Article

Influence of Smartphone Use on Emotional, Cognitive and Educational Dimensions in University Students

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Abstract: The use of mobile devices is one of the increasingly interactive methodologies widely promoted within the European Higher Education Area. It is, therefore, necessary to determine the potential effects of their excessive use on psychological and educational variables. The aim of the present study was to assess smartphone addiction and its relationship with emotional, cognitive, and educational dimensions in university students. Participants comprised 144 university students aged between 19 and 27 years old and studying psychology and education at the University of Granada. Various tests were administered to assess variables grouped into the following dimensions: smartphone addiction (TDM), general intelligence (Wonderlic), emotional intelligence (TMMS-24), motivation (Mape-3), creativity (CREA test), and attitudes toward competencies. An ex post facto design was employed. Direct associations were observed between addiction symptoms caused by smartphone use (withdrawal, tolerance, excessive use, and problems caused by the same) and the variables of extrinsic motivation (fear and avoidance of the task) and intrinsic motivation (motivation toward the task). The results also indicated direct relationships between the problems caused by excessive smartphone use and anxiety and extrinsic motivation toward learning. An inverse relationship was observed between smartphone addiction and the emotional intelligence dimension of clarity of feelings. The anxiety provoked by excessive smartphone use was related to the tolerance generated by such use and to cultural and artistic competencies. The data obtained thus shed light on the effect of smartphone use on emotional, cognitive, and educational dimensions in university settings.

Keywords: addiction; competencies; creativity; emotional intelligence; smartphone

1. Introduction

Society is changing at a dizzying speed, requiring teachers to deploy new learning strategies that may involve the use of mobile devices [1]. Needless to say, smartphones form an intrinsic part of young peoples' lives; consequently, hindering their use in the context of education would imply limiting access to the new "knowledge society" [2]. Smartphone use can generate benefits and consequences for the development of individuals in a society. It has been found that greater smartphone use inside and outside the classroom increases the risk of developing addictions associated with substance consumption, in addition to encouraging virtual communication in preference to social interaction

or face-to-face contact with others [3]. In a study of 1328 subjects aged between 13 and 20 years old, Sánchez-Martínez and Otero [4] observed that around 20% of the sample met the criteria for smartphone dependence. Another study found that smartphone use also appears to induce many of the symptoms of depression and anxiety [5].

Some authors argue that smartphones should be used in university contexts as a teaching tool in order to optimize performance, employing an approach known as m-learning, mobile learning, or mobile-assisted learning, provided that students are taught to use them appropriately [6]. Sanbonmatsu, Strayer, Medeiros-Ward, and Watson [7] studied multitasking skills to assess motivation toward smartphone use in 310 students. They found that participants presenting higher levels of benefit- or reward-based motivation and weak avoidance behavior (with high levels of impulsivity and sensation-seeking) reported greater multitasking behavior. In addition, participants with less executive control (greater impulsivity) tended to present higher levels of multitasking behavior, preventing them from focusing on the target behavior. In a sample of 1,301 students at the University of Madrid, Muñoz-Rivas, Fernández, and Gámez-Guadix [8] observed that abusive internet use via various technologies—including smartphones—correlated significantly with disruptive personality factors. Those who made most use of mobile devices presented greater loss of control, changes in health habits, and behavior that was often conditioned by negative reinforcers. Another study found that appropriate smartphone use correlated positively with self-esteem [9] and increased perceived self-efficacy [10], creativity [11], and motivation [12]. In addition, Choi, Song, and Oh [13] observed that smartphone addiction correlated with low emotional intelligence (EI) and detected a negative correlation between the variable of tolerance–withdrawal and EI, whereby the lower the smartphone tolerance, the higher the EI, and vice versa.

Use of a multidimensional psycho-educational model focusing on the common characteristics of gifted students on programs implemented in academic contexts [14] indicated that the specific skills that enabled them to acquire knowledge more easily than the rest of their peers according to Renzulli's [15] consolidated three ring model included the three inter-related dimensions considered present in gifted people; higher general intelligence, high general motivation, and high levels of creativity. A combination of the three dimensions would yield optimum performance and success. Along the same lines, based on a socio-cultural model, Tannenbaum [16] proposed that giftedness should be measured in terms of general mental ability, or the *g* factor, specific skills, motivation/self–concept, contextual family level, and what he called the "luck factor". Other studies have also indicated the importance of abilities, such as a high capacity for problem-solving, self-regulation processes, facility for acquiring knowledge, flexibility, high creative capacity, and high motivation toward learning [17,18]. Using the CAITAC (constructive, self-regulating, interactive, and technological) model, Beltrán, Alcillo, Pérez, and Rodríguez [19] found that the new technologies—including smartphones—enabled students to construct global and self-knowledge and endowed them with the capacity to plan their own activities and observe their personal progress. However, other studies have indicated that people who make heavy use of smartphones are characterized by a lower level of emotional intelligence [20,21]. The variables selected for the present study are relevant in these models; nevertheless, few studies of university students have explored the possible relationship between smartphone use and the cognitive, emotional or educational constructs such as emotional intelligence, general intelligence, creativity, or motivation.

2. Theoretical Background

2.1. Smartphone Addiction

Contemporary society has entered a technological era. It is primarily young people who are influenced by these technological advances, which have had a profound impact on people's lives. One of the technological devices that have affected young people's lives most is the smartphone, which has become indispensable for them. Velasco [22] argues that technological development has

gone hand in hand with an exponential growth in the availability of learning content on the internet. Since 2009, there has been significant growth in the number of webpages created for educational purposes; similarly, YouTube has moved from being a platform for uploading music and entertainment videos to hosting educational videos on how to produce materials and objects, perform mathematical operations, and even learn a language [23].

