Investigating Relationship between Using Smartphones for Learning and Academic Performance of Secondary School Students in Nigeria

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Abstract

Students are the primary users and recipients of smartphones and their persuasiveness has an impact on the general public. Several studies have found that there is a strong relationship between the use of smartphones and educational performance, as it led to behaviors that impair students' careers and learning habits. However, these studies only looked at smartphone usage patterns and presented a limited number of them. It is being proposed that the gap can be bridged by integrating smartphone usage and academic performance to keep track of users. The study involved 90 students in selected secondary schools in Sokoto State. According to the study, elements such as design functionality, design appeal, and design navigation influence students' use of smartphones. Students are more likely to utilize their smartphones if they can quickly download pages, access e-learning systems and navigate between pages. It was also discovered that secondary school students in Sokoto frequently used their smartphones for some school learning activities, enhancing the perceived value of utilizing a smartphone for learning. They use their smartphones to access and share learning resources, chat with classmates and teachers, look up solutions to tasks, and even learn new things at any time from anywhere. In general, the study shows that using smartphones for learning improves general knowledge and has a good impact on secondary school students' academic performance.

Keywords: Smartphones; Academic performance; Use; Secondary School; Nigeria.

INTRODUCTION

For the past years, academic institutions have invested heavily in records management and language exchange technology (ICT). Technological developments in today's trendy societies are changing the behavioral and receptive structures of people around the sector (Mahmood *et al.*, 2020). ICT influences the current situation (Abbas *et al.*, 2014). Since its introduction in 2000, the most famous and popular gadgets for everyone are smartphones that anyone can carry in their pockets. In all respects, it has become an integral part of the lifestyle of today's

generation, especially among secondary school students, teens, and young people who are the biggest customers or buyers of smartphones (Hossain, 2019).

With the appearance of the present-day commercial revolution, it`s been stated that using ICT devices has gotten growing attention (Abbas, 2020). Smartphones have emerged as one of the maximum famous verbal exchanges and multifunctional gadgets among those technologies. The phone has developed right into an essential and first-rate verbal communication tool. Without a smartphone, one feels incomplete, and it has converted each component of human existence, along with educational research, business, health, sports, leisure, etc. It has been determined that using smartphones has exceptionally accelerated for decades now. On any precise occasion, whether or not in a public place, college, or any circle of relatives gathering, everybody stays in contact with it. Research shows that almost all people, mainly the younger generation, continue to be busy calling, checking messages, chatting, gaming, etc. and this has come to be an unavoidable part of an individual's lifestyle. With the right to access the Internet, what's happening anytime, anywhere is shared in just a few seconds and spreads rapidly throughout the online community.

However, the use of smartphones has a great impact on social and mental life as well as physical lifestyle. Bhalla (2017) believes that smartphones are a well-known innovation and a need for time, primarily for the younger generation. It has both effective and terrible effects. It can be used as a teacher, reminder, academic tool, and entertainer. Phones, on the other hand, act as a distraction and disturb its user from important tasks with inappropriate notifications that disrupt the lifestyle of society.

Thus, this study aims to discover factors that influence the use of smartphones for learning and to investigate the impact of this phone use on the overall academic performance of secondary school students in Sokoto, Nigeria. The specific objectives of the study are: to identify the factors influencing smartphone use by secondary school students; to examine the factors that influence smartphone use for learning by secondary school students in Sokoto; to identify the relationship between smartphone use for learning and academic performance of secondary school students in Sokoto State. The study hypothesized that: H_O: There is no significant relationship between smartphone use for learning and the academic performance of secondary school students in Sokoto; H_A: There is a significant relationship between smartphone use for learning and the academic performance of secondary school students in Sokoto.

Use of Smartphones
Students who use their smartphones excessively in class get disengaged from what they are studying, which hurts their academic performance (Abbas, 2014). The pros and cons of smartphones can be found in previous literature and research reviews. Students using smartphones can access the internet, send and receive e-mails, video messages and video chat with friends and family from the palm of their hands. Students also use social media sites and applications, online libraries and portals on their phones to help them learn effectively (Mahmood et al., 2014). The growing popularity and development of mobile learning resources and electronic libraries have increased the usefulness of smartphones and improved student information-seeking behavior (Abbas et al., 2014; Kuznekoff and Titsworth, 2013).

