

Smartphone, Attention and Academic Performance of Adolescent Students in the 4th Grade

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ABSTRACT

The present study aims to identify the influence of smartphone use on the attention and academic performance of 4th grade adolescents. To achieve this, we used both quantitative and qualitative research tools to collect the data. These are the questionnaire and the Zazzo attention test. Academic performance was measured using scores on the French and math assessments. The results show that the students with the best academic performance are those who use their smartphones for less than 120 minutes (2 hours) per day. Students spend on average between 120 min (2h) and 240 min (4h) per day using their smartphone. Games and social networks are the smartphone applications most used by these adolescents. It is essential to make students aware of the disadvantages of abusing their phones.

Keywords: *Adolescents, Smartphone, Attention, School Performance*

Technological advances taking place in the mid-twentieth century, particularly the invention of the cell phone, have revolutionized the world of communication (Bardin, 2002). The number of cell phone users in the world has reached 5.27 billion, or just under 67% of the total world population (Taha, 2021). In Burkina Faso, the Institut National de la Statistique et de la Démographie (2015) reports that 64% of Burkinabè aged 15 or older own a cell phone. In rural areas, 56% of the population aged 15 or older owns a cell phone vs. 87% in urban areas. To understand how the cell phone has invaded our daily lives, Martin (2007) conducted a study to determine the logic of cell phone use. The results show that the cell phone is first perceived as a mediation tool with the family; then it is seen as an object of mediation with friends and work relations and, finally, it is considered important in the professional sphere according to the need of the job and the reconciliation between private and professional life. Speaking of the cell phone, we distinguish between the smartphone (or smart phone) and the keyboard cell phone.

The smartphone can run various software/applications thanks to an operating system specially designed for mobiles, and therefore in particular provide functionalities in addition to those of the classic cell phones such as: diary, television, calendar, web browsing, e-mail consultation and sending, geolocation, dictaphone/recorder, calculator, compass, accelerometer, gyrometer, visual voice mail, digital cartography, etc. It is a "nomadic" object that is easily moved and

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Smartphone, Attention and Academic Performance of Adolescent Students in the 4th Grade

easily carried on or with you (Chermeleu, 2013). In addition to making phone calls and sending messages, the smartphone offers the possibility of accessing the Internet, reading and sending emails, listening to music, watching movies, playing games, taking photos and videos... The addition of applications allows to personalize the device according to one's needs. Among the individuals who use the smartphone as a means of communication, there are teenagers.

According to Amri & Vacaflor (2010), the smartphone has become, among adolescents, a tool for identity construction, which goes far beyond its basic function of social contact. Amri and Vacaflor (2010) speak of technological exposure of the self. The "self" is represented in all the moments, situations, actions and expressions in which the mobile is involved. Moreover, the mobile has become a mirror of identity because it has become an instrument that authentically speaks of the "self". In the same vein, Mba (2017) showed that the penetration of smartphones in the environment of Gabonese students has allowed them to become familiar with it and that the telephone first replaces other tools used quite often in the classroom: the calculator, the sound recorder, the camera, the still camera... Then, its more specific functions are mobilized: SMS, access to the Internet... Finally, the analysis of the data allowed us to examine the processes used by the learners to use and integrate these devices into their learning strategies. The results reveal that smartphones are ubiquitous in the school landscape and that they are proven learning tools for these high school students. According to Geffrier and Cossa (2017), the first cell phone typically arrives with the entry into middle school (around age 11), across all phone categories. Students' smartphone use strains their attention and time. The amount of time they spend on their cell phones is a concern for many, when you consider that the recommended screen time for teens is 120 minutes (2 hours) per day (Canadian Psychological Association, 2017). This limit reduces the impact of digital tools on their health, and allows them to keep a natural rhythm, in accordance with their physiological and cognitive development. This allows them to maintain appropriate sleep time, scheduled meals, and continuous social connection (Canadian Psychological Association, 2017). However, it is noted that frequently the average screen time per day per adolescent is 4 hours¹¹. Some authors have linked gender and technology (Kakooza et al., 2005), gender and screen consumption (Olds, Ridley, and Dollman, 2006) and have established that boys are more likely to adopt new technology and consume more screens than girls. The Olds, Ridley, and Dollman study found that girls consumed 161 minutes of screens on a weekday and boys consumed 215 minutes. This is explained by an explosion in the number of applications, between social networks and the appearance of many connected objects (MyTwiga, 2020). Indeed, thanks to the multiple applications (games, videos, social networks, search engine...) already installed or easily installable via an internet connection that the smartphone has, a student easily spends (loses or uses to profit) a considerable amount of time using his device. Also by gender, Livingstone and Bovill (2013) argue that girls are more willing to read books and magazines or listen to music while boys easily prefer electronic games. Thus, the recommended time limit is largely exceeded and even doubled. In short, cell phones consume the time of adolescents. It appears that adolescents in school are torn between the use of their cell phone (smartphone) and the need to concentrate on school learning.

