-class in the form of questionnaires to collect student responses, which does increase participation and enables the instructor to collect big amounts of feedback at once (Cox, 2019). When it comes to using online discussions as a means to increase participation rates, some studies have found that implementing online discussions as an additional element has no positive effect on participation overall participation (Stegmann et al., 2012; Lee and Recker, 2021). Effective strategies for online discussion design that contribute to deep and active student discussions include threaded discussions (Gao, Zhang and Franklin, 2013) or using question prompts (Raković et al., 2020).

## 4 Learning & ICT

### 4.1 E-learning

The confluence of learning and ICT is often dubbed by the umbrella term “e-learning”, which has been defined differently by different authors. Turban (2006) provides an extended and comprehensive definition of the term, stating that e-learning is the “online delivery of information for purposes of education, training, or knowledge management, and is different from formal education, which occurs off campus, and usually, but not always, through online resources (distance learning)”. Researchers claim that different generations of e-learning exist on a dynamic continuum (Crump and Costea, 2003).

E-learning 1.0 represents learning that mainly integrates technology (notably learning management systems) to facilitate information transfer from the instructor to the learners, it implies communication of a unidirectional nature (dos Reis, 2011). On the contrary, e-learning 2.0 brought about a shift from sole knowledge transfer to education as a creative activity, which is represented by a surge in popularity of podcasts, wikis, and blogs. The discussions in class were not limited in terms of the topic or the participants: students were able to discuss a wide range of topics with peers outside of their university and even around the world, all within a much less formal way (Downes, 2005). E-learning 3.0 is characterized by the emergence of artificial agents in the learning infrastructure that can explore different formats of information (text, images, audio) and provide automatic feedback and recommend educational content tailored to the user’s preferences or experience (by implementing machine learning) (Moravec, 2009).

E-learning 4.0 incorporates a multitude of technologies into the learning infrastructure. Henning (2018) gives it the following characteristics:

- digital to a large extent: as the volume of information increases at an unprecedented pace and its management can only be possible with the aid of technology, learning will gradually move into the digital space. This does not, however, imply that the traditional media such as printed books will be replaced completely by their digital counterparts;

- network-oriented: people (represented by their digital profiles), web services and databases will gradually become closely interconnected into one knowledge network;
- diverse: informal learning (where knowledge construction happens inside a social context) will be intermixed with formal learning environments and methods;
- constructive: implying “controlled and planned ontology learning” (Henning, 2018). An organized learning process will require the development of critical thinking meta-cognitive competencies in students regarding media. That will eliminate the need for more centralized and stronger control of the learning process. Understanding the meaning of data will be enabled by integrating semantically enhanced material, which is able to provide each short piece of data with information about its place in the context of a more complex ontology;
- individualized and adaptive: as in e-learning 3.0, artificial agents and machine learning are able to gather the necessary data about the student, process it and contribute to creating a learning environment and materials adapted to the student’s needs.

The e-learning generations described above are compared in the following table:

E-learning generation	1.0	2.0	3.0	4.0
Meaning is	Dictated	Socially constructed	Socially constructed and contextually reinvented	Socially constructed, contextually reinvented and experiential
Lecturing is	L/S	L/S; S/S	L/S; L/AA; S/S; S/AA; S/L	L/S; L/AA; S/S; S/AA; S/L, AA/L, AA/AA, AA/S
Classroom location	Building	Building/online	Everywhere (ubiquitous learning)	Everywhere (multidimensional society)

Lecturers are	Licenced experts	Licenced experts	Everybody	Everybody (incl. AA)
Hardware and software	Proprietary and costly	Open source with low cost	Low cost and used purposively	Low cost and used purposively through individual demand
Technologies used (standards)	HTTP, HTML, SOAP, XML, Jave	P2P, RSS, AJAX, Open ID, etc.	OWL, SPARQL, SWRL	Not yet recognized in literature
Technologies used (examples)	Content portals, websites, databases, file servers, file sharing and search	Social portals and networks, multi-user games, instant messaging, blogs and wikis	Intelligence agents, personal assistants, semantic webs, knowledge bases	Multidimensional networks, haptic interfaces, mobile/ambient findability

**Table 1. E-learning generations**

**Source: Costa, Silva and Fonseca (2013)**

Legend: L - Lecturer, S - Student, AA - Artificial Agent

E-learning 4.0 is currently undergoing its development stage, and the technology supporting it is not yet available to most universities. Some e-learning 3.0 technologies, however, can be found in literature. Li et al. (2012) addressed the ever-present and critical issue of personalization in online courses. By implementing evolutionary algorithms (EAs), they created a self-adjusting online course that first receives as its input the basic structure of the course and the learning goals of an individual student. Then, as the student completes the course tasks, the application collects data about their performance and, mapping it to the learning goals, adjusts the course material to match them and create a personalized learning environment for the student. The survey results that students completed after completing the course revealed that 93% of the participants expressed

satisfaction with the proposed course, and the satisfaction rates were higher than those related to a non-personalized course.

When it comes to satisfaction with e-learning in general, some studies on Gen Z, who represent the majority of today's students, point to their dissatisfaction with modern educational environments with regard to their needs and learning styles (Seemiller and Grace, 2017). Variety and technology seem to be paramount to their satisfaction with the learning process. The key to meet their needs, some researchers argue, is to create an environment enriched with digital media, strong guidance, and regular feedback, where students are able to obtain a meaningful learning experience and learn to exercise critical thinking (DiMattio and Hudacek, 2020).

## **4.2 Factors influencing learning**

### **4.2.1 Motivation**

The concept of motivation for learning and its correlation with learning and academic performance has been one of the most studied variables in the field of educational psychology (Alt, 2015). One of the prominent theories in the study of motivation is the self-determination theory (Deci and Ryan, 2008), which seeks to explore humans' inclinations to personal growth and learning and the ways they can be supported. STD establishes a distinction between intrinsic and extrinsic motivation. Enthusiasm and feeling of internal gratification and satisfaction while and after doing a task are characteristic of intrinsic motivation, which has an autonomous nature. It is expressed in curiosity, exploration, and doing activities "for their own sake". Intrinsic motivation has been found to play a crucial role in human life-long learning (Ryan & Deci, 2017) and to be a major positive factor in school achievement (Taylor et al., 2014). Other studies indicate that the level of intrinsic motivation can predict student engagement and academic achievement (Froiland and Worrell, 2016). Despite its significance, intrinsic motivation for activities related to formal learning has a tendency to decrease during the school years, as suggested by research (Ryan and Deci, 2020). An analysis by Gnamb and Hanfstingl (2016) points toward inadequate satisfaction of psychological needs provided by schools as the primary reason for that trend.