Smartphones offer young people a series of benefits, allowing them to access the internet from any location without needing to be sat at home in front of a computer, play video games, or keep in touch with others without calling them. Consequently, smartphones have become the principal medium for communication, social relations, entertainment, and learning [24]. However, not everything is advantageous or beneficial; excessive, uncontrolled smartphone use entails a number of consequences for young people, rendering them vulnerable [25]. Ramírez-Zavala [26] found that excessive smartphone use in adolescents (14–19 years old) was associated with symptoms, such as headaches; nervousness; insomnia; dizziness; fatigue; nausea; momentary memory loss; poor concentration; depression; anxiety symptoms, such as chest pain, irritability, respiratory infections, tiredness, and eye problems, such as watery eyes and momentarily blurred vision. In addition, Young [27] found that excessive smartphone use was related to problems in other areas, including:

- Family problems: excessive users tend to have more problems in the nuclear family (partner, parents, siblings, friends, etc.) due to their imperative need to constantly use their phones, preferring to spend less time with family and friends in order to spend more time on the phone.
- Academic problems: it has been reported that the use of information communication technologies (ICTs) in schools does not usually improve students' performance because they use them to chat with friends, play games, take photographs, or search for information irrelevant to the class; this is problematic, because the use of ICTs in schools can have significant educational benefits.
- Economic problems: people can spend large amounts of money by making purchases via smartphones or buying high end models or models with more features in a quest for constant connection with others.
- Personal problems: excessive users can develop distress, despair, insecurity, and emotional and physical problems, including neglect of body image or personal hygiene.

Therefore, excessive smartphone use predisposes people to and is considered a risk factor for developing addictive behavior toward the device. It has been reported that smartphone addiction leads people to become more introverted, have more problems with interpersonal and social relationships, and experience difficulties in controlling the time spent using the device, modifying the mood in those individuals who make excessive use of smartphones [28]. In addition, smartphones have become a status symbol, whereby people's self-esteem is heavily influenced by the brand of smartphone, the number of messages and likes the individual receives a day, and friends they have on social media [29]. In turn, this has detracted from the value placed on face-to-face leisure activities and social interaction for which smartphones have now become ubiquitous. Thus, overuse of smartphones can have serious consequences for an individual's social life, personal life, and health [30]. The term nomophobia has been coined to describe the irrational fear of being out of smartphone contact. Symptoms include anxiety or panic attacks at the thought of running out of battery, credit, or data or having no network coverage, because smartphones have become an essential tool for affected individuals, who require continuous smartphone contact in order to lead their lives. Furthermore, smartphones help people cope with difficult life events, allowing them to manage their moods, escape or evade social problems, and compensate in some way for lack of social interaction [31].

As regards smartphone dependence by sex, women tend to be more likely to develop dependency because they make more use of smartphones for social purposes than men [29]. It has been reported that men tend to make more use of mobile applications related to leisure and entertainment, whereas the women send more text messages, make more use of social media, and make more voice calls [32]. In addition, although people start to use smartphones at a relatively early age, usage rises significantly

at around 15 years of age, with more time being spent using the phone, which begins to form part of daily life [33].

Navarro and Rueda [34] considered a series of criteria to identify the existence or not of smartphone addiction, based on the criteria proposed by Young [27]:

- excessive preoccupation with smartphone use;
- need to use a smartphone for increasing amounts of time in order to achieve satisfaction;
- unsuccessful efforts to control smartphone use;
- moodiness, depression, or irritability when smartphone use is restricted or curtailed;
- spending more time than agreed using a smartphone;
- jeopardizing significant relationships or work, or achieving poor academic performance;
- lying about time spent using a smartphone;
- using a smartphone as way of escaping from daily problems.

To conclude this section, it should be noted that very few studies have examined the effects of excessive smartphone use on university students or associations with cognitive, emotional, and educational variables, such as emotional intelligence, general intelligence, creativity, motivation, and self-perceived competencies, as proposed by the present study.

2.2. Smartphone Addiction and Emotional and General Intelligence in University Students

Emotional intelligence has been defined as the ability to perceive, assimilate, understand, and regulate one's own emotions and those of others, thus promoting emotional and intellectual growth [35]. Meanwhile, Fretel-Quiroz [36] uses the definition of emotional intelligence given by Goleman [37] as a set of skills, attitudes, abilities, and competencies that define a person's conduct, reaction, and moods and enables people to understand their feelings and those of others in order to cope appropriately with social relations. This emotional intelligence comes into play when we are in contact with other people with whom we can verbalize our emotions, thoughts, and ideas. However, since the arrival of smartphones, face-to-face social contact to exchange emotional experiences and learn from the experiences of others has changed, because emotional states, thoughts, and ideas are now communicated via this new medium. Consequently, social skills and the emotional regulation that enable the development of emotional intelligence have also been influenced and affected by this technological tool [38].

With regard to smartphone dependence and its relationship with emotional intelligence, it has been reported that emotional intelligence is a protective factor against smartphone addiction since it is closely related to the psychological variables of resilience, self-esteem, social skills, and self-control, which protect individuals from developing addictive behaviors. It, therefore, follows that low levels of self-esteem, extraversion, and depression favor the development of smartphone addiction [39]. Self-regulation also plays a major role in smartphone addiction. It has been observed that people with poor self-regulation are at higher risk of having more communication habits that could lead them to develop a smartphone addiction, because with today's smartphones, users do not need to communicate, socialize, or present themselves in real-time, face-to-face [40]. In addition, Goleman has argued that poor emotional self-regulation is related to more behavioral problems and greater difficulties in decoding the facial expressions and emotions of others [36]. In a study to analyze maladaptive smartphone use and its possible association with emotional intelligence and the symptoms of psychological distress, Beranuy, Oberst, Carbonell, and Chamarro [41] found that psychological distress was related to inappropriate smartphone use, and that the consequences of the latter were worse for women. In this case, the components of emotional intelligence explained the variance in the indicators of psychological distress.