The question that arises, and that we ask ourselves, is the following: what is the link between smartphone use and school performance? In the context of Burkina Faso, this question is of major interest given the recurrence of school failure. The present research would like to contribute to this reflection by addressing the specific role of the cell phone. Attention is the awareness by the mind, in a clear and precise form, of an object or a thought

among several simultaneously possible. In a school context, attention serves a goal and selects what is useful to achieve that goal (Mialet, 1999). This selection of appropriate information is crucial when we are interested in students' academic success. Focus and concentration of awareness is the essence of this. It involves the withdrawal of some things in order to effectively process others and is the opposite of the confused, dazed, or dazed state (Lachaux 2013). Attention is a filtering mechanism located between the input channels and the central channel (Camus 1998). The most direct of the experiments conducted by Broadbent is the so-called "split span" experiment. This involved presenting two sets of three letters, one to each ear, so that the subject received them synchronously (e.g. A-C-E to one ear and B-D-F to the other). During recall, the subject will repeat the sequences as they were produced, i.e., "A-C-E" and "B-D-F" (or B-D-F and A-C-E depending on the orientation of attention to one or the other ear), and not "A-B-C" or "D-E-F." Broadbent hypothesized that the subject paid attention to one ear and then went to search for the memory trace of the material presented to the other ear (Leclercq and Azouvi 2002). In addition, Liebherr, Schubert, Antons, Montag, and Brand (2020) studied the effects of smartphone use on attention, inhibition, and working memory. Their results show that general smartphone use may or may not have beneficial effects on certain attentional processes in students.

METHODOLOGY

Participants

One hundred and twenty-seven (127) students, including sixty-three (63) private students (35 males vs. 28 females) and sixty-four (64) public students (29 males vs. 35 females), participated in this research. Their average age was 15 years. They are non-duplicating students and each have at least one (1) smartphone that they use regularly. They all attend the fourth grade. This class is known to be difficult to pass by the students. It has the highest repetition rate. The research was conducted in one private and one public school. The choice of the two schools was based on the fact that they are the two schools with the largest student populations in Ouagadougou.

Instruments

We used several types of instruments for data collection: questionnaire, two dams test, and notebooks.

1 The questionnaire: It is composed of two (2) sections: identification and relationship with the smartphone. The first section collected information on the identity of each participant such as status (double/non double), age, gender. The second section provides information on the relationship that each participant has with his or her smartphone. It is composed of 8 items in the form of closed, semi-open or open questions. The average time to complete the questionnaire is 10 minutes.

2. Zazzo's two dams test: The test consists of locating two particular signs (a small square with a horizontal bar to the left and a small square with a downward slash at 45° to the right). These particular signs must be crossed out as much as possible in a limited time (ten minutes), working line by line, from left to right, while leaving out all the other signs whose bar orientation is different. Two types of errors can be counted: either the participant crosses out signs that are not identical to those displayed on the board (additions), or he forgets to cross out signs (omissions). The material used includes a test sheet, a pencil and a stopwatch.