In one study. Alfawareh and Jusoh (2014) found that almost every college-level student owns a smartphone. The majority of students did not buy a smartphone for learning or educational purposes, but eventually, it turned out to be a useful tool. In addition, many studies have

shown that students who overuse smartphones in the classroom during lectures are separated from their learning content which affects their academic performance (Abbas, 2014). Teachers are concerned that such connections to the social arena could result in students being separated from their research. This concern is supported by both theoretical and empirical evidence that suggests that students can divert their concentration and attention in a way that makes them forget the essential details during class. The repercussions could negatively affect their performance (Chen et al., 2013).

The Concept of Smartphones in Mobile Learning

Using wireless technology and mobile computers, mobile learning allows for learning to take place at anytime and anywhere. Mobile learning is defined as "learning that involves the use of wireless devices such as smartphone, PDA, iPod, palmtop, or even digital camera and USB keys in the learning and teaching process" by Naismith et al. (2004, as referenced in Sarfoah, 2019, p.29).

A smartphone is an essential device in the world of mobile learning. The most crucial elements include a smartphone's user base, a powerful battery, a touch screen, and millions of downloaded apps (Godwin-Jones, 2011). A smartphone is a "mobile phone with improved processing capability and connectivity as compared to a feature phone with limited functionality," according to Fordjour, Zakaria, and Afriyie (2015, p.1). The first smartphone was introduced in 2000. The first manufacturer was Ericsson, and the model was known as R380 (Alfawareh & Jusoh, 2014). Ease of use, the speed and accessibility of the e-learning platform, as well as the attitude of users, are some aspects that affect utilizing smartphones for learning.

The usefulness of Smartphones in Students' Academic Performance

Corbel and Valdes-Corbeil (2017) did a study on the question of "are you ready for mobile learning?" when compared to the conventional face-to-face method of instruction and learning. The study found mobile phones significantly increase communication between teachers and students, enabling teachers and students to learn on the go.

The works of Mohtar Hassan, Hassan, and Osman (2013) reported on a second study on smartphone use among Malaysian students. According to the report, smartphones have become indispensable to Malaysian students who attend higher education institutions. Students use their smartphones to record lectures, share notes with friends, and take pictures of assignments for future reference. Similar to this, Tuncay (2016) investigated the use of smartphones as tools for remote learning. The study finds that the ability to take notes during lectures makes smartphones very useful for students, they can also browse the web and actively note ideas for subsequent usage.

Effect of the Use of Smartphones in Students' Learning Activities

In accordance with Ifeanyi and Chuwuere (2018), depending on the application, using smartphones among students might have both beneficial and bad consequences. The author also highlighted the disadvantages, noting that smartphones have significantly increased the amount of distraction in the classroom. Children who are addicted to their phones have a high propensity to check updates or notifications almost every minute if not carefully controlled. This causes them to become distracted from their studies, even when a teacher is giving his or her all in a lecture. The author concluded that numerous factors affect how well students learn or do academically.

Despite the fantastic benefits of smartphones for learning, Kibona and Maya (2015) argued that these devices are a double-edged sword because the majority of applications, such as WhatsApp, Facebook and gaming, have a negative impact on Tanzanian students on all levels due to their addictive nature. Thus, it unintentionally robs students of their academic achievement. More specifically, frequent smartphone use causes problems like vascular permeability, neck pain, musculoskeletal diseases, and mouse brain damage.

METHODOLOGY

Research Method
The study deployed a quantitative survey method using questionnaires to collect data from secondary school students in Sokoto. A random sampling technique was used in selecting participants across the metropolis. The first part of the questionnaire includes demographic characteristics such as age and gender, and the questions in the second part were centered on the study and the findings. Sagsan and Abbas (2019) also followed a similar approach in their research.

Population of the Study
The study's target demography is based on a criterion that includes only students enrolled in three selected private secondary schools in Sokoto, Nigeria, who use smartphones in education/learning. It needs to be noted that the study focused only on smartphone users in sample secondary schools within the Sokoto metropolis. The researc7h was carried out in May 2022, and the data were collected between March and April 2022.