In another study to determine the relationship between problematic smartphone use and the components of emotional intelligence (attention to feelings, clarity of feelings, and mood repair, as in the present study), Vegue [39] found that all three components were influenced by problematic smartphone

use, and that attention to feelings was also influenced by sex. People with a smartphone addiction showed greater attention to feelings, whereas subjects who did not present problematic smartphone use showed greater clarity of feelings, recognizing and understanding their moods. As regards the variable of mood repair, he found that people with a smartphone addiction experienced greater difficulty in repairing emotions or seeking others with which to substitute disagreeable emotions. Paredes and Ríos [29] also attempted to determine the relationship between smartphone dependence and emotional intelligence, concluding that women were more affected than men by smartphone dependence, which agrees with the finding reported earlier that sex is a risk factor for developing smartphone dependence. They also found that the women presented low levels of emotional intelligence and detected an inverse relationship between dependence and emotional intelligence, albeit this did not reach significance. However, they did find a significant relationship between tolerance–withdrawal and mood, whereby the worse the mood, the greater the problems of tolerance or withdrawal with respect to smartphone use.

As can be seen, many studies have investigated the relationship between smartphone addiction and emotional intelligence, but few have analyzed the effect of this addiction on general intelligence. It is known that a normal or normal–high intellectual quotient, appropriate levels of resilience, and high self-esteem act as protective factors against developing addictive behavior toward smartphones. Those who are addicted to this technological tool are people who need immediate answers, otherwise their self-esteem is affected, and their self-confidence is diminished [42]. The repercussions of abusive smartphone use for students' academic performance have also been investigated, finding both positive and negative consequences. The negative effects include less time spent on school work and study and poorer concentration; the latter is as a result of the person's excessive need to constantly use a smartphone. Nevertheless, smartphone use has also been associated with beneficial or positive effects, such as a reduction in time spent seeking information. It has thus been reported that smartphone addiction does not have a significant impact on mean grades [43]; however, not all authors agree with this finding, as some consider smartphone dependence to exert a negative effect on learning. In a study to determine the existence or not of this relationship, Morán [44] found that indiscriminate smartphone use led to dependency, which had a negative effect on academic performance and learning, affecting conceptual, procedural, and attitudinal components.

2.3. Smartphone Addiction and Creativity in University Students

In relation to creativity, much depends on how smartphones or other new technologies are used. ICTs can help enhance creativity if they are used responsibly, but when such use becomes addictive and dependent, smartphones are transformed into instruments of domination, which prevent the expression of creativity. Instead of using smartphones or the internet as a support when carrying out academic tasks, many young people use them as a means to easily complete their tasks without engaging their creativity [45].

One of the consequences associated with the arrival of smartphones is that students and young people have lost many of the natural capacities humans had before. For example, ever since smartphones began to include a built-in GPS system, people have stopped planning routes or thinking about the best way to reach a given location; instead, they enter the address in the GPS and simply follow the directions. This erodes our creative capacity, because it is no longer necessary to stop and think about how to travel from A to B or what to do if we get lost. Furthermore, this creates the belief among young people that smartphones have all the answers, and so they do not try very hard to conduct specific and detailed searches but are content with superficial information obtained from a rapid, cursory search, often copying and pasting such information before having read it carefully to understand and assimilate it [46]. This problem has also been highlighted by Domínguez and Pérez [47], who concluded that when young people have unlimited access to smartphones and the internet without any control from teachers or parents, they spend all their waking hours waiting for messages or activity on social media to see what their friends are doing, and that this behavior is associated with a reduction in their creative and cognitive capacities, which limits and restricts their development of skills necessary to

solve problems of everyday life. However, if we want young people to take full advantage of this tool, the solution is not to restrict its use in the classroom or at home while studying. Teachers and parents need to impress upon young people that smartphones have different academic uses that can open a window onto new activities and might even stimulate them to carry out projects or tasks based on what they have seen on the internet. Hence, the solution is not to condemn smartphone use out of hand, since smartphones now form an integral part of life and society, and the only outcome of such an approach would be to foster rejection toward any suggestion from teachers or parents. Instead, the solution is to encourage young people to spend less time on social media and show them the internet's true potential for widening their knowledge and using their creativity.

Consequently, the arrival of ICTs and the mass use of smartphones have implications for teaching. Young people who have grown up in this technological era are accustomed to using the new technologies to carry out projects and have incorporated them into practically every aspect of their daily lives. However, many teachers have yet to adapt to this change and continue to rely on traditional teaching methods. This actually incites inappropriate use of smartphones in the classroom, distracting students from the matter at hand and thus affecting their academic performance. A better approach would be for teachers to use the new technologies and smartphones in the classroom as a means to create an innovative and flexible teaching–learning process that helps stimulate students' creativity, since these would be more motivated and would learn a new way of using smartphones besides the habitual, everyday use they make of them, which is basically to communicate on social media and post everything they do each day [48]. To this end, teachers must discard their role as custodians of knowledge to become facilitators, helping students to actively participate in the teaching processes, which would include the appropriate and controlled use of smartphones and new technologies. However, if this new way of teaching is to be effective, students must be motivated, and this will also require the active participation of teachers to facilitate their learning, enabling students to develop and enhance their creative capacity in order to improve their academic performance [49]. Many countries are now developing or implementing e-learning systems in which m-learning (mobile learning) using smartphones forms the basis for a series of learning processes in education. There are a number of advantages associated with this kind of methodology, but also disadvantages. Technological disadvantages include the small size and low resolution of the screen, problems with memory capacity and wireless connectivity, and the small size of the keyboard mechanism, which can reduce the speed of text entry. However, as regards teaching, it has been shown that mobile devices enhance the frequency and fluidity of communication, and therefore, their use in classroom settings can improve student–teacher communication [50]. Moreover, m-learning has been shown to improve knowledge transfer and acquisition in the learning process and to enhance creativity, because students learn better when the information is important, has a social connection, and is of personal interest [51]. In any event, it can be seen that further research is required in university contexts to analyze the relationships between the variables of smartphone addiction and creativity.

