

## CONSIDERATIONS ON THE USE OF MOBILE PHONES IN EDUCATIONAL CONTEXT

Prof. Dr. Silvia Cristina Freitas BATISTA  
Instituto Federal Fluminense  
Campos dos Goytacazes – RJ, BRAZIL

Prof. Dr. Gilmara Teixeira BARCELOS  
Instituto Federal Fluminense  
Campos dos Goytacazes – RJ, BRAZIL

### ABSTRACT

Technological advancements have allowed mobile phones to perform various functions with increasingly better performance. However, the use of these devices in educational contexts divides opinions, especially when used in the classroom. Mobile phones can support different pedagogical tasks, but may also be responsible for problems such as distractions during classes. Therefore, such use is still facing resistance in formal education. Considering the scenario described, this paper aims at discussing the use of mobile phones in education with support of data obtained in a survey with undergraduate students and teachers of Mathematics Education at a federal institution. Data showed that the participants' opinions are consistent with the literature, signaling difficulties and benefits of using the mobile phones in education.

**Key Words:** Mobile Phones, Educational Contexts, Mathematics Education.

### INTRODUCTION

With the growing portability and functional convergence of technologies, as well as with cost reduction of products and services, mobile devices are increasingly present in everyday life. According to the 2013 UNESCO Report, mobile technologies are commonly found nowadays even in areas where schools, books, and computers are scarce. Due to the fall in prices of these technologies, mobile phones in particular, many people, even in impoverished areas, can afford and know how to use mobile devices (UNESCO, 2013).

Therefore, the presence and relevance of such devices in everyday life have motivated research in the educational field (Pachler et al., 2010). Mobile learning (m-learning) is the field of study that analyzes how mobile devices can contribute to learning (Batista, 2011). M-learning involves the use of mobile technologies, either solely or combined with other communication and information technologies to allow learning anywhere, at any time (UNESCO, 2013).

In formal education, however, mobile devices, especially mobile phones, are criticized by teachers in view of the problems they bring – distraction, for instance. Regarding mobile phones specifically, Machado (2012) argues that it is necessary to establish restrictions to the use of such devices in schools in order to have a better development of the pedagogical actions, and also to “slow down” students from the hectic pace of contemporary life. However, the author also considers feasible to incorporate this equipment into the various educational projects. Gibson et al. (2012) also say that, even though many teachers consider mobile phones a distraction in the classroom, others believe they are beneficial.

In this scenario, this paper discusses the use of mobile phones in education. To support this discussion, the study analyzes data collected in a research conducted with students (pre-service teachers) and teachers in the Mathematics Education program at a federal institution, with focus on their perception on the use of those

tools. The Mathematics Education course was selected for the research due to the fact that this study was carried out within the scope of the research project "Learning with Mobile Devices"<sup>1</sup>, which currently focuses on the use of these tools in Mathematics. Thus, the undergraduate students (pre-service teachers) and teachers of this course have been the target audience of several actions in the mentioned project.

Aiming at the objective of this paper, Section 2 discusses the use of mobile phones in educational contexts, including their potential, and difficulties posed by them. The methodological procedures are described in Section 3; while Section 4 analyzes data collected with students and teachers of Mathematics Education. Section 5 closes the paper with considerations on the theme.

### MOBILE PHONES IN FORMAL EDUCATION: POTENTIAL AND DIFFICULTIES

The popularization and technological development of mobile phones have given prominence to these devices in m-learning (Xie et al., 2011; Gibson et al., 2012; Buck et al., 2013; Burton et al., 2013). Due to their popularity, mobile phones can contribute to increase access to digital educational content. As portable equipment, they can promote learning both inside and beyond the physical space of educational institutions (UNESCO, 2012). Use of such devices can also contribute to more attractive teaching and learning processes, thus catering, with their applications, to different learning styles (Buck et al., 2013). Therefore, mobile phones have the potential to make learning more accessible, collaborative and relevant (UNESCO, 2012).