According to SESP (State Strategic Education Plan) 2011- 2022, there are approximately 75,070 secondary school students across the 23 Local Government Areas in Sokoto State. This estimate comprises students in both public and private secondary schools in the State. The students in public schools usually are not familiar with smartphones because they're from poor families. So private school students were used to carrying out this research because they are familiar with smartphones.

Sample of the Study
Those respondents who are using smartphones, and were well aware of their functionalities were selected for this study. Initially, 120 questionnaires were distributed to the respondents in which 90 responses were found correct and complete. Therefore, the sample size used was 90 comprising both male (26.7%) and female (73.3%) students. Among the 120 questionnaires 35 were given to students of Brilliant Footsteps International Academy, 40 were given to students of Iman International School and 45 to students of Blue Crescent School. Among them 25 were dropped, 14 were incomplete and 11 of all the students didn't use a smartphone while 5 questionnaires were not returned. The questionnaires were distributed based on the total number of SS3 students in each of the schools. SS 3 students were considered for the research because they were more learned about smartphone use and more mature in filling the questionnaire.

Table 1: Distribution of Questionnaires

School	No of the SS 3 students	No of the questionnaires distributed
Brilliant Footsteps International Academy	35	35
Iman International School	40	40
Blue Crescent School	45	45

A non-probability sampling strategy was employed to select three secondary schools as the representations of all secondary schools in Sokoto State. The schools were selected from different geographical locations within the State Metropolis.

Research Instrument
A structured questionnaire was used to collect data to test the proposed hypothesis and validate the research hypothesis. The questionnaire was created and distributed among students from three secondary schools in Sokoto, who use smartphones for learning purposes. They all provided input by volunteering without being pressurized. The questionnaire was divided into three sections, the first section contains demographic information about the survey participants, the second section contains factors that influence the use of smartphones and the last section contains questions regarding factors that influence the use of smartphones for learning. To get the relationship between smartphone use for learning and the academic performance of students the researcher used a simple experiment and test method. The researcher took the results of tests taken by the students.

RESULTS AND DISCUSSION
A general survey was conducted among students of secondary schools in Sokoto, Nigeria. First, the researcher discussed the different demographic features based upon which the data were analyzed. The details are given below. A total of 90 responses were gotten from both genders of the respondents, approximately 26.7% were male students and 73.3% were female students as shown in Table 2. There are different age groups of the 90 students in the study and most of them were between 14 to 19 years. A summary shows that 48.9% of the students were between 14 to 16 years, 48.9% were between 17 to 19 years and 2.2% were above 20 years, as illustrated in Table 2 below. The students were of the same educational level because SS3 students were used throughout the survey.

Certain questions were used to analyze and understand some behaviors and the purpose of using smartphones by secondary school students. The responses to these questions were gotten directly from the students. The questions were a total of 5 in number. The first question was used to find out if a student uses a smartphone or not. The results of the students who answered Yes' were used for this study. The second question was how long they have been using smartphones. Three different durations of choice were given, where 1-2 years were found to have the highest percentage of 48.9, 3-5 years having 26.7%, and 6+ years having 24.4%.

Another question looked at is the time students took using their smartphones. Most of the students use their phones between 0-3 hours a day with 44.4% of the total population of 90 students. Also, the students were asked how many hours on average they use their phones for learning purposes. 42 (students 46.7%) use their smartphones for learning between 2 to 4 hours daily, 34 students with 37.8% between 0 to 1 hour, and 14 students with 15.6% for more than 5 hours in a day.

Lastly, they were asked the reasons why they use their smartphones for learning. Mostly, the students use their smartphones for browsing to get answers to assignments given to them. While some of them use their phones to take online quizzes while others use E-libraries. All of these findings show that smartphones are positively correlated with good academic performance and better learning behavior to learn new things in a new way.