2.4. Smartphone Addiction and Motivation in University Students

As discussed above, young people's smartphone use can be either harmful or beneficial, depending on the use made of these devices. However, it is also important and interesting to determine university students' motivation toward smartphone use when they are aware of the risks and problems entailed in excessive use [52]. Motivation can be defined as an inner state of excitement that drives people to act in a certain way to achieve their proposed goals and objectives, strive to process information, and take detailed decisions. In addition, there are three important factors within motivation that determine whether or not individuals achieve their proposed goal: perceived risk, the importance of the goal for the subject, and inconsistency with attitudes [53]. It has been found that what motivates young people to make excessive use of smartphones—namely, social media sites—is related to procrastination. Subjects who procrastinate present low motivation, because they have problems with delayed gratification and, therefore, use technological advances in order to obtain information rapidly, a strategy that often yields

superficial, shallow results. This also encourages addiction to the new technologies and smartphones as these enable immediate communication with other people without having to wait to see them to hold a conversation, as well as rapid access to information or items of interest without having to leave home to go to a library or store. Having a smartphone available all day provides immediate access to other people, information, and goods, causing increasing numbers of young people to become addicted to smartphones [54].

Subjects may feel motivated to make excessive use of smartphones, because aside from providing rewarding emotions and sensations, they also help mitigate feelings of pain, uncertainty, despair, and loneliness. In addition, they help young people forget about the problems they encounter in daily life, giving them a sense of security and calm [55]. Luengo [56] explained that people who are addicted to or dependent on the internet—and by extension, smartphones—experience:

- a feeling of close intimacy when connected;
- disinhibition;
- freedom from ties;
- the feeling that time passes very quickly, losing track of time;
- a feeling of being out of control.

However, it is not all negative. Berrios and Buxarrais [57] claimed that smartphone use was not always associated with negative consequences, because it can also increase people's motivation toward the task in hand by facilitating the quest for information or ideas that help them move forward in their projects. If people perceive that a smartphone can help them when performing a task, they will be more motivated to use it, for example to study or to improve their academic performance. However, as has been noted throughout the introduction, it is important that subjects control their smartphone use and remain clear about the purpose for which they are using it.

Recent studies [58–60] have analyzed the factors that motivate young people to use mobile devices and their problematic use of these. García-Umaña [61] studied a sample of 313 university students who responded to an online questionnaire based on a scale composed of three dimensions of gratification: (1) access to information and communication; (2) avoidance, and (3) social status. He found than men tended to use smartphones to access information and for communication, and this was one of the gratifications that most predisposed people to smartphone addiction. As regards the use of smartphones for avoidance, to escape from everyday life, this was not found to be a strong determinant of smartphone addiction, since subjects responded that this only occasionally motivated their smartphone use, with men citing this motivation more frequently than women. However, this simply indicates that many young people are unaware that they use mobile applications, games, and social media to escape from situations they find boring or that do not motivate them, for example in class, since they frequently use smartphones in class when bored but do not realize that such use represents avoidance of the situation. Lastly, for the dimension of social status, most young people denied that this frequently motivated their smartphone use and did not consider that they used their smartphones in order not to appear old-fashioned nor to increase their standing among their peers or to feel important. This again indicates the need for further research to analyze the relationships between these constructs.

2.5. Smartphone Addiction and Competencies in University Students

As has been noted throughout this paper, young people present high levels of addiction to smartphones and their associated applications. It is important that university teachers bear this in mind when incorporating smartphones into their teaching methods, focusing not only on enhancing motivation but also on encouraging the acquisition of competencies. These latter can be defined as the knowledge, skills, and abilities that people develop in order to understand, participate in, and transform the world in which they live [62]. Leveraging the large amount of time that young people spend on smartphones and the utility of these, games have been introduced in university and non-university

education to develop specific strategies, based on evidence that games present considerable benefits for young people's development. Video games especially have been highlighted as facilitating their development, aside from their entertainment function. Therefore, it has been claimed that besides being a fundamental means for structuring language and thought, games systematically act on psychosomatic balance, enable meaningful learning, reduce fear of mistakes and failures, invite the active participation of players, and help develop intellectual competence and personal stability [63].

Gónzalez and Mora [64] have explained the benefits of using gaming approaches when teaching computer engineering. They claim that game-based learning strategies can promote the development of specific and cross-disciplinary competencies and enhance students' motivation and enthusiasm toward learning. The use of this type of method not only introduces students to other uses for smartphones and their applications, but also allows them to acquire a series of tools that enable them to improve several aspects, such as:

- Commitment: students are more motivated by and enthusiastic about what they are doing.
- Flexibility: game-based learning improves students' mental flexibility and enables them to acquire problem-solving skills.
- Competition: game-based learning is closely related to humans' natural competitiveness, thus helping students learn from their mistakes without being penalized for them.
- Collaboration: students can communicate with and help their peers online and in person.

Using video games on smartphones can also help develop decision-making strategies. Thus, it has been found that use of video games enables students and young people in general to interpret situations more critically and reflectively, strengthening decision making and helping them develop their capacity for teamwork and logical thinking [63]. For example, the different levels of difficulty and general objectives of strategy games help players develop and consolidate critical thinking, because at given moments during a game, players must block the actions of other players. In addition, the use of strategies is highly motivating, encouraging players to engage and implement their logic in order to plan, organize, and manage the strategies that will win them points for their decisions. Games also help develop spatial–temporal reasoning and hierarchical planning.

Another means to leverage the time spent on smartphones and give these latter another meaning is to use them to improve young people's communication skills. Poor communication skills in university students negatively affect the teaching–learning process, since it is essential to know how to assess, interpret, manage, and apply the information studied. This lack of communication skills is evidenced when students copy and paste, i.e., when they have to search for information on the internet for their work but make no effort to understand what they are reading or to put it into their own words but instead simply copy and paste someone else's idea as if it were their own [23]. In a study of the knowledge, skills, and attitudes that university students acquired when using m-learning, Herrera, Lozano, and Ramírez [65] found improvements in computer skills, communication, productivity, interpersonal skills, leadership, and self-directed learning. Notably, the students showed an improved ability to search for, select, read, assess, and process relevant information. Game-based learning also allows students to practice their language and reading skills, including speaking, listening, reading information critically, and expressing it logically and coherently. This is the case both individually and in groups, which is of particular interest in university education where teamwork is encouraged but frequently without equipping students with the tools necessary to work effectively and efficiently.