Extrinsic motivation refers to external factors, mainly recognition by others, which includes passing exams and achieving good grades or getting any other kind of outside validation. It also comprises motivators such as self-esteem and a strive to avoid feelings of anxiety, guilt or failure. SDT differentiates between several types of extrinsic motivation according to the degree of their internalization. External regulation, the type of extrinsic motivation that mainly encompasses a set of external rewards and punishments, is characterized as controlled, or non-autonomous.

The two types of motivation are deeply connected with the different types of learning. While extrinsic motivation has been linked to a more surface learning approach and weaker stress coping strategies in case of failure (Ryan and Connell, 1989), autonomous motivation has been found to incite deeper learning strategies, increase engagement and boost overall learning outcomes (Vansteenkiste et al., 2005).

Another foundational construct in the study of motivation is amotivation, which does not define any type of motivation but absence of thereof (Ratelle et al., 2007). Students who exhibit amotivation tend to experience lack of purpose and concentration (Vallerand et al., 1993), to have trouble predicting the consequences of their actions and display an overall detachment from their learning process. That leads to lower engagement and intellectual investment in their studies and, as a consequence, to lower academic achievement and a higher probability of dropout (Vallerand, Fortier and Guay, 1997).

#### **4.2.2 Academic emotions**

When it comes to learning, academic emotions also play a crucial part. They can be defined as emotions related to academic outcomes and learning process and studied in the educational context. Such emotions include, among others, self-concept of ability and social emotions towards the instructor and peers. Motivation and academic achievement are closely linked to academic emotions and the three of them constantly interact (Kim, Charles and Hodges, 2012; Op't Eynde and Turner, 2006). A study by Pekrun and Perry (2014) revealed that there is a complex mechanism of interaction between emotions and intrinsic motivation. Generally, positive academic emotions tend to reinforce motivation, whereas negative academic emotions undermine it. However, there is more nuance to it, as some positive emotions (such as relief) can be harmful to immediate motivation to

engage in the task with considerable effort, but at the same time are beneficial to long-term intrinsic motivation. On the other hand, negative emotions connected with learning (e.g. anger) have a mostly negative impact on motivation in most cases, but in some situations can drive the learner to overcome difficulties and challenges in order to avoid failure, thus invoking extrinsic motivation.

As for the relationship between academic emotions and academic outcomes, some research indicates, for instance, that students with better anger management skills and willingness to delay gratification show higher levels of self-regulation and academic performance (Herndon and Bembenuddy, 2014). Also, boredom seems to play a significant role in decreasing students' attention levels, effort and academic outcomes (Watt and Vodanovich, 1999; Jarvis and Seifert, 2002; Hanin and Van Nieuwenhoven, 2016). Its presence and effect can be minimized if the tasks are challenging enough for the students to fully engage, but not too difficult to exceed their level of competence (Pekrun et al., 2010).

#### **4.2.3 Aspects of study material presentation**

Another group of factors refer to the method of study material presentation selected by the educator. An example of that would be the effect that a degree of uncertainty about the task has on curiosity, engagement, and knowledge transfer. Ambiguity, lack of predictability and uncertainty have been found to be beneficial for fostering curiosity (Mushtaq, Bland and Schaefer, 2011). As stated by Piaget (1952), curiosity is a major prerequisite to constructing knowledge. In their 2019 study, Lamnina and Chase found that exposing students to a certain level of uncertainty in their learning activities had a positive impact on their curiosity, which in turn predicted efficient knowledge transfer. Similarly, general domain-oriented interest has been shown to contribute positively to cognition and learning (McIntyre, Gundlach and Graziano, 2021).

### **4.3 Trends in ICT-facilitated learning**

In modern literature related to the topics of education and cognitive psychology, there is an emerging trend, a shift in how learning is understood, as well as the roles of a teacher and a student in the learning process, and the ways that educational institutions can adapt to this change. Research suggests that a shift towards a more student-centered approach



and teaching practices contributes positively to students' satisfaction and engagement. A teacher-centered approach relies more on direct knowledge transfer from the instructor to the students. On the contrary, in a student-centered approach, training practices are oriented towards fostering collaboration between students and joint construction of knowledge. That way, they facilitate students' learning autonomy and critical thinking: they are able to develop skills such as formulating questions, constructing arguments, and reflecting on the knowledge gained. The role of a teacher in this approach is that of a mediator and a developer of learning solutions (Cabero-Almenara et al., 2019).

Technology can be used to support collaborative learning. Collaborative learning is defined as "an activity that involves a process wherein a group of students cooperates with each other to solve some problem-solving tasks in an interactive environment" (Alavi, Wheeler, & Valacich, 1995). It enhances the learning experience by bringing it into a social context, where knowledge is constructed by cooperation and sharing. Another benefit of collaborative learning is that it enables students to acquire skills not directly related to the subject itself, mainly communication and collaboration skills. Social networking sites have been found to serve as effective mediators in collaborative learning, reinforcing students' engagement, creative thinking, and their interpersonal skills (Sarwar et al., 2019).

Learner-centered teaching can be supported by gamification of learning which, as the name suggests, implies integrating game elements in the learning process (or other activities) (Deterding et al., 2011) and focusing on active learning and knowledge application instead of knowledge acquisition (Sandrone and Carlson, 2021). Gamification can be applied to learning in a variety of ways: from simply introducing a badge reward system for students (Hakulinen, Auvinen and Korhonen, 2015) to designing an application that would serve as an interactive learning tool for students (Faghihi et al., 2014). The potential benefits of gamification include fostering intrinsic motivation (Putz, Hofbauer and Treiblmaier, 2020), performance (Sailer, 2017), student engagement (Gatti, Ulrich and Seele, 2019), and knowledge retention. On the other hand, some empirical studies report increased student satisfaction compared to non-gamified learning, but no noticeable increase in knowledge gain (Faghihi et al., 2014; Lee et al., 2018). All in all, this tool is still relatively new, - the term first appeared in literature in 2013, - and the

body of research on this topic has been growing at an impressive pace since 2018 (Díaz-Ramírez, 2020), so it is likely that as more research emerges, it will be possible to get a better picture of its benefits and downsides.