Table 2: Demographics

Particulars	Details	Participants	Percentage
Gender	Male	24	26.7%
	Female	66	73.3%
Age	14-16	44	48.9%
	17-19	44	48.9%
	20+	2	2.2%
How long you've used a smartphone	1-2 years	44	48.9%
	3-5 years	24	26.7%
	6+ years	22	24.4%
Hours for use daily	0-3	40	44.4%
	4-6	30	33.3%
	7+	20	22.2%
Hours used for learning	0-1	34	37.8%
	2-4	42	46.7%
	5+	14	15.6%

Subsequently, the overall responses of the students are shown in Table 3-9 which include the total agreed responses, total disagreed responses and the response of students who neither agree nor disagree with the questions asked in section B of the questionnaire. The analysis was used to gain important insights into response trends and patterns within the data. Specifically, the researcher looked at the following:

- The highest average/percentage form of agreement (all categories).
- The highest average/percentage form of disagreement.
- The mean values are gotten from each data set.
- The standard deviations from the mean of the data.

The students were asked about 3 factors that influence smartphone use and different responses were received.

The first factor was design functionality, where the students were asked, do they download pages fast on the internet with their smartphones? Having a mean of 4.10 and a standard deviation of 1.033, 4.4% of the students strongly disagreed, 2.2% disagreed, 17.8% of the students were neutral while 35.6% agreed and 40% strongly agreed. A total disagreement of 6 students in number (6.6%), a total agreement of 68 students (75.6%) and 32 neither agreed nor disagreed were received. The second question was 'do the smartphones provide all the functions the students needed to get the information they needed? 8 of the students disagreed (8.8%), 12 were neutral while 70 of them agreed (77.7%), with a mean of 4.3 and a standard deviation of 1.092. In response to the statement 'smartphones make E-learning platform accessible easily. A mean of 4.4 was gotten and a standard deviation of 1.056, 4.4% of the responses disagreed while 75.5% of the students agreed with the statement.

Table 3: Design Functionality

DESIGN FUNCTIONALITY	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Mean	Standard deviation
Download pages fast	4 (4.4%)	2 (2.2%)	16 (17.8%)	32 (35.6%)	36 (40%)	4.1	1.033
Provides all the functions needed to find information	4 (4.4%)	4 (4.4%)	12 (13.3%)	30 (33.3%)	40 (44.4%)	4.3	1.092
The E-learning platform is accessible easily	4 (4.4%)	0 (0%)	18 (20%)	28 (31.1%)	40 (44.4%)	4.4	1.056

The next factor was design attractiveness, in response to good use of colors with a mean of 4.3 and a standard deviation of 0.962, 8.9% of the students disagreed while 8.8% were neutral and 82.3% agreed. The students were also asked about good use of images, where a mean of 4.4 was gotten and a standard deviation of 1.208, 8.9% of the students disagreed, 13.3% were neutral and 77.8% agreed with the statement. Another point was the good use of background songs. 15.5% of the students disagreed, 8.8% were neutral and 75.6 agreed with a mean of 3.7 and standard deviation of 1.208.

Table 4: Design Attractiveness

DESIGN ATTRACTIVENESS	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Mean	Standard deviation
Good use of colors	2 (2.2%)	6 (6.7%)	8 (8.8%)	50 (55.6%)	24 (26.7%)	4.3	0.962
Good use of images	2 (2.2%)	6 (6.7%)	12 (13.3%)	26 (28.9%)	44 (48.9%)	4.4	1.060
Good use of background songs	6 (6.7%)	8 (8.8%)	8 (8.8%)	34 (37.8%)	34 (37.8%)	3.7	1.208

The last factor looked at was navigation. Given search engine availability, with a mean of 4.2 and a standard deviation of 1.089, 8 students disagreed (8.8%), 12 neither agree nor disagree (13.35%) and 70 students agreed (77.8%). The next was easy information format, with a mean of 4.1 and a standard deviation of 0.993, 8.9% of the students disagreed, 6.7% were neutral and 84.5% agreed. Because of movement between pages, 6.6% disagreed, 15.6% were neutral and 77.7% of the population agreed to have a mean of 4.0 and a standard deviation of 0.988.

Table 5: Design Navigation

DESIGN NAVIGATION	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Mean	Standard deviation
Search engine availability	4 (4.4%)	4 (4.4%	12 (13.35)	26 (28.9%)	44 (48.9%)	4.2	1.089
Easy information format	2 (2.2%)	6 (6.7%)	6 (6.7%)	32 (35.6%)	44 (48.9%)	4.1	0.993
Easy to move from one page to another	2 (2.2%)	4 (4.4%)	14 (15.6%)	30 (33.3%)	40 (44.4%)	4.0	0.988

Considering perceived ease of use in learning, three things were considered; ease of use for reading, ease of getting notes, not encountering any problem while using a smartphone for learning and not requiring any special skills to use the smartphone. With means and standard deviations of 4.1 and 0.971, 3.8 and 1.135, 3.7 and 1.251, & 3.3 and 1.272 accordingly.