Barragán [23] also attempted to determine whether learning based on smartphone use in the classroom would improve communication skills and found that their use in the classroom facilitated innovative learning and enhanced students' communication skills. The communication skills they developed after using a smartphone for educational purposes were as follows:

- Asking and answering questions: they were encouraged to find information that they did not know by asking the teacher or seeking it on the internet.

- Presenting arguments: they argued and presented their reasons why they could or could not perform the task.
- Interpreting and producing information: they viewed tutorials on the subject matter presented in class, which enabled them to read, interpret, and apply the information transmitted; the information obtained from the teacher and the internet gave them more material which they had to process, assess, interpret, and apply in order to perform the task.
- Ability to analyze information: they learned to break information down into its component parts and determine their inter-relationships, which entailed complex thought processes and enabled them to carry out their tasks satisfactorily.
- Ability to handle information ethically: they learned to use the information obtained from the internet appropriately and responsibly.
- Critical and creative ability: students developed their creativity and voiced their doubts, proposing ideas to improve their tasks and those of their peers.
- Reading skills: students optimized the information and learned to read selectively, focusing on that which met their needs.

Consequently, it should be borne in mind that smartphones are not intended as a substitute for traditional learning. Rather, their use is intended to support traditional, formal learning in the classroom, as a means to motivate students to work more appropriately while also introducing them to new smartphone uses. In order to apply smartphones in education, it is important that students know how to use them and are aware of the risks their use entails, but it is also important that teachers are competent in their use and know how to leverage them so that both students and teachers benefit. The alternative is demotivated students in the classroom who use their smartphones inappropriately, running the risk of developing a smartphone addiction. The few studies identified that have analyzed perceptions of smartphone use and effect on addiction in relation to developing competencies in university students are not fully conclusive.

2.6. Research Hypothesis

The research hypothesis of this study is as follows: Smartphone addiction dimensions are related to a multifactorial construct composed of psycho-educational dimensions, such as educational aspects (attitudes toward competencies) and psychological or cognitive-affective skills (emotional intelligence, general intelligence and creativity). In addition, people who scored higher for emotional intelligence—a protective factor—were expected to present less smartphone addiction.

2.7. Aims

To investigate the correlation between the different dimensions of good/bad smartphone use and selected educational and/or psychological factors among undergraduate university students (e.g., level of creativity, motivation, general and emotional intelligence, and self-perceptions of competence).

3. Materials and Methods

3.1. Design

This was a cross-sectional, observational, descriptive study. An ex post facto design was employed.

3.2. Participants

Participants consisted of 144 consecutively recruited students enrolled in the Faculty of Education and the Faculty of Psychology at the University of Granada. The sample age ranged between 19 and 27 years old ($M = 0.82$, $SD = 2.05$). Of these, 108 were women (75%) and 36 were men (25%). Convenience sampling was used to select participants.

3.3. Instruments

Giftedness was assessed using the method proposed by Renzulli [15]. Smartphone addiction-dependence, general intelligence, motivation, emotional intelligence, and creativity were assessed using the following instruments.

3.3.1. Test of Attitudes Toward the Use of Mobile Technologies

An adaptation of Venkatesh' version by Sánchez-Prieto, Olmos-Miguelánez, and García-Peñalvo was used for the present study [66–68].

3.3.2. Test of Smartphone Dependence (Spanish Initials: TDM)

The TDM, by Chóliz and Villanueva [33], consists of 22 items aimed at assessing the subject's dependence on mobile devices according to 4 dimensions defined in the DSM-IV-TR for this type of disorder. The four factors proposed by the authors and obtained statistically using factor analysis are: (1) withdrawal ($\alpha = 0.901$), expressed as intense anxiety when it is not possible to use a smartphone; (2) abuse and difficulty in controlling the impulse ($\alpha = 0.853$), referring to impulse control in relation to smartphone use; (3) problems caused by excessive use ($\alpha = 0.762$), measuring the negative results of abusive smartphone use, and (4) tolerance ($\alpha = 0.901$), which is very closely related to the dimension of withdrawal. The test shows high levels of reliability ($\alpha = 0.929$). One example of an item from this test is: "When I haven't used the smartphone for a while, I feel the need to call someone or send an SMS".

3.3.3. Perception of the Utility of Smartphone Use for the Acquisition of Educational Competencies

This construct is measured via 10 questions concerning smartphone use, scored on a Likert-type response scale from 0/1, "strongly disagree", to 4, "strongly agree" (e.g., "Mobile applications can be useful to promote social skills and citizenship") [69].

3.3.4. Wonderlic Test

Participants' general cognitive ability was assessed using an individual and group questionnaire, which takes 12 minutes to complete and measures general intelligence through various factors, such as mathematics, vocabulary, reasoning, speed, and perceived accuracy. The questionnaire consists of 50 questions (e.g., "A watch lost 1 minute 18 seconds in 39 days. How many seconds did it lose per day?"). Scores for correct responses are added to together, and then mistakes and unanswered questions are subtracted from the total. The resulting number (from 0 to 50) is a measure of the subject's general intelligence, defined according to the following ranges: (1) 0–19: low/medium-low intelligence; (2) 20–26: medium intelligence; (3) 27–31: medium-high intelligence; (4) 32–50: high/very high intelligence. The test shows high reliability ($\alpha = 0.86$) and a high level of validity ($\alpha = 0.75–0.92$) [70].