Another tool introduced to foster learner autonomy is the flipped classroom. The basic idea is that the activities traditionally done in class and the ones typically done as homework are switched (Gilboy, Heinerichs and Pazzaglia, 2015). In a traditional classroom, the teacher presents the new topic during class time, and some discussion or practice exercises may follow in the form of home assignments. However, some research indicates that the traditional classroom does not provide enough opportunities for students to develop their social and cognitive skills, and to understand the topic at a sufficient level (Lin, 2019). In a flipped classroom, learners familiarize themselves with the new material before class, for which different forms of media are used such as videos. Then, class time can be used to check students' understanding of the material, hold discussions about the topic, and focus on applying the knowledge to practice (Bergmann & Sams, 2014). This class format can be applied both as an element of face-to face learning and a method of online instruction (Stöhr, Demazière and Adawi, 2020). Flipped classroom has been found useful to make the learning more student-centered, promote students' cognitive holding power (Ahmed and Indurkha, 2020), positively affect their learning attitudes (Zhai, Gu, Liu, Liang, & Tsai, 2017), and learning (Gilboy, Heinerichs and Pazzaglia, 2015). However, it is important to note that *effective* application of technology is a critical factor when it comes to benefits of a flipped classroom, especially to students' motivation (Davies, Dean, & Ball, 2013).

## 5 Use of ICT in education

Technology can impact both students' learning and in-class communication. In this chapter, it will be explored how different technological tools can foster student satisfaction, engagement, and academic achievement. Impact of technology use on learners' well-being will also be discussed, as well as the factors impacting integration of ICT in the learning process.

One of the foundational frameworks in the study of ICT use is the Technology Acceptance Model (TAM) introduced by Davis (1989) and extended by Venkatesh and Davis (2000). Studies conducted within that framework suggest that there are two main factors influencing the acceptance of technology in a given environment: perceived usefulness and ease of use. Perceived usefulness is defined as the extent to which the user expects the technology to positively impact their productivity Davis (1989). For instance, in the educational context, students may consider how a certain type of technology can make course material more accessible or perhaps, how it can make the learning process more interactive and entertaining for them. As for the teachers, they might consider if the technology would enable them to cut down the time and effort spent preparing and organizing course material and grading students' assignments. Perceived ease of use reflects the amount of effort required from the user to effectively apply a technology Davis (1989). The question is, essentially, "Does the potential user expect or believe the technology to be easy to manage or interact with?". For technologies used in education, this incorporates a multitude of aspects and characteristics. For example, a student or an instructor may judge the ease of use of a certain technology by its accessibility (e.g., if a website or application is available on multiple platforms and enables both online and offline access) and by the user interface (if it is clear and intuitive, if the user is able to navigate to a certain course chapter or assignment quickly and with minimal effort, etc.).

As the Technology Acceptance Model suggests, use of technology in the educational context depends on the beliefs of the participants. Teachers' beliefs about technology and learner-centered teaching, as well as their technology competences, influence their style of teaching, the way they use (if at all) technology in the classroom, and the effectiveness of their teaching (Admiraal et al., 2017). Therefore, it is crucial that integrating ICT into the education process does not focus exclusively on investing into tech-solutions. It is not

so important what technologies are used, but how they are used. Therefore, adequate training for teachers is crucial for enhancing the pedagogical effect of ICT in class (Cabero-Almenara et al., 2019).

Some examples and models of using technologies to support learning were presented in chapter *Trends in ICT-facilitated learning*. In the following chapters, several types of technologies frequently discussed in literature are introduced, and their benefits and drawbacks are discussed based on existing research.

## **5.1 Learning Management Systems (LMS)**

One of the ways technology can support learning activities is through virtual learning. This method of learning is being adopted by higher education institutions due to its potential to support both full application of e-learning and its combination with face-to-face learning (Cabero-Almenara et al., 2019). Virtual learning has the potential to bring about possibilities of more interactive, flexible, and autonomous learning, which is enabled by Learning Management Systems (LMS) (Pérez et al., 2008). LMS, such as Moodle and Blackboard, comprise a variety of functions: from distribution of study materials to discussion forums. The 2017 report by Brooks & Pomerantz states that about 75% of instructors primarily use LMS to aid them in structuring and sharing course syllabus and material, delivering notes, and requesting and managing home assignments. A recent study by Cabero-Almenara et al. (2019) demonstrated that LMS Moodle is still mainly used by teachers as a repository for study materials and course documents, but it is rarely used for facilitating collaboration between students or reinforcing their learner's autonomy. As for the students, LMS mainly allow them to access course material (including videos and other multimedia), check their knowledge in the chapter-end tests and exercises, and discuss their questions in the forum section (Geng et al., 2019). All those functions contribute to autonomous and student-centered learning, making it possible for learners to access course material at any time and learn at their own pace. Recent research also indicates the benefits of LMS in integrating collaborative tasks into the teaching-learning process (Coicaud, 2016) and introducing new innovative participatory strategies (Sanchez, Sanchez, & Ramos, 2012). Thus, LMS have the potential to facilitate peer-to-peer knowledge construction.

Over the years, research among students and educators has indicated considerable levels of satisfaction with LMS platforms (Horvat et al., 2015; Inzunza et al., 2012; Schoonenboom, 2014). However, other studies have raised a debate about the advantages of LMS and their benefits to constructive improvement and innovation of the education process. Some claim a lack of evidence of real transformation in teaching practices with teachers relying on LMS to support transfer of knowledge but not necessarily to foster knowledge creation and development (Brown, 2010; Browne et al., 2006; Kinchin, 2012). This, as research has demonstrated over the years, may be linked to teachers' pedagogical practices, overall attitude to technology, and level of acceptance of LMS (Hermans et al., 2008; Schoonenboom, 2014). This illustrates a critical issue that the integration of technology into the teaching and learning process on its own does not ensure increased effectivity of knowledge construction (Admiraal et al., 2017). To cite the 2019 study by Cabero-Almenara et al., "the use of [LMS] Moodle in the context of teaching and learning depends critically on teachers having knowledge of the tools, their being aware of how they should be used and their being able to organise the entire communication process". Thus, to maximize the benefits of integrating LMS into the educational process, adequate training for teachers should take place to help introduce more learner-centered strategies and practices (Koehler & Mishra, 2008; Silva et al., 2016).

### **5.1.1 Online courses**

Course material in learning management systems is normally structured into online courses. There is a considerable amount of research conducted with the goal to determine if offline and online university courses have qualitative differences in their outcomes (Jaggars & Xu, 2016). So far, no unanimous conclusion has been drawn, with some studies revealing positive results for online learning and others showing their inferiority and lack of effectiveness (Bernard et al., 2004; Zhao et al., 2005), particularly when it comes to students from disadvantaged backgrounds or having a history of lower academic performance (Figlio et al., 2013; Jaggars & Xu, 2016; Kaupp, 2012). Generally, there appears to be a spectrum of effectiveness of online courses depending on several factors. Different studies and theories have proposed what those factors are. For instance, Moore (1993) came forward with the theory of transactional distance, which they mainly applied to distance learning (a broader term for online learning and e-learning). Moore outlined

the three components that define an online course: structure (how the study material is structured and sequenced), dialogue (the degree of constructive collaboration between students and teachers that contributes to knowledge construction), and autonomy (the range of options that the student has in terms of the content they are willing to learn, how they want to learn it and how much of it). Those variables are not meant to enable measuring the quality of distance learning, but rather to introduce the phenomenon of transactional distance and the ways it may affect students' satisfaction with the course as well as their academic performance. For instance, an online course with a rigid structure and little flexibility may bring about a bigger “distance” between the student and the instructor, thereby demanding a higher degree of autonomy from the learner.