3. Notebooks: We used the grade books to assess academic performance in French and mathematics. A good mark is greater than or equal to 15/20; an average mark is between 10 and 15/20; a poor mark is between 7 and less than 10/20. A very poor mark is less than 7/20.

Procedure

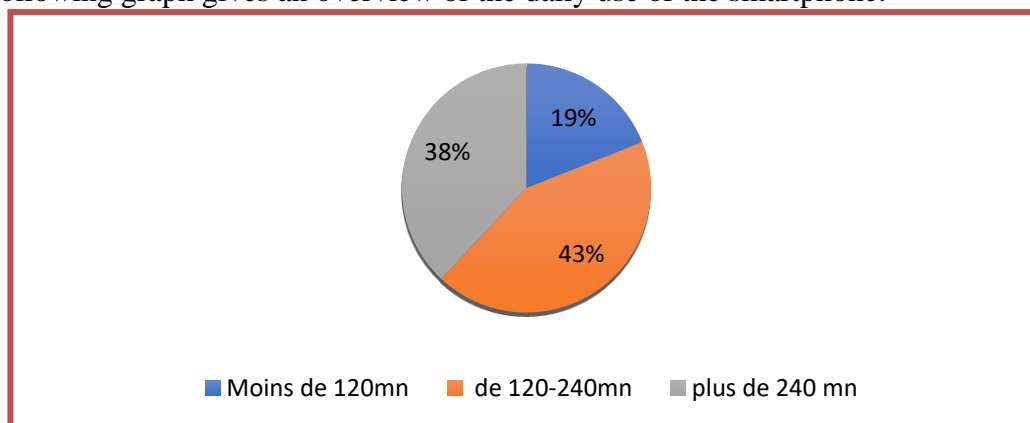
We requested and obtained grade books from the institutions concerned, which enabled us to record the participants' performance in the subjects concerned. The participants were then subjected to the questionnaire and the attention test.

RESULTS

The results presented concern the frequency of daily smartphone use, the applications used, and the links between smartphone use, attention and academic performance.

1. Frequency of daily smartphone use

The following graph gives an overview of the daily use of the smartphone.



Graph 1: Frequency of daily smartphone use by students

This graph shows us that 43% of the students spend between 120mn (2h) to 240mn (4h) per day using their smartphone and 38% of them spend even more time using their smartphone on a daily basis, more than 240mn (more than 4h). Only 19% of them record a frequency of use that does not exceed 120mn (2h). Taking into account the gender variable, the table below shows the average time in minutes that girls and boys spend on their smartphone in the morning, afternoon and evening.

Table 2: Average frequency (in minutes) of daily smartphone uses by gender and time of day

	Morning	Afternoon	Evening	Total
Frequency of use				
Gender				
Girls	78	90	122	253
Boys	86	87	118	237