3.3.5. MAPE-3 Questionnaire

Participants' motivation was assessed using the MAPE-3 questionnaire [71], which has 3 dimensions measured by 124 questions and a dichotomous response scale (YES/NO). These dimensions are in turn divided into sub-dimensions, as follows: (1) extrinsic motivation, which includes the factors "fear of failure" ($R = 0–17$) (e.g., "I often remember situations where someone has negatively assessed my work"), "desire for success/recognition" ($R = 0–24$) (e.g., "I strive to be the best at everything"), and "motivation toward learning" ($R = 0–11$) (e.g., "What I most enjoy about my work is solving problems that are new to me"). These assess the subject's behavior orientation toward external goals, taking into account their nature. (2) motivation toward the task, which consists of the factors of "external motivation" ($R = 0–21$) (e.g., "When I finish a job, I think about all the benefits I will gain from it"), "willingness to make an effort" ($R = 0–9$) (e.g., "I don't know how I manage it, but my occupations don't leave me any free time"), and "lack of interest in and avoidance of work" ($R = 0–11$) (e.g., "For me, work and pleasure are incompatible and of course I prefer the latter"). These assess the

interest aroused by the activity. The third and final dimension is (3) facilitating anxiety for performance (R = 0–14) (e.g., "Being slightly nervous helps me to concentrate better on what I do"), which assesses the anxiety aroused by the intention to achieve success in a specific goal. The reliability of the scales is 0.79 (between 0.74 and 0.86).

3.3.6. Trait Meta-Mood Scale (TMMS-24)

Emotional intelligence (EI) was measured using the TMMS-24 [72], an adaptation to Spanish of the Trait Meta-Mood Scale by Salovey, Mayer, Goldman, Turvey, and Palfai [73]. This assesses meta-knowledge about emotional states and is scored using a Likert-type response scale from 1, "strongly disagree", to 5, "strongly agree". It has three dimensions, each with 8 items: (1) attention to feelings (AT), which measures the extent to which a person experiences and expresses emotions correctly (e.g., "I can always say how I feel"); (2) clarity of feelings (CL), which measures the extent to which a person accurately understands their emotions (e.g., "I can come to understand my feelings"), and (3) mood repair (RE), which measures the extent to which a person can regulate their emotions (e.g., "When I am angry, I try to change my mood").

3.3.7. CREA Test of Creative Intelligence

Participants' level of creativity was assessed by means of the CREA test [74]. This is a quick test that can be administered to individuals and groups. It consists of three types (A, B, and C), which are adapted for specific age ranges. Type C was selected for the present study, which has a concurrent validity of 0.811. This instrument has been applied in samples similar to the one reported here and shows a high level of reliability. The CREA test measures creativity through questions related to a given image (a telephone, for example) and takes a very short period of time—4 minutes—to administer. It has a very precise scoring schema, which enables the direct score to be directly converted to a percentage score. Scores are defined according to the following three ranges: (1) 1–25: low creativity; (2) 26–74: *average creativity*, and (3) 75–99: *high creativity*.

3.4. Procedures

The questionnaires were individually administered at the start of classes taught in the morning. Subjects were informed that study participation was voluntary, and that all information obtained from the questionnaires would be treated as confidential. This study received approval from the Ethics Committee for Research on Humans at the University of Granada. The mean time for questionnaire administration was 15 minutes.

3.5. Data Analysis

All statistical analyses were performed using SPSS v. 20.0 (IBM Corp., Armonk, NY, USA). The descriptive analysis was calculated, and the normal distribution of variables was confirmed by means of the Kolmogorov–Smirnov test. A scatter diagram was used to verify compliance with the assumptions of linearity and homoscedasticity and determine whether to apply parametric or non-parametric tests. Multiple linear regression analyses were conducted to determine if there is relationship between smartphone use and general motivation, general intelligence, emotional intelligence, creativity, and competencies in university students. A value below $p < 0.05$ was considered statistically significant in all cases.

4. Results

4.1. Descriptive Results for the Sample

The final sample consisted of 144 students with a mean age of 20.82 years ($SD = 2.05$). Of these, 75% were woman and 25% men. With regard to general intelligence, 11% showed low/medium-low intelligence, 28.5% showed medium intelligence, 22.2% showed medium-high intelligence, and

the remaining 22.2% showed high/very high intelligence. Table 1 gives the values for variables related to smartphone addiction and dependence (withdrawal, abuse and difficulty in controlling the impulse, problems caused by excessive use, tolerance, and attitudes toward competencies in relation to smartphone use).

Table 1. Main characteristics of smartphone use (*n* = 144).

Smartphone Use Dimensions	Range	Minimum	Maximum	Mean	SD
Withdrawal	20.00	0.00	20.00	9.05	4.58
Abuse and difficulty controlling the impulse	33.00	1.00	34.00	22.37	7.18
Excessive use	16.00	0.00	16.00	2.73	3.00
Tolerance	16.00	0.00	16.00	8.52	3.72
Attitudes toward competencies	31.00	29.00	60.00	45.58	6.59

Table 2 gives the results obtained for the tests of creativity, emotional intelligence, motivation, general intelligence, and participants' perceptions of the utility of smartphone use. With regards to creativity, the mean obtained for participants was 52.34 (SD = 31.28), indicating a moderate level of creative production. Meanwhile, the mean obtained for emotional traits was 28.33 (SD = 6.73) for attention to feelings, 27.91 (SD = 6.98) for clarity of feelings, and 27.93 (SD = 6.18) for mood repair. These results indicate that participants possessed good, healthy EI. For motivation, the factors comprising extrinsic motivation obtained means of 6.98 (SD = 4.73) for fear of failure, 8.47 (SD = 4.61) for desire for success/recognition, and 3.02 (SD = 2.34) for motivation toward learning. The mean obtained for the dimension of external motivation was 16.56 (SD = 3.04) above the rest, while for willingness to make an effort it was 3.84 (SD = 2.35) and for lack of interest in and avoidance of work it was 3.65 (SD = 2.52). Lastly, the mean for anxiety aroused by the effort to achieve success was 7.72 (SD = 3.76).

Table 2. Levels of general intelligence, motivation, emotional intelligence, and creativity (*n* = 144).