A solid base of research has emerged before and after the theory was presented that corresponds to Moore's conclusions. For instance, many studies emphasize that a clear structure and a tight link between the course learning objectives and the content of assessments play a significant role in student satisfaction with the course (Jaggars & Xu, 2016; Zhao et al., 2005). Studies about online learning and its best practices have also claimed that interpersonal communication tends to be a considerable factor in the effectiveness of online learning (Ralston-Berg, 2010, 2011; Scardamalia & Bereiter, 2006).

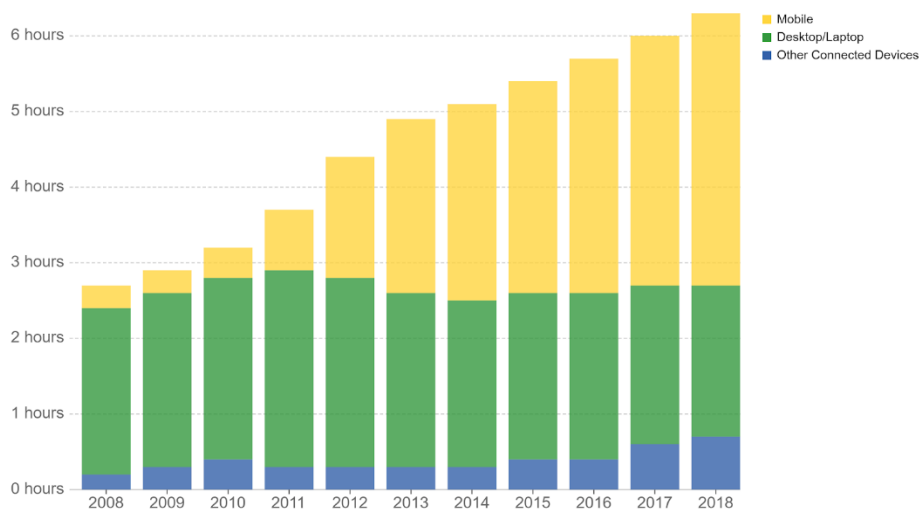
## **5.2 Mobile learning**

For the purposes of this paper, a mobile device will be defined as a piece of technology that is (a) easily transportable and accessible and (b) always connected to the Internet. This definition may include laptops and tablets, but a smartphone is the best example due to its exceptional mobility. It is within reach most of the time and is regarded as “friendly and personal” by learners (Traxler, 2007).

The use of mobile devices has been growing rapidly in the last decade, both as an absolute unit and proportionally to the use of technology in general. This trend is reflected in the following graph demonstrating data (although specifically for the USA) from Bond Internet Trends (2019):

### Daily hours spent with digital media, United States, 2008 to 2018

Average hours per day spent engaging with digital media (e.g. digital images and videos, web pages, social media apps, etc.) The data for 'other connected devices' includes game consoles. Mobile includes smartphones & tablets. All data includes both home & work usage for people 18+.



Source: BOND Internet Trends (2019)

CC BY

**Figure 2. Daily hours spent with digital media, United States, 2008 to 2018**  
**Source: BOND Internet trends (2019)**

When it comes to the use of mobile devices in the educational context specifically, the Educause Center for Applied Research [ECAR] 2012 survey report concerning the use of mobile technology (including cell phones, smartphones, and tablets) in higher education states that around 67% of surveyed university students agreed that mobile devices play an important part in their academic success and reported using such devices for learning purposes.

Mobile learning can be characterized as individual and ubiquitous (implying that information can be accessed anywhere and at any time) (Boyd & Ellison, 2007; Motiwalla, 2007). The latter is facilitated by the mobility of the devices itself. Mobile devices are an integral element of informal learning, which occurs in the context of "daily work-tasks, family or leisure activities" (Halliday-Wynes & Beddie, 2009). On the contrary, formal learning takes place inside the classroom and involves a teacher as well as learning materials produced or processed by the teacher. One of the criticisms of informal learning supported by mobile technologies is that learners are switching between sources of information which are often not connected and uncontextualized, which poses a high risk of knowledge fragmentation (Traxler, 2010; Liu & Gu, 2019). It is important

to emphasize, however, that not only is knowledge fragmentation caused by mobile devices, but also by the way that the learning materials can be organized.

According to the findings of Gikas and Grant (2013), students primarily use mobile devices to access course content on platforms such as Blackboard and communicate with instructors and fellow students via email or text messaging. The participants of their study argued that integrating mobile technologies in their learning process had a largely positive effect: they found themselves more engaged in the study process and communicated more with each other. Exploring and sharing ideas was made more accessible, and their learning became more situated: they could gain information and construct knowledge from it in the same context where that information could be used. They also experienced the ubiquitous nature of mobile learning: because they were spending time on the phone as it was, their education became more intertwined with other parts of their lives. However, the participants also shared some frustrations, mainly concerning the inconsistency of technology acceptance levels among their instructors. Whilst some teachers were welcoming of technology and encouraged its use in and outside of the classroom, others had a policy which strictly forbade the use of mobile devices during in-class activities.

### **5.3 Social media**

The term "social media" is used interchangeably with the term "Web 2.0". Obar and Wildman (2015) point out the integral features of social media:

- they are, essentially, Web 2.0 Internet-based applications;
- their content is mainly user-generated;
- individuals and groups create designated profiles for websites and applications developed and supported by social media services;
- social media services enable the emergence of social networks by means of interconnecting the profiles of individuals and/or groups.