However, despite the potential of mobile phones for educational purposes, schools in general do not make use of them; choosing, quite often, to prohibit their use in the classroom (Seabra, 2013). This author recognizes that mobile phones can be responsible for distractions, and that they enable, with their embedded technology, transfer of answers in tests and exams in more efficient ways than traditional ones. Nevertheless, in spite of these pitfalls, Seabra (2013) is optimistic about the use of such devices in schools, suggesting that, in regards to distraction, the teacher discusses acceptable usage rules with students. The author stresses that one must consider that pencil and paper (and the brain itself) can also contribute to distraction when the student is not engaged in the lesson. As to the transfer of answers, the author recommends the teacher to change the preparation of tests and exams.

Machado (2012) also discusses the problems and potential of using mobile phones in schools, but more prudent than Seabra (2013). For Machado (2012), ringtones in the classroom, with their variety of musical genres and styles (often amusing) may significantly disturb pedagogical activities as planned by the teacher. Though a silent practice, texting can also draw attention away from the lesson, as well as be used to send answers of tests or exams. In addition, games, music, videos, photos and access to the internet may compromise student performance in class (Machado, 2012). Therefore, the author understands that, in general, use of mobile phones should be restricted in schools, but that, on the other hand, this equipment can contribute to pedagogical actions as a tool for research and production.

In her joint analysis of an exploratory research and a case study on the use of mobile phones in education, Batista (2011) lists these positive aspects found in the two experiments: i) students' ability to use the keypad; ii) practicability; iii) the students' receptiveness regarding the educational use of mobile phones. The author also identifies these negative points: i) variety of models and resources in the phones; ii) size of the screen; iii) cost of internet access.

These pitfalls are not exclusive to a specific area of the curriculum. Similarly, the potential of these devices are quite ample, as they support pedagogical actions in different areas. This article, however, focuses on studies aimed at Mathematics (Tangney et al., 2010; Ndafenongo, 2011; Kallou & Mohan, 2012), to illustrate that, even in formal sciences, researches have shown the possibilities and contributions of mobile phones.

Tangney et al. (2010) argue that, given their inherent capacity to motivate collaboration and contextualized learning, mobile technologies have the potential to contribute to Mathematics Education. The authors provide strategies to develop resources for smartphones aimed at the teaching and learning of Mathematics, as well as support teachers in using them. Such resources are aimed to data analysis, geometry and measurement,

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<sup>1</sup> <<http://plataforma.nie.iff.edu.br/projetomlearning/>>.

numbers, operations, and algebra. When using these tools and apps, the teacher is free to create learning activities, according to his/her teaching objectives. The authors also provide results of a study conducted with 24 students working in groups. In this investigation, the resource *Angle Tool* was used to measure the height of three structures in the school. Though acknowledging that it is not possible to draw final conclusions, Tangney et al. (2010) say that the initial results were quite positive. Most students: i) found the tool easy to handle; ii) found the experience engaging; iii) enjoyed working collaboratively; iv) said they would like to do this type of Mathematics activity more often.

Ndafenongo (2011) investigated how mobile phones can be used in the teaching of Mathematics. In their study, the authors used five video clips on the Pythagorean Theorem. The videos were sent to the student's phone and were used in class to support the understanding of the subject. This case study was conducted in two high schools in Grahamstown, South Africa, involving two teachers from each school and 47 students altogether. The investigation showed that mobile phones can be useful resources to support teaching and learning in the classroom, mostly in schools lacking resources. According to the author, use of video clips in mobile phones contributed to improve student participation and concentration, to accelerate content development, to stimulate peer collaboration and interaction, and to promote student autonomy.

Kaloo and Mohan (2012) describe a study carried out in Trinidad and Tobago using *MobileMath*, an app designed to test the hypothesis that m-learning can help students improve their performance in Mathematics. Aimed at the study of Elementary Algebra, *MobileMath* presents lessons, examples, tutorials, quizzes, and curious facts. Use of this app was evaluated over a period of three months with students from different high schools using the same phone model. Results showed improvement in student performance, mainly of those who had studied Algebra in the previous period (the impact was not so significant for those having algebra for the first time).

In general, the studies described here show positive results regarding the use of mobile phones. Nevertheless, one must consider that this is a recent area of research.

Before closing this section, two issues must be addressed. One is the fact that mobile phones containing many technological limitations restrict, or even impair their use in education (Batista, 2011). Accordingly, the expectation is that popularization of smartphones becomes more practical this use. However, even with smartphones, the choice of apps requires special attention, since many are specific to certain operating systems (Batista, 2011).