Table 6: Perceived Ease of use for learning

PERCEIVED EASE OF USE FOR LEARNING	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Mean	Standard deviation
Easy to use for reading	2 (2.2%)	4 (4.4%)	14 (15.6%)	32 (35.6%)	34 (42.2%)	4.1	0.971
Easy to get notes with smartphones	4 (4.4%)	10 (11.1%)	12 (13.3%)	34 (37.8%)	30 (33.3%)	3.8	1.135
Don't get problems while using the phone for learning	8 (8.8%)	8 (8.8%)	20 (22.2%)	26 (28.9%)	28 (31.1%)	3.7	1.251
Does not need any special skills to use	14 (15.5%)	8 (8.8%)	22 (24.4%)	32 (35.6%)	14 (15.6%)	3.3	1.272

When speed in learning was considered, also the students were asked about three things; first, do you prefer using a smartphone for learning? At this point, the response rate was quite

different, while 20 students (22.2%) strongly disagreed, 20 students (22.22%) were in strong agreement. The mean of the sample was 3.0 with a standard deviation of 1.461. Secondly, the respondents were asked whether they preferred smartphones to libraries. Most of them (33.3%) preferred smartphones while a few (6.7%) preferred going to the library. Thirdly, in response to getting learning materials fast, 17.9% disagreed, 11.1% were neutral and 71.1% were in total agreement.

Table 7: Speed in Learning

SPEED IN LEARNING	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Mean	Standard deviation
Prefer using a smartphone for reading	20 (22.2%)	16 (17.8%)	18 (20%)	16 (17.8%)	20 (22.2%)	3.0	1.461
Prefer smartphones to library	6 (6.7%)	16 (17.8%)	12 (13.3%)	26 (28.9%)	30 (33.3%)	3.7	1.286
Faster to get learning materials	2 (2.2%)	14 (15.6%)	10 (11.1%)	34 (37.8%)	30 (33.3%)	3.9	1.116

The next factor perceived was the usefulness of smartphones in learning. Considering that smartphones help in sharing notes, enable online group discussions, enable taking pictures of assignments for later use and allow taking online quizzes, the researcher got the means to be 4.5, 4.6, 4.3 & 4.2, and standard deviations of 0.957, 0.952, 0.854 & 0.882 respectively. This shows that the smartphone is useful in learning.

Table 8: Perceived usefulness of smartphone use in learning

PERCEIVED USEFULNESS OF SMARTPHONE USE IN LEARNING	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Mean	Standard deviation
Helps in sharing notes	2 (2.2%)	4 (4.4%)	6 (6.7%)	30 (33.3%)	48 (53.3%)	4.5	0.957
Enables online group discussions	2 (2.2%)	2 (2.2%)	10 (11.1%)	22 (24.4%)	54 (60%)	4.6	0.952
Enables taking pictures of assignments for later use	2 (2.2%)	0 (0%)	8 (8.8%)	22 (24.4%)	58 (64.4%)	4.3	0.854
Allows taking online quizzes	0 (0%)	4 (4.4%)	14 (15.6%)	26 (28.9%)	46 (51.1%)	4.2	0.882

The last factor is the attitude of students towards the use of smartphones for learning purposes. The students were asked if smartphones improve access to learning materials, and help in studying individually, hence the use of smartphones should be encouraged in secondary schools. From the data retrieved most of the students agreed to all these statements. Again, most of the students wrote in the comment section that smartphones should be introduced for learning in secondary schools.

Table 9: Students' Attitude toward the use of smartphones for learning

STUDENTS' ATTITUDE TOWARD SMARTPHONES FOR LEARNING PURPOSES	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Mean	Standard deviation
Improves access to learning materials	4 (4.4%)	0 (0%)	8 (8.8%)	50 (55.6%)	28 (31.1%)	4.4	0.943
Helps me to study on my own	4 (4.4%)	4 (4.4%)	14 (15.6%)	24 (26.7%)	44 (48.9%)	4.0	1.106
Smartphone usage should more be encouraged for learning in secondary schools	4 (4.4%)	6 (6.7%)	18 (20%)	20 (22.2%)	42 (46.7%)	3.9	1.159

Analysis of smartphone use for learning and academic performance of students

When it comes to analyzing research findings, researchers must consider whether the findings happened by coincidence or not. Hypothesis testing is a method of determining if the findings of a research study support a specific hypothesis that applies to a group of people. Hypothesis testing evaluates a population hypothesis using sample data. Hypothesis testing is also known as T Testing in statistical analysis. It is a key to testing two sets of random variables within a set of data.

The researcher took some students at random among those that filled out the questionnaire. These students were divided into two groups. The first group did not undergo any sessions while the second group was taught simple arithmetic in mathematics with a smartphone using a mathematics Application. The application has both learning and quiz sections. After learning with the smartphone, the researcher gave both groups a quiz from the application to answer. The results of the quiz are shown in table 4 below.

Table 10: Results of students' quiz

Students	Scores	Mean
The first group (Control group)		40
1	25	
2	50	
3	20	
4	55	
5	45	
6	50	
7	35	
2nd group (the group that used the smartphone)		60
1	70	
2	75	
3	60	
4	45	
5	30	
6	60	
7	80	

Using the results from the test quiz, a hypothesis test was carried out for the study. Having null and alternative hypotheses as thus. **H₀:** There is no significant relationship between smartphone use for learning and the academic performance of secondary school students. **H_A:** There is a significant relationship between smartphone use for learning and the academic performance of secondary school students. The sample means x is 60. The total population n is 14 students. The mean population μ is 50. The Standard deviation of population δ was calculated and gotten as 17.61. For a two-tailed test (the direction of the effect is not specified) at the 5% significance level (25% each tail).

$Z = x - \mu / (\delta / \sqrt{n})$
$\alpha = 0.05 \Rightarrow z = +1.96$ and -1.99
$= 60 - 50 / (17.61 / \sqrt{14})$
$= 10 / (4.71)$
$= 2.12$

A 'Z' score of 2.12 is more extreme than the cut-off Z of +1.96. The result is significant and thus, the null hypothesis is rejected. The result rejects the null hypothesis therefore, the alternative hypothesis is accepted, which means there is a significant relationship between the use of smartphones for learning and the academic performance of secondary school students.

Generally, factors like design functionality, design attractiveness, and design navigation have an impact on the use of smartphones by students. If students could download pages fast, access e-learning platforms easily and navigate easily between pages, they tend to use their smartphones more. Good use of colors, images and background songs also attract students to use their smartphones. Moreover, it was revealed that the students of secondary schools in Sokoto find it easy to use smartphones in their academic activities which enhances the perceived usefulness of using a smartphone for learning. It also gives students control over their studies and learning activities. With their smartphones, they can access and share learning materials, communicate with their peers and teachers, can browse for answers to assignments, and can learn new things any time anywhere. The usage of smartphones for learning often increases students' general knowledge and has a good effect on their academic achievement. The use of smartphones for learning boosts secondary school student's academic achievement, according to the present research, which offers helpful insight to parents, academic staff, and anyone else interested in children's learning behavior or performance.

CONCLUSION
Important points were made in the study that highlighted the beneficial effects of smartphone use on the academic performance of secondary school students in Sokoto. There is strong evidence that students now use smartphones to assist them in completing academic tasks. In conclusion, the research shows that smartphones have an effect on Sokoto secondary school students' academic lives. The impact of smartphones on students' academic progress in literary studies has been debated both for and against.

The use of smartphones by students to enhance their academic performance and the influence of low-income families or communities on this usage should then be the subject of additional research in developing nations.
- In respect to the report, secondary school students should be encouraged to utilize their smartphones for educational purposes.
- Additionally, parents should make an effort to purchase smartphones for their children.
- Within school grounds, there should be a reliable Wi-Fi connection and an ongoing power supply.
- Students should receive instruction from their schools on how to use their smartphones for learning activities with the fewest possible distractions.

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