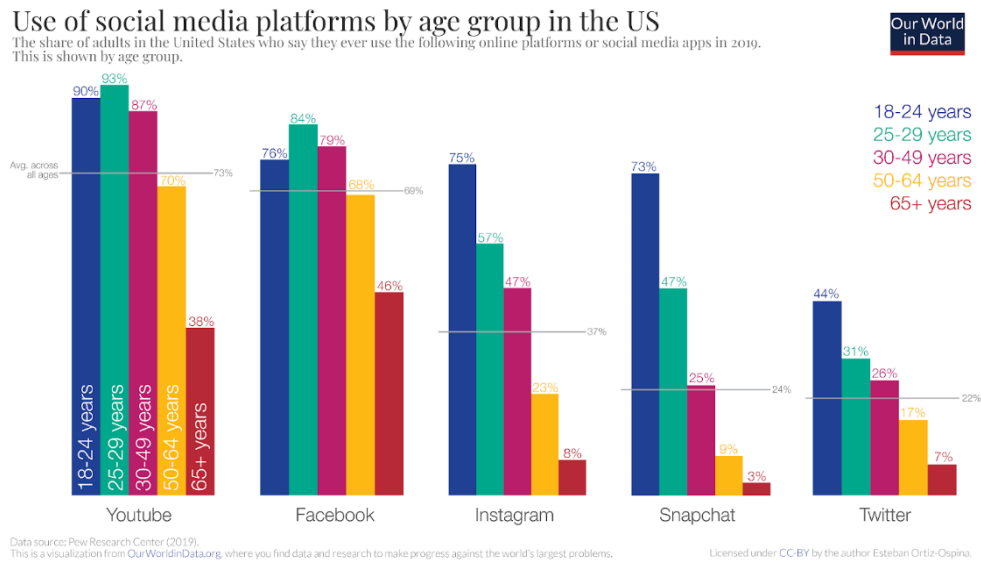
User-generated content is the key feature of social networking sites and it has great importance for the users (both individuals and organizations), because user-generated content creates and fosters an unbiased environment that contributes to unconstrained expression of ideas and opinions (Fersini, 2017). It is possible to classify social



networking sites by the type of user-generated content that is prevalent on them (Pallavicini, Ciproso and Mantovani, 2016). Some of the distinct categories include:

- profile-based social networks are user-centered, their model is based on the user's need and desire to express themselves and connect with their contacts (friends, family, colleagues, etc.). On such websites, private and personal information can be shared, such as content concerning a person's interests, opinions, and experiences. Facebook is the most prominent representative of this type of SNS;
- microblogging social networks can be described as more content-centered, the focus there is on the user's idea or message that can be shared with an audience. For instance, Twitter enables sharing concise and clear messages or statements about a variety of topics, from personal life to pressing social issues;
- content-based social networks are the most content-oriented, the creator's personality can have various degrees of importance. For instance, Flickr is centered around sharing one's photography and is not very much engagement- and personality-oriented, whereas YouTube content creators typically have more of their personality reflected in their content.

The graph below displays the percentages of adults in the USA (by age group) who used social media platforms, specifically YouTube, Facebook, Instagram, Snapchat, and Twitter, in 2019. It is clear from the data that millennials (or Generation Y) tend to gravitate to profile-based social media networks, as they have a strong need to stay and feel connected with their friends, to feel involved in the lives of others (Nadkarni & Hofmann, 2012). They have also been found to consider Facebook as the optimal platform to find entertainment (Leung, 2013). Gen Z, on the other hand, are more likely to use content-based and microblogging social networks, as they provide a large variety of content that keeps them engaged.



**Figure 3. Use of social media platforms by age group in the US**  
**Source: Pew Research Center (2019)**

Research suggests that the dominant motivation behind the increasing use of social media by adolescents is the desire to satisfy their social needs. Specifically, the need to belong and the need for popularity (Utz, Tanis and Vermeulen, 2012), which are especially crucial for adolescents (Santor, Messervey and Kusumakar, 2000). For instance, Facebook has been found to aid college students in maintaining their high school friendships as well as building new social connections in the university setting (Ellison et al., 2007, 2011). Moreover, it enables students to seek out information about their peers and influences their perceived level of social capital (Ellison et al., 2011).

Furthermore, social media can be considered a channel for one's frustrations, both social and emotional. They enable a user to escape emotional states such as boredom and loneliness, as well as dissatisfaction with one's relationships (Przybylski et al., 2013).

Social networks enable efficient communication, collaboration, and quick exchange of ideas, all made even more accessible due to their interactive nature and with the help of mobile devices. For example, a study by Ellison et al. (2011) explored students' communication strategies in the educational context and found that connecting with classmates on Facebook encouraged them to be less hesitant to request information or support. Those functions of social networks could potentially be extremely beneficial to facilitate collaborative learning and students' learner autonomy (Raut and Patil, 2016).

Therefore, there is an emerging and growing need to incorporate social networks into the academic environment. Multiple studies have examined the use of social networks and their effect on the learning process (Alwagait, Shahzad and Alim, 2015; Sarwar et al., 2019). However, previous studies call for more research on the subject, especially on students' perception of social networks as learning tools (Shittu et al., 2011).

The uses of social media include seeking and sharing information, entertainment, socializing, and learning (Whiting and Williams, 2013). Due to the extensive use of social networking platforms by the current generation of students, integrating them into the education process may foster the ubiquitous nature of learning, providing the means to access, acquire and share information and knowledge even outside the classroom and at virtually any point in time.

Social media can facilitate learning in multiple ways. Many studies explore the idea of integrating Facebook groups into the learning process (Chugh, Ruhi, 2017; Dyson et al., 2015; Mendez, Le and Cruz, 2014). The main use of Facebook groups seems to be distributing study materials among the students. Studies on the topic have yielded controversial results. In some studies, the effect of Facebook integration into the classroom was considerably beneficial (Awidi, Paynter and Vujosevic, 2019), increasing students' engagement in the course and creating a sense of community among them. Other researchers have found that it has little effect on the engagement levels as well as understanding course material (Dyson et al., 2015). The consensus, however, seems to be that successfully incorporating Facebook into the learning process is a complex task, and its effect is contingent upon an interaction between a variety of factors, such as students' perceptions of social media, the interconnectedness of course material and the social media content being integrated, and aspects of content delivery.

### **5.3.1 Effect of social media use on learners**

Using social media in and outside of the classroom can bring about a multitude of positive effects. It has the potential to encourage overall learner's autonomy by enabling self-regulation and self-paced learning. Thus, students become less dependent on the instructor and their teaching approach and can tailor their learning according to their own learning style. Additionally, social media can support efficient cooperation and

collaboration between students. Students are able to socialize and build social relations with their peers, which engenders more peer-feedback and shifts the learning model towards a more student-centered one (Ricoy, Feliz, 2016). Some research on the topic also suggests that social media can facilitate students' motivation and boost their creative thinking skills. Social media use among university students has also been found to contribute positively to their real-life network heterogeneity and diversity (Kim and Kim, 2017, 2019), which is in turn linked to improved social capital and subjective well-being (Kim and Kim, 2017).