The second issue refers to the fact that several projects in m-learning are financed by telecommunication companies. Such projects are definitely significant, but as Kress and Pachler (2007) warn, the market has its own strong rules that pervade the various social contexts. Thus, one must be alert, as market factors have become so natural that end up being adopted as models in both social decisions and education (Kress & Pachler, 2007).

Use of mobile phones in education is, therefore, a complex theme which presents positive aspects and difficulties that must be taken into consideration. The authors of this paper stress the necessity to discuss this issue with pre-service teachers early in their academic life, so that they can reflect on the several aspects involved.

Next section describes the methodological procedures used in the research conducted with students and teachers of a Mathematics Education program.

#### **METHODOLOGICAL PROCEDURES USED IN THE RESEARCH**

A descriptive research<sup>2</sup> was conducted with the objective of collecting the opinion of students and teachers in a Mathematics Education program in a federal institution on the use of mobile phones in educational contexts.

Two survey questionnaires were organized to collect data: one for students (pre-service teachers), another for teachers. Both questionnaires presented topics such as: i) possession or not of a mobile phone (for those who

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<sup>2</sup> According to Gil (2008), descriptive researches are used to present characteristics of a population, phenomenon, experience, or establish relations among variables.

answered “Yes”, the following question was whether it was a smartphone); ii) experience with the educational use of mobile phones (followed by various questions about their affirmative and negative answers); iii) adequate school level for the pedagogical use of mobile phones; iv) experience or lack of experience with situations in which use of mobile phones disturbed attention in the classroom; v) suggestions for the educational use of smartphones.

Both questionnaires were created in Google Drive<sup>3</sup>, and their link was sent to participants by e-mail. Students participating in the survey were enrolled in the 2nd, 4th, and 6th terms (periods)<sup>4</sup>, in the first half of 2013. All classes were informed, in person, about the survey and the e-mail with the link to the questionnaire. Nevertheless, only 21 students answered the survey: nine from the 2nd period, seven from the 4th, and five from the 6th period.

Regarding the teachers, only the 11 of those working with specific Math disciplines participated in the survey. The study with these teachers took place in the beginning of the second term of 2013. In this group, nine answered the questionnaire.

It must be stressed that data analysis was qualitative, which hindered generalizations from it, and in the case of the students, it was made as a whole – without specifications of the student’s term. Data analysis and discussion are presented in the next section.

## ANALYSIS OF THE RESULTS

The 21 students in the Mathematics Education program, subjects of the investigation, were 22 years old in average, with the standard deviation of 2.45, approximately. In this group, 18 were female. All individuals said they owned mobile phones, but only six (approximately 29%) had smartphones. In regard to teachers, all nine individuals were female, and 42 years old in average, with the standard deviation of 7.40, approximately. All teachers owned mobile phones, but only six (approximately 67%) had smartphones.

Asked whether they had used mobile phones for educational purposes, participants replied as shown in Tables 1 and 2. In Table 1, 100% correspond to 21 students and, in Table 2, to nine teachers.

Table 1: Use of Mobile Phones for Educational Purposes - Students

Options	Students (%)
Yes	52
No	48

Table 2: Use of Mobile Phones for Educational Purposes - Teachers

Options	Teachers (%)
Yes, but only for personal reasons (not in activities designed for students).	22
Yes, but only in activities designed for students.	0
Yes, both privately and in activities with students.	33
No	45

Results show that, even though most answered “Yes” in Tables 1 and 2, this percentage is not very significant (a little over 50% in both cases). This indicates that the educational use of mobile phones is not a usual practice among the participants yet.

<sup>3</sup> Google’s on-line file storage and synchronization service which allows file sharing, and offers several production applications, such as forms, spreadsheets, presentations, among others.

<sup>4</sup> In this program, student enrolment is annual; therefore, one semester has only even periods, and the other only odd periods.

The 10 students and four teachers who answered “No” were presented with the alternatives listed in Table 3. They were asked to indicate the main reason for having never used mobile phones as a pedagogical tool. Thus, in Table 3, 100% of the students correspond to 10 people, and 100% of the teachers correspond to four people.

Table 3: Main Reason for Not Using Mobile Phones in Education

Reasons	Students (%)	Teachers (%)
Resources in the device do not favor educational use.	70	0
I never had interest in using them for this purpose.	20	75
I do not find mobile phones useful for this purpose.	0	0
Other	10	25

As most of the students did not have a smartphone, the percentage of the first option in Table 3 is a natural result in the context. Even the participant who marked option “Other” explained that his/her phone did not run programs. This reason is also related to the lack of resources in the phone that allow programs to run. Therefore, most students justified their not using mobile phones for educational purposes for technological limitations. This fact indicates that, in general, no previous use of mobile phones for educational purposes was not due to rejection to the idea.

As for teachers, most said they never had any interest in using mobile phones for those purposes. The teacher that marked option “Other” explained she did not know how to use it in pedagogical situations. These results were also considered coherent with the context, since studies related to the use of mobile devices in education are relatively recent and still did not become common sense among teachers.

The 11 students and five teachers who answered “Yes” for the educational use of mobile phones were asked to answer alternatives listed in Table 4. They were requested to mark the main uses of these devices (they could check more than one option). In the case of teachers, this part of the survey focused on the private use of mobile phones (that is, not in activities with students). Thus, in Table 4, 100% of students correspond to 11 people, and 100% of teachers correspond to 5 individuals.

Table 4: Educational Use of Mobile Phones

Ways	Students (%)	Teachers (%)
Via educational apps	55	60
Searches on the Internet	100	80
Use of social networks	45	40
Access to a virtual learning environment	9	20
Use of resources in the phone (pictures, videos, etc.)	45	100
Other	0	40

Table 4 shows that doing searches on the Internet is a very frequent reason for using mobile phones for educational purposes, both by students and teachers. As argued by Machado (2012), mobile phones have the potential to contribute to pedagogical actions as a searching tool. Educational applications received a percentage above 50% in both cases, but do not present significant values. Thus, even though there are good options of free Math apps, of various types and of great quality (Amaral, 2013), use of apps is still not a common practice among the participants of the study. Use of resources in the phones is relevant in regard to teachers. According to Seabra (2013), mobile phones function like cameras, allowing the user to take pictures, edit and publish them. They also have resources for recording video and audio files, as well as positioning sensors and GPS. All these options open several pedagogical possibilities. For option “Other”, a teacher mentioned “reading e-mails”, and another did not mention the resource she uses.

The three teachers who confirmed having had used mobile phones in the classroom were asked to tell what activity they proposed in class. The answers were: i) recommendation to use graphic plotters; ii) request of pictures and films for video productions; iii) use of calculators; iv) searches on the Internet during class. Although few teachers used mobile phones in activities with students, it can be observed that this was done with a variety of purposes, demonstrating the pedagogical potential of those devices.

The 11 students who answered “Yes” for the educational use of mobile phones were asked to list its positive and negative aspects. The most listed positive features were: i) convenience of carrying the device; ii) popularization; iii) possibility of Internet connection when necessary. As for the negative aspects, distraction caused by such devices was mentioned by most students. Size of the screen was also pointed out.

The five teachers who answered “Yes” listed the following positive aspects: i) mobility; ii) practicability; iii) speed and easiness to download apps; iv) variety of free apps. As negative aspects, the following were listed: i) size of the screen; ii) difficulty to type, depending on the model; iii) possibility of sending answers in tests; iv) few apps in Portuguese.

Results for positive and negative aspects listed by teachers and students were coherent with the literature review discussed in this article.

The statement below was presented to all 21 students and nine teachers participating in the investigation, with the alternatives given in Table 5 (only one option could be marked). Thus, in Table 5, 100% of the students correspond to 21 individuals, and 100% of the teachers correspond to nine people.

*Some Brazilian states and municipalities have laws prohibiting use of mobile phones in the classroom, as they may compromise student attention in class activities. There are exceptions, in several cases, for the pedagogical use of these devices. Being an in-service teacher or a student teacher, you consider the use of mobile phones in classroom activities appropriate:*

Table 5: Appropriate School Levels for the Pedagogical Use of Mobile Phones

School Levels	Students (%)	Teachers (%)
Only at university level	10	0
High school and university	33	22
Starting in junior high school	33	22
From the beginning of elementary school	19	56
In none of the school levels	5	0

It is interesting to observe that the majority of the teachers considered the pedagogical use of mobile phones to be viable as of elementary school, while students, younger individuals, were more careful in marking their options. It is possible that, as more active users of the functionalities in mobile devices, students fear the distractions caused by them.