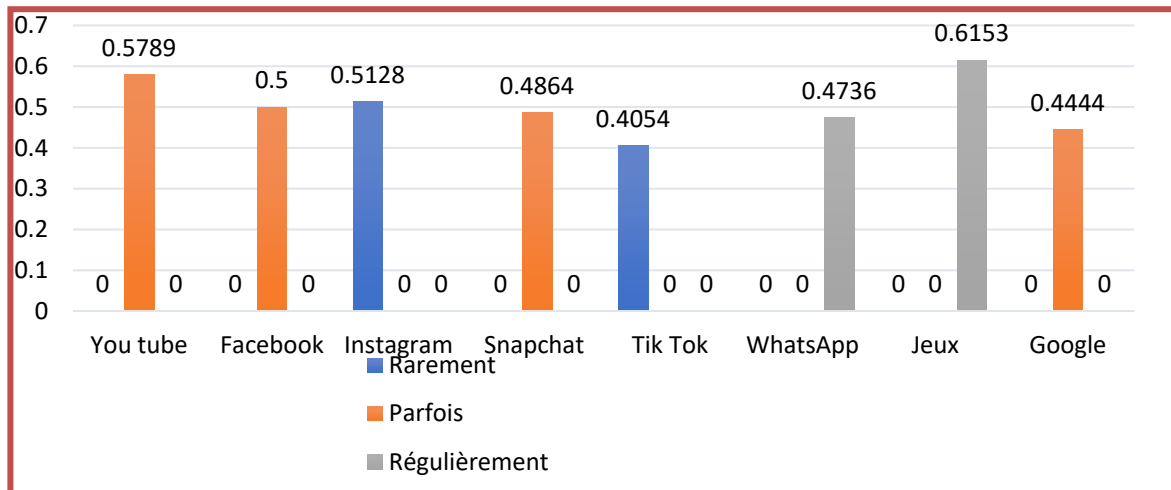
Source: Our field data

This table indicates that girls have a higher daily frequency of smartphone use 253 min (4h12) and are more active in the afternoons (1h30) and evenings (2h). Boys have an average frequency of 237 min (3h 57) and are more active in the morning (1h 25).

2. Frequency of use of smartphone applications by students

The graph below shows how often (regularly, sometimes or rarely) students use some applications on their smartphone. These are You tube, Facebook, Instagram, Snapchat, Tik Tok, WhatsApp, Games and Google apps.

Smartphone, Attention and Academic Performance of Adolescent Students in the 4th Grade



Graph 2: Frequency of use of applications

The above graph shows that the smartphone applications regularly used by students are those of games (61.53%) and WhatsApp social network (47.36%). Those sometimes used are You tube (57.89%), Facebook (50%), Snapchat (48.64%) and Google (44.44%) respectively. The applications rarely used are Instagram (51.28%) and Tik Tok. (40,54%). Taking the gender variable into account, table 3 below provides an overview of the average frequency of app use by girls and boys.

Table 3: Average frequency of application use by gender

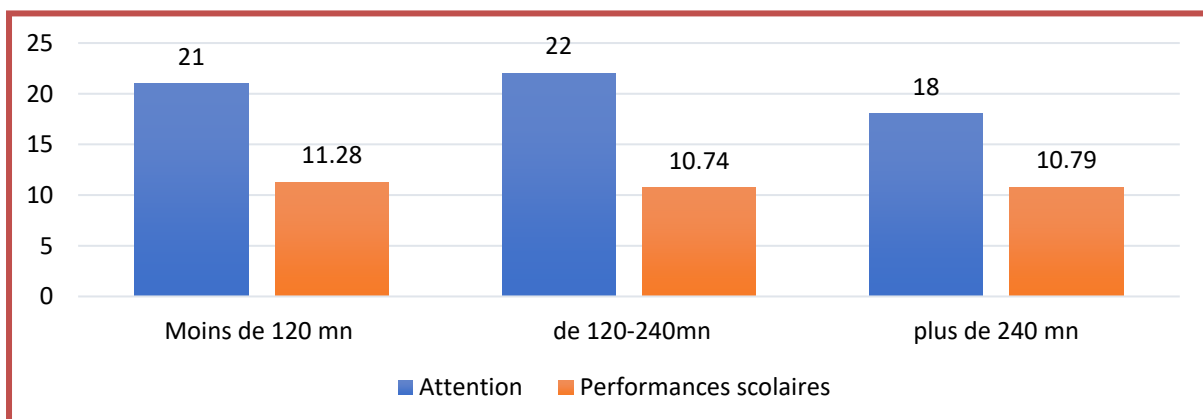
Application Gender	You tube	Facebook	Instagram	Snapchat	Tik Tok	WhatsApp	Jeux	Google
Girls	27	22	25	29	28	28	33	31
Boys	45	50	39	33	34	56	65	62

Source: Our field data

From this table, we can see that girls (11/18) are more active on Snapchat, while boys (23/31) are more focused on games.

3. Frequency of smartphone use, attention and academic performance

Graph 3 shows the average on the attention test and academic performance as a function of students' daily smartphone usage frequency.