Although the nature of social networks and online interactions at large is considered mostly positive, there are several aspects of online communication that raise concerns about its impact on students' learning and mental well-being (Kross et al., 2013). While social media are often considered an invaluable tool to fulfil one's social needs, studies show that rather than improve the users' well-being, they tend to undermine it. One of the main moderating factors often mentioned in literature is cyberbullying.

Cyberbullying is an aggressive act carried out by an individual or a group using electronic means to harass or threaten others through emails, mobile messages, social networks, or web pages (Sarwar et al., 2019). Cyberbullying has been found to cause distraction among students, inhibiting the process of knowledge acquisition and negatively influencing their academic performance. Furthermore, it has also been linked to a decline in motivation and overall deterioration of students' mental well-being, causing depression, loss of self-confidence and lack of enthusiasm to participate in classroom learning activities (Kim et al., 2011).

Another phenomenon contributing negatively to social media users' well-being is *Fear of Missing Out*, or FoMO. As one of the mechanisms proposed to explore and explain the dual nature of social networking sites, this phenomenon is defined as "a pervasive apprehension that others might be having rewarding experiences from which one is absent" and implies a need to stay connected to what others are doing (Przybylski et al., 2013). As stated by Przybylski et al., FoMO can be viewed as one of the factors linking social media engagement and inadequate fulfilment of psychological needs. In their study, higher levels of FoMO were reported by individuals who also displayed less satisfaction of needs such as competence, autonomy, and connectedness to others. Also,

a link was found between FoMO and the prevalence of extrinsic motivation and amotivation.

A study by Beyens, Frison and Eggermont (2016) found that extensive use of Facebook is linked to an increased level of FoMO, which motivates users to use Facebook even more, thus perpetrating the vicious cycle and increasing the levels of Facebook-related stress. Examples of unwanted effects of FoMO on adolescents' mental well-being include loss of sleep linked to nighttime media use (Santor, Messervey and Kusumakar, 2000) and unhealthy eating patterns (mainly skipping meals and fast eating attributed to the desire of staying connected with peers and coping with FoMO (Van den Bulck and Eggermont, 2006)). It is important to note that the FoMO phenomenon and its impact on psychological well-being remain relatively understudied and more research is needed to confirm or refute those assumptions.

## 6 Methodology

The methodology of this study is based on a paper published by Joanne Gikas and Michael Grant in 2013, “Mobile computing devices in higher education: Student perspectives on learning with cellphones, smartphones & social media”. Their study was limited to the use of mobile devices in the context of learning, whereas in this study, the field of research will be extended to a bigger variety of devices (computers, laptops, tablets) and web-based services (LMS Blackboard, social media).

For the purposes of the study, a qualitative research method was chosen. Contrary to quantitative research, qualitative research does not seek to predict and measure phenomena and factors that influence their occurrence. Instead, it enables the researcher to examine how the participants experience reality in a certain context at a certain point in time. From those observations, new themes and factors can surface, including some that had not yet been discussed in other studies or considered by the researcher themselves (Greiner & Merriam, 2019).

The context of this research was two faculties of one public higher-education institution. The teachers were included in the sample based on the following criteria:

1. The teacher implemented ICT (LMS, mobile devices, social media or all at the same time) in the learning environment for at least two semesters;
2. They used ICT (specifically the categories mentioned above) to enhance and facilitate their students’ learning and/or communication (that is, not for research activities or administrative university-related tasks).

Once a teacher was interviewed, their students were invited to express their perspectives on the instructor’s comments. After that, they were asked questions related to their experiences of using ICT in that teacher’s course. Finally, students were encouraged to share their experiences and perspectives on distance learning.

The students were selected based on the maximum variation sampling strategy, with the main dimensions being:

- a) Study program;
- b) Year of study;

c) Gender.

## **6.1 Context & participants**

The study was conducted in spring 2021, when face-to-face learning at the university where the research took place had been suspended for around a year with some minor exceptions (several weeks of offline classes at the start of the academic year). Thus, distance learning supported by virtual learning environments and applications was the primary instruction method implemented by teachers.

In total, 3 instructors agreed to participate in the research, and between 2 and 6 of their respective students agreed to take part in the focus group interviews. Pseudonyms are used throughout the report for the names of the teachers and the students to respect the participants' privacy and anonymity. The participants are summarized in Table 2. In total, 12 students took part in the survey, including 6 female and 6 male students. Although students from different years of study were asked to participate, no students from the first year agreed for an interview. The reasons for that present an opportunity for further research.

Study program	Year of study	Number of participants
Political Science	2	2
Travel and Tourism Management	3	1
Applied Informatics	2	2
Information Systems Management	2	4
Financial Management	2	2
	3	1

**Table 2. Participant information**

**Source: author**

With respect to the goals of this study and to the domain of literary review, the term of ICT in this study was limited to (a) electronic devices with access to the Internet that enable communication and support learning activities, (b) learning management systems (such as Blackboard and Moodle) that function as repositories for learning material and as a communication environment, and (c) social media platforms.

The maximum variation sampling strategy was selected as the sampling strategy for the study. As described by Patton (2002), maximum variation sampling strategy implies (1) identification of key dimensions of variations and (2) seeking and finding cases that vary as much as possible within those dimensions. The purpose of this strategy is to record and document diverse variations that occur in adapting to different conditions, and then to identify and examine important patterns that emerge across those variations (Patton, 2002).

## **6.2 Data collection & analysis**

Focus groups interviews were selected as the method of data collection. A semi-structured interview protocol was drawn up (adapted from Gikas and Grant (2013), see Appendix A). That made it possible to have a certain degree of flexibility and tailor the interview questions to each case, determining when it is appropriate to explore certain subjects in more depth (Patton, 2002). It also allows the researcher to come across new themes and subjects that were not anticipated at the stage of research design.

The interviews were conducted over VoIP, specifically over Skype and MS Teams, which made it easier to reach the participants who were located far from the university campus, as they could take part in the study from the comfort of their homes. A big portion of the participants (83,3%) preferred to use the MS Teams application to conduct the interview, stating that they felt more familiar with it and that it is easier to access as it is the main platform used by their university to conduct distance learning activities. This method also enables the researcher to make use of the participants' time more efficiently by cutting down or out the travel time. An important potential obstacle in using VoIP as an interview medium are the technological requirements, such as adequate Internet connection and, for video-conferencing interviews, a device equipped with a camera (Iacono, Symonds and Brown, 2016). Also, the level of technology acceptance and technological skills should



be factored in when implementing the VoIP technology for data collection. As this study is aimed at teachers and students who used ICT in the educational setting for at least one semester, it is assumed that the participants fulfilled the pre-conditions to participate in the study and have the necessary tools and skills to do so. Another possible issue regarding using applications like Skype as a data collection method in qualitative studies is rapport, which King & Horrocks (2010) define as “enabling the participant to feel comfortable in opening up to you”. In literature, there are both positive and negative perspectives regarding Skype and rapport. Cater (2011), for instance, states that establishing a “working alliance” and building rapport through Skype is challenging, mainly due to the lack or absence of visual cues. Other researchers, however, found little connection between using Skype and ease of building rapport, and that it is more likely to depend on the interviewee’s personality than the method choice (Deakin & Wakefield, 2013).