Each participant was asked to justify the option marked in Table 5. Some of the justifications are quoted below. It must be explained that, for data analysis, students are identified as  $S_1$ ,  $S_2$ ,  $S_3$ , and so on. In the case of teachers, they are named as  $T_1$ ,  $T_2$ ,  $T_3$ , and so on.

The two students who marked option “Only at university level” justified their choice as follows:

*Because in college, at least theoretically speaking, people are more mature. They know that bad performance in college can compromise their professional career, so they are usually more interested in studying. The same doesn't happen with children and teenagers, who study because they “have to”, and with a phone in their hands, they would browse the internet or do things they were not supposed to ( $S_4$ ).*

*I think the student must be mature when using a mobile phone for pedagogical purposes, so that the device isn't used only for entertainment ( $S_{16}$ ).*

Seven students and two teachers chose option “high school and university”. Three justifications are listed next:

*Because students are more mature in this stage, being able to use their phones as a didactic resource (S<sub>5</sub>).*

*When used adequately, mobile phones can, indeed, be a learning tool, because they are part of most students' daily life. One must consider the students' level of maturity, so I believe this work is easier and more effective from high school on (S<sub>9</sub>).*

*It all depends on the class plan, but with elementary school students (and even with those in junior high school), it is more difficult to keep them concentrated on the activity and not being distracted with other resources offered by mobile phones (T<sub>5</sub>).*

Seven students and two teachers also selected option “Starting in junior high school”. These are their justifications:

*Because students in junior high school are aware of what is right and wrong, of what is necessary or not; thus it is easier to educate them in regard to the use of the Internet (S<sub>3</sub>).*

*As of 5th grade I believe the student is a little more careful when using his/her mobile phone and knows it can be an educational resource (S<sub>10</sub>).*

*Considering that children are born in the digital age and are digital natives, working with technologies is much easier and practical for them, so it would be interesting to make students aware of how mobile phones can be used for educational purposes; so I think elementary school children are able to understand it (S<sub>21</sub>).*

Four students and five teachers selected option “From Elementary School”. Three justifications are given next:

*Children find it very easy to use mobile phones; so their use in the classroom can make learning something more attractive and meaningful for them (S<sub>11</sub>).*

*If there is a pedagogical plan, it is possible to take advantages of mobile phones to stimulate students and, thus, to contribute somehow to the teaching and learning process (T<sub>1</sub>).*

*I believe that, just like with calculators, mobile phones, if used the right way, can contribute to the teaching and learning process. Learning environments can no longer ignore the technological development of the last decade, ‘pretend’ that they don't exist. If mobile phones are always at hand, why not use this resource? (T<sub>7</sub>).*

Only one student marked option “In none of the school levels”, justifying as follows:

*I believe many students are not mature enough to use such device (Student Q).*

The position of the participants of the survey on the school levels in which use of mobile phones would be appropriate reflects quite well the complexity of the issue. Opinions are diverse and, yet, they are coherent, indicating that it is an issue with both positive and negative aspects, making it difficult to reach a consensus. However, data collected in the study indicate that the positive aspects pointed by the participants are greater than the pitfalls, since only one student found the use of mobile phones not viable in any school level. It must be emphasized that the word ‘maturity’ was mentioned by several participants, signaling their concern with possible distractions that the device may cause.

When asked whether they had experienced, as a university student or teacher, situations in which mobile phones disturbed their class, participants answered accordingly to Table 6. In this case, 100% of the students correspond to 21 individuals, and 100% of the teachers correspond to nine people.