Giftedness Dimensions	Range	Minimum	Maximum	Mean	SD
Creativity	99.00	0.00	99.00	52.34	31.28
Emotional intelligence					
Attention to feelings	30.00	10.00	40.00	28.33	6.73
Clarity of feelings	28.00	12.00	40.00	27.91	6.98
Mood repair	26.00	14.00	40.00	27.93	6.18
General motivation					
Fear of failure	17.00	0.00	17.00	6.98	4.73
Desire for success/recognition	24.00	0.00	24.00	8.47	4.61
Motivation toward learning	11.00	0.00	11.00	3.02	2.34
External motivation	12.00	9.00	21.00	16.56	3.04
Willingness to make an effort	9.00	0.00	9.00	3.84	2.35
Lack or interest in and avoidance of work	11.00	0.00	11.00	3.65	2.52
Facilitating anxiety	14.00	0.00	14.00	7.72	3.76
General intelligence	43	0	43	27.56	7.34
Perceptions of the utility of smartphone use					
Mobile applications can be useful to promote speaking skills, communication skills, and social skills, among others	3	1	4	2.74	1.00
Smartphone use can help in the acquisition of basic and specific competencies	3	1	4	2.88	0.890
Digital competence and information processing	2	2	4	3.66	0.529
Mathematical competence	21	1	22	2.97	2.00
Autonomy/independent learning	3	1	4	2.92	0.919
Learning to learn	3	1	4	2.78	0.925
Cultural and artistic	3	1	4	3.02	0.946
Social and citizenship	3	1	4	2.71	0.980
Mathematics	3	1	4	2.77	0.862
Knowledge of and interaction with the physical world	3	1	4	2.21	1.055

4.2. Relationship between Smartphone Use and the Selected Psychological and Educational Variables

The results are presented below of a multiple linear regression analysis of the factors related to smartphone use and general motivation, emotional intelligence, and competencies in university students (Table 3). In relation to favorable attitudes toward smartphones, significant positive results were obtained for fear of failure ($p < 0.003$), basic and specific competencies ($p < 0.000$), and cultural and artistic competencies ($p < 0.001$).

Table 3. Model of multiple linear regression analysis of attitudes toward smartphones and general motivation, emotional intelligence, and competencies in university students ($n = 144$).

Related Factors	B	95% CI		β	SE	*p*-Value
		Lower limit	Upper limit			
Fear of failure	0.319	0.108	0.531	0.221	0.107	0.003
Basic and specific competencies	0.442	2.687	5.042	0.210	0.124	0.000
Cultural and artistic competence	0.247	0.916	3.175	0.126	0.118	0.001

Attitudes toward Smartphones ($r^2 = 0.487$)

r^2, coefficient of determination; B, estimators of the regression coefficients; *CI*, confidence interval; β, estimators of the standardized regression coefficients; *SE*, standard error.

Table 4 gives the linear regression analyses for the variables of smartphone addiction and general motivation, emotional intelligence, and competencies in university students. Positive relationships were found between smartphone withdrawal and motivation toward the task (lack of interest in and avoidance of work) ($p < 0.002$). Positive relationships were also observed between abuse and difficulty controlling the impulse to use a smartphone and motivation toward learning ($p < 0.013$). Problems caused by excessive smartphone use were significantly related to anxiety ($p < 0.018$) and motivation toward learning ($p < 0.036$), and negatively related to clarity of feelings ($p < 0.012$), indicating that the problems caused by smartphone use are due to a poor understanding of emotions. The anxiety provoked by these problems was also related to the tolerance generated by smartphone use ($p < 0.006$). In addition, this tolerance showed a significant positive relationship with cultural and artistic competencies ($p < 0.014$). No significant relationship was detected between smartphone addiction and creativity or general intelligence.

Table 4. Model of multiple linear regression analysis of the variables of smartphone addiction and general motivation, emotional intelligence, and competencies in university students ($n = 144$).

Related factor	B	95% CI		β	SE	*p-value*
		Lower limit	Upper limit			
Motivation toward the task (lack of interest in and avoidance of work)	0.538	0.200	0.876	0.298	0.170	0.002

Smartphone withdrawal ($r^2 = 0.089$)

Related factor	B	95% CI		β	SE	*p-value*
		Lower limit	Upper limit			
Motivation toward learning	0.731	0.160	1.302	0.244	0.288	0.013

Abuse and difficulty controlling the impulse to use a smartphone ($r^2 = 0.059$)

Table 4. *Cont.*

Problems arising from excessive smartphone use ($r^2 = 0.141$)						
Related factors	B	95% *CI*		β	SE	*p-value*
		Lower limit	Upper limit			
Facilitating anxiety	0.180	0.031	0.329	0.225	0.075	0.018
Clarity of feelings	−0.102	−0.181	−0.022	−0.237	0.040	0.012
Motivation toward learning	0.250	0.017	00.483	0.200	0.118	0.036
Smartphone tolerance ($r^2 = 0.137$)						
Related factors	B	95% *CI*		β	SE	*p-value*
		Lower limit	Upper limit			
Facilitating anxiety	0.264	0.077	0.451	0.262	0.094	0.006
Cultural and artistic competence	0.918	0.188	1.649	0.233	0.368	0.014

r^2, coefficient of determination; B, estimators of the regression coefficients; *CI*, confidence interval; β, estimators of the standardized regression coefficients; *SE*, standard error.

5. Discussion

The aim of the present study was to assess whether the different dimensions of good/bad smartphone use in a university context were related to levels of creativity, motivation, and emotional and general intelligence measured through the intellectual coefficient. Participants reported experiencing symptoms related to withdrawal when they could not access their smartphones. In some cases, they experienced considerable physical and mental distress, leading to a state of confusion and a feeling of isolation that sometimes generated anxiety. These data are consistent with recent research demonstrating that excessive smartphone use causes withdrawal symptoms very similar to those induced by certain drugs [75]. Other studies have shown that university students with a medium-high lack of control of devices need to use them in order to combat the unpleasant symptoms of withdrawal, which in turn can be related to high means for tolerance, confirming that as with other addicts, more time is required to obtain the same benefits as before [76]. However, it should be noted that although some level of addiction was confirmed in the present study sample, participants did not perceive their smartphone use to be excessive, but instead saw it as completely normal.