Firstly, the data was analyzed using the method of inductive analysis. As described extensively by Thomas (2003), inductive analysis allows to transform extensive and varied raw text data into a summary format in a way that is not restrained by other, more rigid, deductive methodologies. The purpose is to shed light on the key themes and concepts emerging in the data that are sometimes overlooked due to preconceptions in more structured deductive methods implemented in, for instance, hypothesis testing research. In inductive analysis, data is first condensed into a summary format. Afterwards, links and connections to the research objectives are established within the data that consequently serve as the basis for a model or theory developed to explain the underlying structure of the patterns present in the data.

Even though inductive analysis is designed to help the researcher avoid bias and preconceptions concerning the research findings, it is still important to remember that the importance of key themes surfacing from the raw data is judged by no other than the researcher themselves. Moreover, the interpretation of the research findings is also contingent upon the initial research objectives.

Using the inductive analysis, the interview transcripts were read thoroughly multiple times and analyzed. Then, the data was broken down into segments, also called meaning units, and the main ideas and categories were identified and labelled. Finally, the key

overlapping themes relevant to the research objectives were selected and connections were sought out between them to find the overarching themes and patterns present across the interviews.

## **7 Findings & interpretations**

After the research data were collected and analyzed using the inductive method, three main themes emerged: students' perceived benefits of ICT in learning, students' perceived benefits of virtual learning, and students' frustrations with virtual learning.

The students who agreed to participate were mainly in their second year of undergraduate studies, so they were able to reflect on their university experience that preceded the lockdown and could compare the approach of different teachers in the three semesters that they were studying almost exclusively on-line.

As for the technology used by the respondents and their instructors, they mainly included LMS Blackboard or Moodle (depending on the course) for sharing and accessing materials and completing assignments, MS Teams for sharing study materials, syllabus, on-line lectures and seminars, other internet sources (such as an instructor's own website) for additional materials, and e-mail and MS Teams for communication with the teacher. As for communication between students, none of the respondents reported a presence of a dedicated channel or platform where students could cooperate or discuss subject-related topics. For working on group projects, MS Teams and WhatsApp (for working with international students) were used, and for informal communication students preferred Messenger.

Overall, students' opinions on the use of ICT in the learning process were relatively homogenous: they responded mostly positively to how their instructors adapted to the changes imposed by the external conditions. The perceived effect of ICT on their motivation and understanding of the material did not seem to correlate, for instance, to source of motivation (extrinsic or intrinsic). However, they also felt like there were also aspects of distance learning that negatively impacted their ability to learn and communicate. The overall perceived effect of technology use on the effectiveness of learning was not noticeable for the respondents. Their perspectives will be presented in more detail in the following chapters.

### ***7.1 Perceived benefits of ICT in learning***

Most students appreciated that their instructors used ICT for both administrative and teaching purposes. Among the most noticeable advantages they noted the fact that the

information concerning the syllabus, project deadlines, and tests was available to them at any time they needed it - it was either stored on the LMS platform Blackboard or in the Files folder of the course in MS Teams. They reported that it was a positive change compared to their experiences of ICT not being integrated in their studies or being integrated to a smaller degree. In those circumstances, they were presented with that information during the first week of the course and had to rely on their memory and notes to meet the deadlines.

Students seemed to respond positively to pre-recorded lectures if the instructor was able to adapt their presentation style to one expected in face-to-face classes. For instance, when a math teacher used a graphic tablet to imitate writing on a whiteboard during the on-line lecture, it helped the students feel more engaged and positively contributed to their understanding of the study material. Also, pre-recorded lectures with higher production value (good lighting, the teacher's face is seen in the video, and the overall format resembles a face-to-face lecture) were more engaging and attractive for students. This corresponds to the findings of Nicholas (2020), who claims that the visual element of media is an important part of how Generation Z learn.

## ***7.2 Perceived benefits of distance learning***

In the situation when face-to-face learning was not feasible, ICT was used as the primary teaching tool. Some teachers stored the necessary study materials on the LMS platform Blackboard, whereas others used the Files folder in MS Teams for this purpose. Availability and accessibility were again the key benefits reported by the participants. Students whose instructors uploaded pre-recorded lectures to the learning platform of choice stated that it enabled them to play the teacher's presentation back several times, which facilitated their understanding of the study material. This feature was especially appreciated by students who had before had to commute to school for face-to-face classes or worked and studied at the same time. 24/7 access to the study materials made their learning more accessible, convenient, and less time- and effort-consuming.

There was no evidence of a difference in student satisfaction between courses where teachers arranged on-line live seminars and discussions, and those where students studied only using pre-recorded and pre-uploaded material. However, when on-line discussions

were held, the number of participants seemed to play a role: students who had bigger groups (35-40 participants) reported that it was much harder for them to participate and they were more reluctant to do so, as there was no time or space for everyone to take part in the discussion equally. On the other hand, one student whose teacher divided the participants of a “normal” face-to-face class into two separate groups claimed that they felt more eager to engage in discussions and respond to the teacher’s questions. This finding corresponds to previous research related to the link between class participation and class size (see chapter *External factors*).

### **7.3 Students’ frustrations with distance learning**

Some students did not feel like distance learning affected their motivation in any way compared to face-to-face learning. Others reported that because their academic life was more routine than before, it was sometimes challenging for them to find motivation. One student also stated: “Distance learning definitely puts more responsibility for learning on the student”, which may be indicating that adapting to fully distance learning requires more autonomy from the student.

Another setback that several students experienced was lack of engagement during on-line meetings and seminars. Here, they specifically noted a contrast between face-to-face and distance learning: discussions and classroom participation in face-to-face learning seemed more productive because, to quote one student, “you don’t have the option to hide behind your screen, so you feel more inclined to participate in the discussion”. This might be linked to lack of visual contact with other students and the teacher, as this respondent also claimed that “when you don’t see the other people’s faces you don’t care as much and can’t establish a firm connection”.

Another barrier to effective on-line learning that was frequently reported is difficulty to concentrate during the meeting. One participant stated: “Even when I was present in the lecture, time flew by very quickly and as soon as the lecture ended, I did not feel like I’d been able to listen actively and learn anything”. In this regard, students mentioned different reasons: some found it harder to focus on the class because their home environment presented many distracting factors for them, whereas others mentioned technology itself as the main distracting factor: “When you’re at the computer, you have

all those different tabs, and the Internet, and you sometimes feel the urge to open something else, like Facebook. At the same time, you are bombarded with notifications and don't really pay attention to the lecture”.