Graph 3: Frequency of smartphone use-attention-academic performance

Smartphone, Attention and Academic Performance of Adolescent Students in the 4th Grade

Students (8/49) who spend less than 120 minutes per day with their smartphone have an average omission rate on the attention test of 21 signs and an average academic performance of 11.28/20. Students (16/49) who spend more than 240mn per day have an average omission on the attention test of 18 signs and an average 10.79 on academic performance.

Table 4: Attention and academic performance

	French	Mathematics	You tube	Facebook	Instagram	Snapchat	Tik Tok	WhatsApp	Jeux	Google
Attention total	-0.204	-0.413*	0.094	0.332*	-0.050	0.280*	0.087	0.201	0.178	-0.148
Omitted	-0.005	-0.096	0.022	0.197	0.047	0.334*	0.281*	0.135	0.099	-0.182
Added	-0.256*	-0.447*	0.138	0.258*	-0.102	0.079	-0.116	0.144	0.144	-0.039
Average			0.031	-0.155	0.083	0.001	0.016	-0.358*	0.076	-0.234

Source: Our field data

This table highlights the correlation coefficients between attention and academic performance. Those mentioned with a star are statistically significant. We find that using the social network Snapchat is associated with a significant score on the attention test. Facebook influences additions and Snapchat and Tik Tok have an effect on omissions. There is a negative correlation between additions and math score, between additions and the social network WhatsApp.

Table 5: Gender-Specific Averages of Academic Performance and Attention

Gender	Performances	Academic performances (Average)	General attention (Average)
Girls		10	30
Boys		11	20
Girls + Boys		10,50	25

Source: Our field data

The table on the right shows the average academic performance of girls and boys. We notice that the average academic performance of the boys is higher than that of the girls. The same is true for the attention test.

Table 6: Frequency of smartphone use and level of attention

	Total population	Boys	Girls
	Test of attention	Test of attention	Test of attention
Frequency of use	0,0324	0,0167	0,1663

Source: Our field data

The table above indicates that the correlation coefficients between the frequency of smartphone use and the level of attention of the total population and by gender are not significant.

DISCUSSION

The smartphone is useful to students for its various functions. More than half (52.30%) of the sample considered agree that the smartphone is a communication tool through calls and SMS. This inescapable usefulness of the smartphone cited by the students is in line with the results of Martin's study (2007), which show that the cell phone is primarily perceived as a tool for mediation with the family. Indeed, they believe that communication with the smartphone is mainly used to maintain the family link (parents, siblings, grandparents) and in case of emergency (accident, illness, change of schedule). Second, students consider the