The results of this study suggest that smartphone addiction is a factor that affects the more behavioral variables related to motivation. Positive attitudes were observed toward appropriate smartphone use to acquire competencies. In this respect, other studies have suggested with regard to participants' basic, specific, and cultural knowledge, an education based on m-learning would help students make reasonable use of the resources provided by smartphones for the acquisition of competencies [77], and that appropriate smartphone use would increase students' interest in and positive attitude toward learning [78], as also indicated by the results of the present study. In a study to determine whether the use of smartphones in the classroom and learning how to use these improved communication skills, Barragán [23] found that these facilitated innovative learning in the classroom and enhanced communication skills. Another study suggests that fear of failure is a positive factor for good use of smartphones, whereby those who are more worried about their future use smartphones as a mechanism to obtain the highest possible return. The positive relationships between withdrawal caused by high levels of smartphone use and factors associated with extrinsic motivation, such as lack of interest in and avoidance of work, suggest that one of the main characteristics of this addiction might result from a deficit generated by lack of motivation inside and outside school [79], which would create a greater need to use smartphones as an escape from lack of enthusiasm or boredom. In another study, it has been shown that this lack of interest in learning renders students incapable of paying attention to what is being taught, and as a result, they make compulsive and excessive use of the "more interesting" applications they can access on their smartphones, such as games or social media. Other research

indicates that the students who use smartphones most in the classroom initially sought distraction and entertainment [80].

No correlation was found in the present study between problems caused by excessive smartphone use and extrinsic motivation toward learning. Matalinares [54] found that smartphone addiction is on the rise among young people, which may be related to the tendency to procrastinate found in people showing low motivation, since these find delayed gratification difficult and, therefore, use the new technologies, because these enable immediate communication with other people without having to wait to see them to hold a conversation and provide rapid access to information or items of interest without having to leave home to go to a library or store. Even if they are extrinsically motivated toward work and strive more in academic tasks, it will be necessary to continue to determine the influence of smartphone use. Berrios and Buxarrais [57] have stated that smartphone use is not always associated with negative consequences, because it can also increase people's motivation for the task in hand by facilitating the search for information or ideas that help them move forward in their projects.

As regards the emotional dimension, no correlations were detected between anxiety and the problems caused by excessive smartphone use. Such problems can generate or be associated with other difficulties, such as calls for attention or higher financial costs, which can also increase anxiety levels and smartphone tolerance, in turn possibly generated by a lack of understanding of one's emotions. Thus, not only is it necessary to adapt teaching methods to the new technologies, but there is also a need for an education based on understanding and managing one's own emotions [81]. This lack of EI together with a lack of motivation may be one of the main causes of smartphone addiction, and vice versa [82]. In reference to the positive dimension of emotional intelligence, an inverse association was observed between smartphone addiction and the emotional dimension of clarity, in agreement with a previous study by Vegue [39], to determine the relationship between problematic smartphone use and the components of emotional intelligence (attention, clarity, and repair, as in the present study). Vegue [39] found that that all three components of emotional intelligence were influenced by problematic smartphone use. In particular, people with a smartphone addiction showed a greater attention to feelings, and those who did not present problematic smartphone use showed greater emotional clarity, recognizing and understanding their moods. As regards the variable of repair, he found that people with a smartphone addiction experienced greater difficulty in repairing emotions or seeking others with which to substitute disagreeable emotions. Paredes and Ríos [29] also studied the relationship between smartphone dependence and emotional intelligence and found significant relationships between tolerance–withdrawal and mood, whereby the worse the subject's mood, the greater the subject's problems with smartphone tolerance or withdrawal.

As in the present study, the results regarding general intelligence have been inconclusive. Many studies have investigated the relationship between smartphone addiction and emotional intelligence, but few have analyzed the effect of this addiction on general intelligence. It is known that a normal or normal-high intellectual quotient, appropriate levels of resilience, and high self-esteem act as protective factors against developing addictive behavior toward smartphones. Those who are addicted to this technological tool are people who need immediate answers, otherwise their self-esteem is affected, and their self-confidence is diminished [42].

With respect to the variable of creativity, addiction was not observed to exert any effect on creativity or emotional intelligence.

Limitations and Future Research

This study may have some limitations. Firstly, the assessment of creativity is usually a hard task in research. Future studies could be conducted using other alternative instruments and tools evaluating creativity. Nevertheless, given the difficulties of administering the CREA test for the time required with the necessary materials, the representative sample used to assess this construct was considered of great interest in the study context. Secondly, another study limitation may be the sample size. Future research should expand the sample, for example, by including different educational levels. In addition,

measures other than self-report should be used, and a longitudinal design could be used to analyze the cause-effect relationships between the variables. Finally, more robust multivariate analyses are also required to further investigate the effects of other possible relevant variables, such as academic year, sex, and different degree courses, on relationships between the psychological and educational variables selected for this study.

6. Conclusions

This research shows direct associations between addiction symptoms caused by smartphone use (withdrawal, tolerance, excessive use, problems caused by the same) and the variables of extrinsic motivation (fear and avoidance of work) and intrinsic motivation (motivation toward the task). Correlations were also found between the problems caused by excessive smartphone use and anxiety and extrinsic motivation toward learning, while an inverse relationship was observed between smartphone addiction and the emotional intelligence dimension of clarity of feelings. The anxiety induced by excessive smartphone use was related to the tolerance generated by said use and to cultural and artistic competencies. Addiction was not observed to exert an effect on creativity or emotional intelligence.

Contributions such as the present study are highly relevant, since smartphones are now ubiquitous in the daily lives of young people. In the field of education, they affect intrinsic and extrinsic motivation and interest in the subject matter and raise the need to update teaching strategies in today's knowledge society, where information and the new technologies play such an important role.

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