Students also reported that building connections and developing their social skills was an integral part of the university experience for them, and it was challenging for them to do so without meeting their fellow students on campus. Some participants noted that even though they still had the possibility to connect with others using technology such as MS Teams, WhatsApp, and Messenger while working in group projects, their communication was more limited to the topic of the project itself, and the informal communication was missing. Students reported that finding friends among other students was harder than on campus, but maintaining the connections they had already made was not. When it came to contacting other students for study purposes, such as asking a question about a topic or a practice problem, some students had a more positive perspective: technology enabled them to contact someone very quickly and easily: “To me, it is even easier to just message someone in Teams than it was before when I had to go after someone in the hallway and look for the people who go to the same class. You see them [the other person] in that window, in the seminar, and you just click “Contact” or “Send a quick message” and ask.”

## **8 Discussion & implications**

The findings of this research suggest that in general, students respond positively to ICT being used in the learning process. The main advantages the respondents noted were the availability and accessibility of learning materials and more possibilities to tailor their learning to their own lifestyle. Most students did not experience decreased motivation compared to face-to-face learning. Also, use of ICT seemed to have little perceived effect on understanding of the study material and effectiveness of learning.

Although the findings of this research do not point directly to an increased or decreased effectiveness of learning when technology and distance learning in particular are used, they present a reflection of the participants of the learning process on the perceived usefulness of ICT and satisfaction with ICT in learning. Also, this study points at several strategies that helped increase students' learning and made them more motivated. That includes fostering discussions and participation by decreasing the number of students in one group and adapting the style of instruction to make it as engaging as in traditional classes.

This study also revealed that students experienced some frustrations related to distance learning. Those include difficulties with focus and concentration, decreased participation and engagement in class activities, and less opportunities to make new connections, build friendships, and develop their social skills.

It is challenging to determine from the obtained data if students' frustrations related to distance learning were caused by the shift in their education on its own or by the shift in their lifestyles on the whole, as studies indicate that mental health issues such as depression, anxiety, and feelings of isolation have been experienced by many more people since the start of the pandemic, and the effect is even stronger for people who had not previously dealt with issues of that nature (Marques et al., 2021; Pan et al., 2021). This is an issue that presents opportunities for potential research in the future.

## 9 Conclusion

The goal of this paper was to present the current findings on the ways that information and communication technologies are used to facilitate learning and communication, to assess the contribution and effect of those technologies on learning and communication, and to contribute to the existing research by studying the perspectives of students on their experience with technology in the academic context. That was achieved by conducting focus groups interviews using a semi-structured interview protocol. After the data was collected, it was coded and analyzed with the help of inductive analysis, and overarching themes emerged from the data. The findings of this research correspond with the findings of other researchers, such as LMS being useful to support learner autonomy (Pérez et al., 2008) and having little overall effect on learning effectiveness (Admiraal et al., 2017), class size being an important factor of student participation (Ruthotto et al., 2020), and communication between students and teachers having a major impact on student engagement (Gunawardena & Zittle, 1997; Moore, 2013; Shearer, 2013; Young, 2006). Technologies enable us to overcome some barriers to effective teaching, learning, and communication that are almost inevitable in face-to-face learning, such as class logistics and lack of student collaboration caused by the teacher-centered learning approaches often implemented in formal learning. When used mindfully, they can foster creativity, better engagement, and higher academic performance, as discussed in the previous chapters. At the same time, technology use can have adverse effects on students' well-being and, consequently, on their academic achievement and social skills.

To successfully integrate ICT into the learning process, it is crucial to apply the systems thinking perspective to our studying and understanding of the classroom and the university as a whole. This paper presents a fraction of all the variables that can impact this process, as well as the process of communication and the interaction between them. Focusing on implementing the newest technology for its own sake will not necessarily lead to student satisfaction and better education, just like building a car by buying every part from the best manufacturer will not necessarily yield the best car, as the parts may not fit together at the end (Gharajedaghi and Ackoff, 1985). A system (such as a single course, for instance) is more than the sum of its parts. How efficiently a system functions is also contingent upon the interaction between those parts and how the parts work to



enhance the whole (Patton, 2002). In the case of technology in education, ensuring that the system works to benefit the students, the teachers and the universities as institutions requires adequate teacher training, mindful and purposeful introduction of ICTs into the learning process with a clear understanding of their potential benefits and drawbacks, and regular exchange of feedback between students and instructors.

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# 11 Appendices

## ***11.1 Appendix A. Focus group interview protocol***

1. What are the changes to the learning environment when ICT is integrated?
2. Can you describe the course where you used ICT (mobile computing devices, social media, LMS)?
  - 2a. Tell me how that is different from a course not using ICT?
  - 2b. Tell me what your role was in interacting with the technologies used in the course?
  - 2c. Tell me about your teacher's expectation of your interaction with ICT? What did they expect from you?
  - 2d. How did that impact your understanding of the content?
3. How did ICT help you interact with classmates/teachers?
4. Have you had experience with both face-to-face and virtual learning? How did those experiences differ?
  4. What changes did you see in the learners when you used ICT?
    - 4a. Tell me about your experience of using ICT (mobile computing devices, social media, LMS) in the learning environment.
    - 4b. Tell me how that's different from a course not using ICT.
5. What change did you see in the learner's behavior? What types of change did you see in the student interaction with the content?
  - 5a. Tell me about the student interaction with the types of technologies used in the course — what course related activities did they use it for?
6. How were the technologies used for communication?

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Téma práce: **Využití informačních a komunikačních technologií a jejich dopad na komunikaci a proces učení**  
Téma práce anglicky: **The Use of Information and Communication Technologies and Their Impact on Communication and Learning Process**  
Vedoucí práce: **Mgr. et Mgr. Marcel Pikhart, Ph.D.**  
**Katedra aplikované lingvistiky**

### Zásady pro vypracování:

Aim: To provide an overview of the application of modern information and communication technology (ICT) in the classroom and set out to estimate its effect on students' communication as well as their learning process. Structure: 1. Introduction 2. Use of ICT in learning 3. Impact of ICT 4. Methodology 4.1. Context and participants 4.2. Data collection 4.3. Data analysis 4.4. Rigor & trustworthiness 5. Findings and interpretations 6. Discussion and implications 7. Conclusion 8. References 9. Appendices

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Podpis studenta:

Datum:

Podpis vedoucího práce:

Datum: