The Response Systems in the Student's Learning/Teaching Process
A Case Study in a Portuguese School

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Abstract: Over the past few years there has been a large investment in information and communication technologies applied in the teaching/learning process. In this context the response systems appear as an innovative tool associated with different methods and strategies. Response systems are technological products designed to support communication and interactivity, generating enormous potential when applied in the teaching/learning process. The student motivation increases when this technology is used leading to a greater participation and consequently to a better and faster acquisition of concepts. Collaborative and cooperative attitudes between student/student, student/teacher and student/class are increased when response system are used in the context of the classroom. The use of response systems and their implications for the teaching/learning process are some of the challenges that teachers are facing nowadays as a driving agent in the implementation of this technology at school. This article examines the use of response systems in the student's learning/teaching process, exploring their use in a Portuguese school.

1 INTRODUCTION

The information and communication technologies, integrated in the teaching/learning process are a fundamental means of building the student's knowledge (Costello, 2010; Liu, 2010). Making use of these technologies, learning and interest are encouraged in the contents they are taught, becoming a promoting factor of learning that leads to the formation of competent students with open horizons and predisposed to invest in innovation (Arends, 2008; Costello, 2010).

Over the past decades, teachers have recognized the value of the use of technological tools in the classroom, and since that time they have been making efforts to adapt to this reality in order to improve the teaching/learning process (Liu, 2010). With the numerous technologies that are available, teachers and students can access a great variety of information and make use of them, exploring their potential. The use of technology in classroom provides a better relationship between teachers and students, it provides the interaction between them and leads to closer and more dynamic learning. The daily contact with them, creates challenges to the student to learn more and look for new ways to adquire new knowledge (Costello, 2010).

Regarding response systems, in the literature dedicated to this technology, are used different names such as: audience response system, personal response system, student response system, electronic response system, voting system, "clicker" or "zappers" (Fies et al., 2006; Kay and Knaack, 2009; Kolikant et al., 2010). So, the name given to this technology has no consensus and, in this article, the term chosen was response system, because it is simple and it creates, at the same time, its own concept.

Response systems are defined in the literature, as technological products based on combinations of hardware and software designed to support communication and interactivity in the teaching/learning process (Beatty, 2004). These systems are considered an innovative technology and are characterized as systems that include portable electronic devices that allow students to select the answers to the questions asked by the teacher during lessons, enabling the teacher to control these answers (Lowery, 2005; Barber and Njus, 2007).

The key objective of the response systems is to allow the interactivity between student/student, student/class and student/teacher (Costello, 2010). The fact is that the teacher is always looking for

ways to keep students` attention by involving them in the learning process; it makes this technology an important tool to promote their participation in class, improving students' attitudes and their satisfaction (Siau et al, 2006; Morgan, 2008; Eastman et al, 2011).

In the literature there was not found similar studies in the context of Portuguese school (Azevedo, 2012). The literature presents several cases about the influence of the response systems in the learning/teaching process but it does not present studies with the focus of the assessed paper.

For this investigation the main question was defined as: "What is the use of response systems in the students' learning/teaching process?" based on two general questions: (1) *What is the knowledge and the use of response systems in a Portuguese school?* (2) *What is the contribution of response systems in the student's learning/teaching process?*

The article is organized in this way. In section number two the state of the art response systems are presented, in section three, the applicability of this technology in the teaching/learning process is discussed; in section four the research methodology and the data analysis of the study are presented and it ends with a final reflection of the implications of the use of response systems in the student's learning/teaching process in a Portuguese school.

2 RESPONSE SYSTEMS

The use of response systems began around the late 60s, with their application in the business and governmental areas and in meetings. In terms of playfulness their application was used in television quiz shows. Subsequently, this technology was applied in educational institutions, universities first and later in secondary and basic schools (Judson and Sawada, 2006; Kay and LeSage, 2009).

At the beginning, systems needed physical connections and they were considered as a very costly, ineffective and non-functional technology (Judson and Sawada, 2006; Kay and LeSage, 2009). By the 90s, there were systems that incorporated infrared technology and later radio frequency, bringing the advantage of low cost, a factor which led to the expansion of the use of response systems in academic areas (Barber and Njus, 2007; Zhu, 2007). In recent years, the technology of the response systems was begun to rely on the web, allowing the adaptation to online courses and the use of the tablet, smartphone, WebCT, Blackboard, etc. (Lowery, 2005).

The goal that is behind the use of response systems - realize the level of understanding and learning of each student and make adjustments to the teaching/learning process - is not new. For many years teachers have used interactive and cooperative teaching to encourage participation of all students in discussions (Arends, 2008; Lebrun, 2008).

The introduction of response systems as an innovative technology in the teaching/learning process needs to consider all aspects, only looking at one aspect is missing opportunities. The impact of its implementation is beyond the development of skills, because it affects the whole method of teaching and curriculum management in general (Zhu, 2007; Kenwright, 2009).

The incorporation of response systems in the teaching/learning process allows students to participate more in class, answer questions and receive feedback from the teacher about what the acquisition of the contents that were taught is related to. On the other hand, the teacher can assess whether the student is following his exposure and set the level of understanding that each student has been achieving in relation to classmates. As a result, students show more commitment, more attention, more involvement with the class, realizing that the response system is easy to use and useful for their learning (Eastman, 2007; Beatty and Gerace, 2009).

The increase of participation is directly related with the anonymity that the response systems allow, leading the student not to be judged by his peers and be able to interact without recrimination (Caldwell, 2007; Simpson and Oliver, 2007). The anonymity encourages students to participate and believe in their abilities, allowing the teacher to know which concepts were understood and which ones need to be strengthened. The student can identify his own gaps and work on them out (Barrett et al, 2005).

Response systems are not a magic solution to the problems that exist in the teaching/learning process, they are firstly a tool that can be used in different ways to achieve specific goals. The research and professional development should focus on teaching specific practices considering the individual differences of each student (Barrett et al, 2005; Edens, 2006).

3 APPLICABILITY IN TEACHING/ /LEARNING PROCESS

Response systems are a technological tool that

cannot function on its own. The teacher has to adapt his teaching methods and approach strategies in order to properly implement the use of this tool (Beatty, 2004; Njus and Barber, 2007; Eastman, 2007). The teacher should start using response systems in a very slow way and can encourage student participation in a topic that was considered problematic. According to Beatty et al (2005), the teacher cannot tell the students what to think but rather, stimulate their thinking, comparing it with alternatives and looking for the solution that best works and is adapted to each context. The student becomes more involved in the teaching/learning process, demonstrating a sense of ownership about his personal contribution to the learning of the class (Liu, 2010). The teacher should request training for the responsible people for the installed system and to exercise the material that will demonstrate in class how to feel comfortable and to convey to students the use of technology (Barber and Njus, 2007; Eastman, 2007).

The response system is a useful pedagogic tool in the classroom, especially when combined with an implementation strategy as "*peer instruction*" or "*class-wide discussion*" (Beatty, 2004; Kennedy and Cutts, 2005). This technology can be used for a variety of purposes, including evaluation, research and consensus building (Barrett et al, 2005). The impact of the application of the response system largely depends on how the questions are prepared, their suitability for the intended results and how effectively they are used to set the rhythm of the lesson (Beatty et al, 2005).

The questions that are asked in classroom allow teacher to determine quickly if the student is assimilating the presented concepts, giving the student that cannot understand, a second opportunity to inform the teacher of his situation, without having to face the embarrassment of asking questions in front of the whole class (Barrett et al, 2005).The well-designed questions are just a tool, an approached component oriented towards a learning content, but the way that the teacher uses questions to interact with students in classroom is the most important aspect. However, the lack of effective questions to use with response systems can be a serious barrier and frustrating to the teacher who wishes to learn and practice the use of targeted questions. The feedback given to the teacher on students' acquisitions can, if carefully studied, reveal problems of implementation (Penuel et al, 2007; Kenwright, 2009).

Response systems can lead to the realization of a formative and summative assessment, merged with

coherent process, clearly integrated in each class (Hancock, 2010). The formative evaluation is used to determine the level of understanding achieved by the student about concepts, but without quantifying. It wants to identify misconceptions and allows to adjust the development of the lesson. The regular use of a response system can provide real-time feedback, both for the teacher and for the students, about how the concepts are being understood (Beatty, 2004; Beatty et al, 2005; Caldwell, 2007; Simpson and Oliver, 2007).

The feedback system also allows the realization of the summative evaluation, because almost all kinds of evaluation that test structure can be easily adapted to the use of this technology. The system records and classifies the answers from each student for each question and the software has the functionality to export the results to an external file in order to be treated by a specific software. The results will then be used by the teacher, and treated according to the objectives (Barrett et al, 2005). In this context, the learning that was already undertaken leads to positive frequent interaction, allowing greater articulation of the student's thought and a greater focus on his misunderstandings with discussions between peers, which leads to more active learning (Beatty, 2004; Caldwell, 2007). In essence, by using a response system it is possible to transform a unilateral transmission of information, relatively static, into a dynamic transmission and interactive transmission by the student (Kennedy and Cutts, 2005, Morgan, 2008).

4 RESEARCH METHODOLOGY

4.1 Context

As a research methodology the quantitative research approach was selected in order to understand, on the one hand which technologies teachers regularly use in classroom and, on the other hand, in what context the response systems are used in classroom and, consequently, the implications in the student's learning/teaching process.

The process of data collection was based on the use of questionnaire surveys, opting to include, in general, closed questions. The questionnaire, being the data collection selected instrument, aimed to collect information through the examination of a representative group of the studying population. The investigation by survey, being widely used in education, allows the identification and enumeration of the studied situations without requiring major

concern in determining, systematically, the relationship between all the variables involved in the process, because sometimes it is not possible to collect data in an appropriate way (Tuckman, 2000). The questionnaire is a tool for collecting data well adapted to quantitative researches, because it makes possible the work with large samples in a relatively short time enabling the establishment of statistical relationships for the generalization. It allows a series of questions with no interaction between the respondents and the researcher (Hill and Hill, 2005).

The questionnaire was applied to a school with the second and third cycles of basic education and secondary education, in order to cover the various levels of education. The purpose of it was to measure the experiences of that school´s use of technological response systems. Therefore, it was decided to apply the questionnaire to two groups, teachers and students, with the intention to compare the perspectives of the two agents involved in the teaching/learning process, concerning the use of this technology in the context of the classroom

4.2 The Planning and the Designing of the Questionnaire

In the definition of the objectives of this survey the type of information required and the desired goal were presented. As the technology of response systems, studied here, is quite recent, the option was only related to the use of response systems. The risk of receiving more questionnaires with no answers was very high, so, after analyzing the school context, it was decided to include a section related to the technologies already used in classroom. In this context, the investigation led to the perception of what technologies were used in classroom and how they influence the student's teaching/learning process, realizing how the technology of response systems is used in classroom.

The questionnaire included a set of general questions followed by specific ones. The questions were designed in order to allow diverse kinds of answers, avoiding the respondent's demotivation to answer. On one hand, listing items were used for where the respondent answers by selecting one of the possible options presented. On the other hand, some answers were selected using Likert's scale of values, which measures the respondent's opinion, that is given by the average of his position against the set of proposals propositions (Gable and Wolf, 1986). The respondent's answers are directly located in terms of attitude, positioning himself in an affective gradation according to their agreement or

disagreement on the issue. According Gable & Wolf (1986), Likert's scales are often used because they are valid, they are easy to construct and easy to adapt to measure various characteristics of the emotional component.

All the questions included in the questionnaire needed to be answered since all the respondents had worked together during the school year 2011/2012, being the active agents in the classroom. Some issues include the option "Other", allowing the respondent to specify a different option from those shown. As a methodological option two questionnaires were produced one directed to teachers and one to students, although both with the same structure

4.3 Collection of Data

The school that was studied is the seat of a grouping of schools, being placed in an urban, industrial and commercial area, having local residence, but also others from the surroundings. For reasons of confidentiality the school cannot be identified. The school offers the second and third cycles of basic education and the secondary education, it has 118 teachers, divided into five departments. According to the studying population this one consists of 1334 students, distributed among the different levels of education. The questionnaire was administered to teachers and students, in order to compare the perspectives of the two agents involved in this educational process about the use of the technology in the classroom.