Table 6: Mobile Phones Responsible For Disturbance

Options	Students (%)	Teachers (%)
Yes	62	67
No	38	33

It can be observed that, even at university level, the inappropriate use of mobile phones may cause distraction. The following comments were made by participants who answered “Yes” in Table 6:

*Loud music, silly apps with tunes, etc. (S<sub>1</sub>).*

*When a classmate was surfing on Facebook during class and called me to show me something. This distracted me during an explanation (S<sub>19</sub>).*

*Texting, accessing Facebook, and making phone calls (T<sub>3</sub>).*

*When the student cannot resist the temptation to check his/her e-mail, messages and social networks, this is can be a cause of distraction. One must know how and where to use it; it is a matter of good manners. Even in work meetings, we can observe colleagues doing something with their phones (T<sub>4</sub>).*

The last part of the questionnaire asked for suggestions related to the pedagogical use of smartphones. Three suggestions are quoted below:

*Use (of mobile phone) should be free for all students, and teachers should be trained to instruct pupils on how to use them (S<sub>3</sub>).*

*Teachers can suggest games and apps that can be used to help understand a topic or the application of a specific content. It can be quite useful, if well guided (S<sub>4</sub>).*

*There are applications for mobile phones that draw function graphs, something that can be perfectly used in the classroom (T<sub>7</sub>).*

Although the answers collected in the survey do not allow generalizations, they provide a general view of a group of people directly related to the educational context. They are not experts in the research theme, nor have a wide experience in m-learning, but their answers were coherent with what is, in general, discussed in the literature about mobile phones in education.

## CONCLUDING REMARKS

In current society, digital mobile technologies are present in various professional fields, including the educational sector. Thus, it is important that pre-service teachers discuss the use of these technologies in educational contexts, so that they become more aware of the role of digital tools in their professional activity.

Use of mobile phones, especially, is an issue that still poses several difficulties that must be discussed. Prohibition of the use of these devices in the classroom may not prevent problems, as students often get around restrictions. This is a complex topic that requires common sense and dialogue, even if only to justify reasons for prohibition.

It is also essential to consider that even in other sectors mobile phones can cause trouble. Distraction related to the use of these devices can, for instance, affect work, personal relations, and leisure. Hence, this is a matter that demands pondering even in contexts other than educational.

On the other hand, one cannot deny that the practicability of having, at hand, such equipment with countless functions, as is the case of smartphones, can make a difference in many situations. If used in the proper way, these devices can make great contributions to educational actions.

To conclude, it must be emphasized that, in future researches, students and teachers in other courses and school levels, as well as parents of students in elementary and junior high schools may be consulted about the pedagogical use of mobile phones, thus expanding the analysis presented in this paper.



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#### BIODATA AND CONTACT ADDRESSES OF AUTHORS



**Silvia Cristina F. BATISTA** is professor at Instituto Federal Fluminense, Brazil. In 1987, Batista has graduated in Science- Specialization in Mathematics, from the Faculdade de Filosofia de Campos. She received her Master's Degree in Engineering Sciences, focus on Production Engineering, in 2004, from the Universidade Estadual do Norte Fluminense Darcy Ribeiro, Rio de Janeiro. She received her Ph.D. in Information Technology in Education from the Universidade Federal do Rio Grande do Sul Federal – UFRGS, Brazil, in 2011. Her research interest is mobile learning, and digital technologies applied to Education.

Prof. Dr. Silvia Cristina F. BATISTA  
Dr. Siqueira Street, 273,  
Parque Dom Bosco, 28030-130.  
Campos dos Goytacazes, Rio de Janeiro, BRAZIL.  
E. mail: [silviac@iff.edu.br](mailto:silviac@iff.edu.br)  
<http://plataforma.nie.iff.edu.br/projetomlearning/>



**Gilmara T. BARCELOS** is professor at Instituto Federal Fluminense, Brazil. In 1988, Barcelos has graduated in Science- Specialization in Mathematics, from the Faculdade de Filosofia de Campos. She received her Master's Degree in Engineering Sciences, focus on Production Engineering, in 2004, from the Universidade Estadual do Norte Fluminense Darcy Ribeiro, Rio de Janeiro. She received her Ph.D. in Information Technology in Education from the Universidade Federal do Rio Grande do Sul Federal – UFRGS, Brazil, in 2011.

Her research interest is pedagogical use of Internet social networks, teacher training, and digital technologies applied to Mathematics.

Prof. Dr. Gilmara T. BARCELOS  
Dr. Siqueira Street, 273,  
Parque Dom Bosco, 28030-130.  
Campos dos Goytacazes, Rio de Janeiro, BRAZIL.  
E. Mail: [gilmarab@iff.edu.br](mailto:gilmarab@iff.edu.br)

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