smartphone useful for research. Our results support those of Amri and Vacaflor (2010) who discuss this use of the smartphone as a tool for technological self-exposure through social networks. They explain how, beyond a utilitarian use, young people experiment with this device in new forms of fun, intimacy, interaction and identification with spheres of belonging. This explains the tendency of students to use more social network applications such as Facebook, WhatsApp and Snapchat. They also support those of Mba (2017). This author showed that high school students have adapted to the smartphone which, thanks to access to the internet, allows them to use the Google search application. The smartphone is a useful device for games (13, 83%) and access to social networks (9.23%). The results of the present research show that only 19% of students spend less than 120 min (2h) of time per day on their smartphone. 43% of students spend between 120mn (2h) to 240mn (4h) per day using their smartphone. 38% of participants report spending more than 240mn (4h). Girls spend more time on their smartphones, on average 253mn (4h12) than boys 237mn (3h57). It appears that students spend more time using their smartphone. The work of Olds, Ridley, and Dollman (2006), Kakooza et al. (2005) on the relationship between gender and technology, gender, and screen consumption has shown that boys are more likely to adopt new technology and consume more screens than girls. These results differ from ours as it appears in this research that girls, compared to boys, use their smartphones the longest. The results also indicate that the applications that are regularly used are those of games (61.53%) and the social network WhatsApp (47.36%). The applications that are sometimes used are those of the social networks You tube (57.89%), Facebook (50%) and Snapchat (48.64%), and Google search (44.44%). Those rarely mobilized are Instagram (51.28%) and Tik Tok (40.24%). The Google search application occupies the 6th place of the most mobilized applications after those of games and social networks. As a result, this calls into question what the students said about the usefulness of the smartphone for them. Indeed, the latter said that after communication, the smartphone is useful for research; games and social networks occupy respectively the 3rd and 4th position of usefulness in their eyes. Girls are more active on Snapchat, while boys are more focused on games. It appears from these results that the students in the sample use the smartphone more as a game tool than a learning tool. Thus, beyond its communication function, this device is above all a tool for entertainment and connection to social networks. These results are in line with those of Amri and Vacaflor (2010) and Martin (2007) who found, respectively, that the different practices and modes of appropriation of the mobile are closely related to the identity of young people and the expression of self-identity. This instrument has become the object of not only physical but also affectionate attachment where the "self" is represented in all the moments, situations, actions and expressions in which the mobile is involved. This seems to be an action appreciated by girls who are more active on Snapchat which is a photo and video sharing application. Boys, on the other hand, are more game-oriented (Livingstone and Bovill, 2013). It seems clear that students spend more time playing and chatting with real and virtual friends than doing academic research. From the results of the attention test and the frequency of smartphone use, we find that students who spend less than 120 min and those who spend between 120 min-240 min per day, have roughly equal results on the attention test (21 and 22 respectively). On the other hand, those who spend more than 240mn have a better score on the attention test which is 18. This result is lower than the overall average on the attention test, which is 25, but slightly higher than the baseline condition that states that a high score is the sum of omissions and additions, greater than 15. Nevertheless, this means that the more time the student spends using their smartphone, the more attentive they are. These results are similar to those of Liebherr, Schubert, Antons, Montag and Brand (2020) who found that general smartphone use may or may not have beneficial effects on certain attentional processes in students. In this particular case, it

Smartphone, Attention and Academic Performance of Adolescent Students in the 4th Grade

appears that smartphone use longer than 240 min has a beneficial effect on certain attentional processes in students. In sum, we retain from these results that the level of attention of the students is not dependent on the frequency of use of the smartphone. For, the results showed that there is no correlation between the frequency of smartphone use and the level of attention. The results show that students who spend less time using their smartphone, less than 120 min per day, have better academic performance (11.28/20 average) than those who spend more time using it. We can say that the frequency of smartphone use has an influence on school performance. Indeed, the less time the student spends with his smartphone, the better his academic performance. Thus, we can say that the use of the smartphone more than 120mn (2h) per day has a negative influence on school performance. The students mainly use the applications of games and social networks. The Google search application occupies the 6th place in their frequency of use of different applications. This means that students mainly use the smartphone to play games and chat on social networks with virtual friends. The average academic performance of girls is 10/20 while that of boys is 11/20. This is explained by the fact that girls spend more time using their smartphones and less time on academic learning.

CONCLUSION

The cell phone, whether it is a keyboard or a touchscreen, is an essential tool nowadays. Its multiple functions and applications allow a great deal of flexibility in terms of use and are, therefore, its main cause of attraction. To understand the enthusiasm of users of this revolutionary device, we focused on a young population, teenagers in particular. We tried to find out how they manage to appropriate this element in relation to their studies. The results obtained highlight the omnipresence of the smartphone in the lives of some teenage students. They allowed us to judge the effects of the use of this device on attention and academic performance. It appears that the lower the frequency of use of the smartphone, the better the student's academic performance. Games and social networks are the smartphone applications most used by the young people who participated in this study. They use it as a tool for self-exposure through social networks. Only a few uses the smartphone as a learning tool. This research does not claim to have exhausted the subject. Future representative research could address it to better capture young learners' relationship to the smartphone. There is a need to educate young people on how to better use the smartphone as an ally in their academic success.

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Smartphone, Attention and Academic Performance of Adolescent Students in the 4th Grade

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Conflict of Interest

The author(s) declared no conflict of interest.

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