Concerning the teacher's population in the studied school, it was concluded that there was a broad implementation of information exchange through institutional email. According to this factor, it was decided to send the questionnaire to all teachers, trying to get a larger number of answers. Therefore, the questionnaire was sent to all teachers by email, via institutional email, having as the sender a member of the school leadership in order to induce greater attention to the content of it, leading to a greater number of answers. In this email it was requested that the cooperation of all teachers, assuming complete anonymity, appealing to the completing of the questionnaire in order to know which technologies are more used in the classroom, and to what extent they contribute to improve the student's teaching/learning process.

Applying this process to the entire student population became impractical because teachers do not have the emails of all students. This way, the approach was looked at from two perspectives, and

the defined sampling was laminated to cover a sampling rate identical in every teaching level. Students who used the computing labs weekly answered during the lesson and other students were randomly selected from amongst the missing teaching cycles. They were invited to attend a computer lab and answer the questionnaire, properly guided by a teacher. The perspectives used enabled that the questionnaire could cover the same sampling rate at different levels of education.

The sample included 60 teachers and 291 students, representing 51 % of the teaching population and 22 % of students, each one having particular features but with a common characteristic - the same educational context during the school year. These elements were the units of analysis on which the information was collected, considering that this sample is representative of the population and provides accurate information.

4.5 Data Analysis

From the analysis of the use of technologies in the school studied it´s easy to conclude that these are used in a cross context being worked and explored in all subject areas. It is important to know that this factor is as a promoter of meaningful learning which leads to the formation of competent students with open horizons and predisposed to invest in innovation.

Following this, and in order to be possible to compare teachers' and students' perspectives, the issues equally applied to the two samples were analyzed in contrast, assessing the points of contact and withdrawal.

The first part of the questionnaire is related to technologies used in classroom and it is possible to conclude that, in general, information and communication technologies are implemented in the classroom, with predominance in the use of the projector. This result is directly related to the fact that all the school rooms are equipped with this technology, which allows the teacher to use them every day without needing to request equipment, internet connection, etc. In contrast, the technology less used is the response system with a residual number of answers to indicate its use (see graphics 1 and 2).

About the software that is used for the creation and presentation of the syllabus contents, the answers are focused on electronic submission and word processor, but while teachers firstly prefer the word processor and secondly the electronic submission, students do it in reverse

Technologies are generally used with a very high frequency and most of the answers are in the category of between once to three times a week, followed by the option in all classes. It demonstrates the importance teachers give to the use of technology as a tool to support the student's teaching/learning process. The two objectives chosen as the most important ones and that are closely related to the use of technologies in classroom, not only by teachers but also by students, are:
• Promoting more creative, dynamic and motivating lessons;
• Using different strategies and resources to improve the quality of teaching and learning.
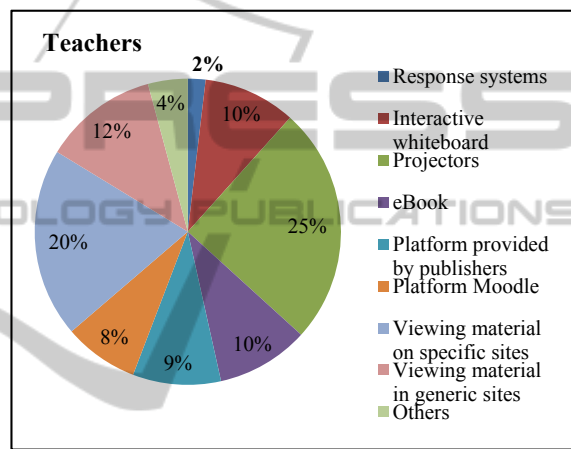
Graphic 1: Technology used in classroom.
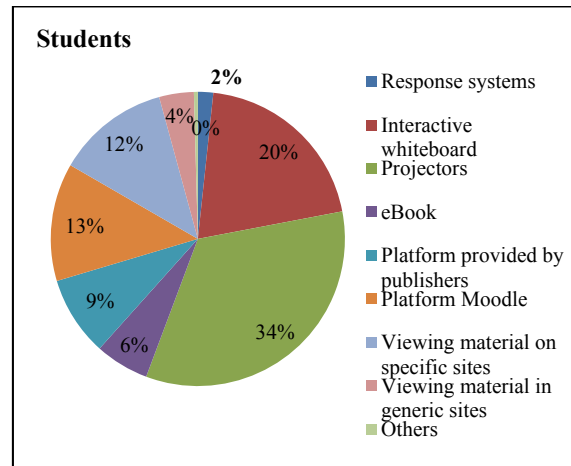
Graphic 2: Technology used in classroom.

Both teachers and students converge on the objectives, realizing that they can reach and realize the justification of using technology in classroom. Teachers apply and use technologies when

presenting the content, and students realize their usefulness and incorporate them into their learning, leading to more collaborative classes.

Concerning students' attitudes towards the use of technologies in classroom, the data points to the existence of agreements between teachers and students, because both mention that the interest and the involvement increase. Both groups refer to the assiduity as an attitude that is kept or that is not observable.

From this analysis, in what concerns the use of technologies in classroom, it is possible to conclude that these are being widely used, being noticeable that both educational agents, teachers and students, understand the importance of their use, being evident the confluence of the answers, illustrative of the daily work that involves the use of technology as a crucial pedagogical tool in the student's teaching/learning process.

About what the response system is related to, it is evident the limited use of this technology, realizing that the vast majority of teachers and students have never used it before and they don't even know their functionalities and applicabilities.
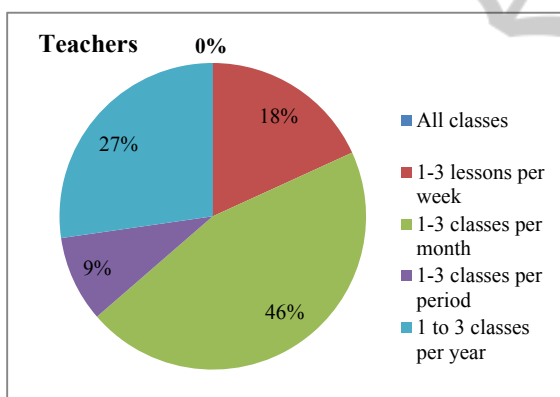
Graphic 3: Frequency of the use of response system.

After analyzing the answers we easily understand that the frequency of using the response systems is negligible; teachers use it three times per month, followed by one or three times a year, while the majority of students converges on one to three times a year (see graphics 3 and 4).

Response systems are not frequently used in school and their use is quite limited, however their impact on the teaching/learning process could be distinctly different if it was regularly used. Both teachers and students felt that the response systems were mainly used in activities where the purpose is to assess knowledge in a specific subject. The activities are less referenced in a summative assessment and in the registration of assiduity.
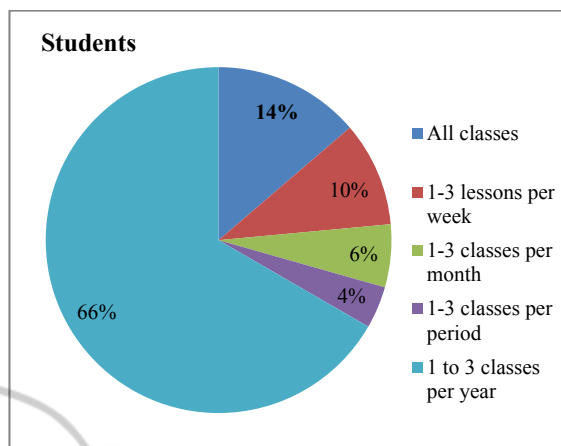

Graphic 4: Frequency of the use of response systems.

Response systems are not frequently used in school and their use is quite limited, however their impact on the teaching/learning process could be distinctly different if it was regularly used. Both teachers and students felt that the response systems were mainly used in activities where the purpose is to assess knowledge in a specific subject. The activities are less referenced in a summative assessment and in the registration of assiduity.

Regarding students' attitudes, those which increase when this technology is used in the classroom are interaction, involvement, participation and interest. The attitude that mostly remains unchanged or is not observable is the assiduity.

Turning to the operationalization of the response systems, teachers consider that the time spent on the creation of questions is low or reasonable and it is not an inhibiting factor of their weak usefulness. When they are formulating questions, the most common type that is used is multiple choice.Compared with other technologies, teachers identify as an added value the fact that response systems allow us to check how the learning is being performed, monitoring the answers and identifying which students need strengthening. This technology leads to reduced paper usage and copying on a large scale, enabling a reduction of the costs of the school (see graphics 5).

The collected data show in an interesting and motivating way that most teachers surveyed demonstrate willingness to learn the technology of the response systems, revealing an interest in their applicability, strengths and characteristics in order to implement in the near future this technology in classroom but, above all, able to articulate the response systems with methods of teaching that help the learning process.
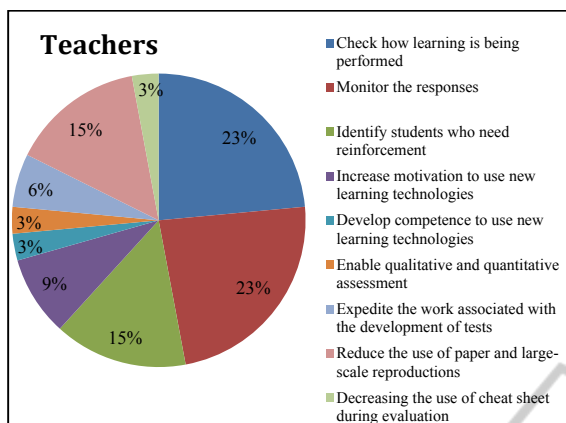
Graphic 5: Activity using the response system.

5 CONCLUSIONS

In this study, the use of technology in the response systems itself doesn't guarantee success in the learning/ teaching process, however, when it is used as an element of an effort to support engagement in active learning, there is great evidence that they can support higher motivation, at least as a result of their ability to provide fast feedback on the learning process. This technology favors the use of very motivating teaching methods for students. These factors associated with the playful aspect, portability and even a little to the novelty factor, mean that this technology has a good educational impact. The use of response systems is a solution that achieves good results in increasing student participation and no high cost, since it can be shared.

In general, it is accepted that the response systems represent an opportunity to enrich lessons. The emphasis in the involvement and interaction can induce teachers to rethink their conception of teaching and reviewing strategies and teaching methodologies. The integration of response systems in the teaching/learning process can facilitate a variety of teaching practices that promote collaborative and cooperative work of students. The use of a response system increases the quantity and quality of the discussions in the classroom, especially when combined with different strategy (Beatty, 2004; Kennedy and Cutts, 2005).

It is clear that the response systems appear as a technological tool with educational interest, both for students and teachers. The studies tend to drive the analysis of students' perception and investigate the impact on learning and their achievement. The benefits of using response systems will only be achieved as soon as the teacher carefully thinks

about the learning objectives and how the discussions created from the questions used with this technology can help to achieve these goals. Sometimes, the promotion of useful discussions and the enrichment of learning and feedback are more important than providing a correct answer. This technology encourages students to articulate thought regardless the level of knowledge that each one has at the moment. To use response systems successfully it is essential that teachers know their potential and applicability in the context of the classroom as a possible promoter of educational success.

The use of this technology enables an increase in interaction, participation, involvement and student's interest. Crossing the obtainable results of this study with Shaffer & Collura (2009)'s study in which they compared students' attitudes to the use and non-use of response systems we conclude that the reactions of students towards the use of response system was overwhelmingly positive. Students classified the class as more interactive, funnier, more interesting and helpful in understanding the contents. These results are directly related to the fact that the teacher has used response systems as a catalyst for the student's participation, leading them to compare their answers with their classmates. It is much easier when a teacher can show the whole class the results and explain how and why, to make a transition to important contents.

Compared with other technologies, the surveyed teachers identify as a surplus value fact that the response systems allow them to check how learning is being performed, by monitoring the given answers and identifying which students need strengthening. It allows to investigate the assimilation of knowledge in real time, enabling the teacher to change his presentation, directing his speech to the areas that show more difficulties in most students' understanding. The teacher has the possibility of testing before, during and after the presentation of the contents, getting instant feedback of results (Roberson, 2009).

The collected data shows in an interesting and motivating way that most teachers demonstrate willingness to learn the technology of the response systems, revealing an interest in knowing its applicability, strengths and characteristics in order to implement in the near future this technology in the classroom but, above all, being able to articulate response systems with teaching methods able to make learning easy. In the Fies & Marshall (2006)' study it is reported that the response systems promote learning when combined with teaching appropriated methodologies and supported in

environments that led to higher learning gains.

To answer the research question, it is clear that the use of response systems in the student's teaching/ learning process, it is not possible to conclude that learning gains have been achieved. Nevertheless the results show that the response system technology could be more effective if applied in a more widely way

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