

The Flipped Classroom Approach via the M-Learning Model: Impact on Student Learning and Motivation

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Abstract: Over the past decade, there has been a growing emphasis on integrating modern technology into educational systems, particularly in the form of new information and communication technologies (NICT), including mobile technologies. Mobile learning (M-Learning) is an advanced form of e-learning that allows learners to access educational materials and knowledge sources through intelligent digital electronic devices in a flexible mobile environment. This study explores the impact of applying the flipped classroom pedagogical approach via the M-Learning model on learners' motivation. To investigate this, an experiment was conducted on a group of 86 learners in the Operating System and Local Area Network course, where M-Learning was adopted as the teaching model. The experimental group was compared with a control group, and the obtained results showed that the experimental group had a significant improvement in learning outcomes and remarkable motivation according to the ARCS model. The findings indicate that the experimental group demonstrated improved learning and remarkable motivation according to the ARCS model. This suggests that incorporating M-Learning into the flipped classroom approach can be an effective way to enhance learners' motivation and engagement in the learning process.

Keywords: flipped classroom, m-learning, ARCS model, motivation.

通过移动学习模型的翻转课堂方法：对学生学习和动机的影响

摘要：在过去十年中，人们越来越重视将现代技术融入教育系统，特别是以新的信息和通信技术（包括移动技术）的形式。移动学习是电子学习的一种高级形式，它允许学习者在灵活的移动环境中通过智能数字电子设备访问教育材料和知识源。本研究探讨了通过移动学习模型应用翻转课堂教学法对学习动机影响。为了研究这一点，对一组86名学习者进行了操作系统和局域网课程的实验，其中采用移动学习作为教学模型。将实验组与对照组进行比较，得到的结果表明，根据“注意力、相关性、信心和满意度”模型，实验组在学习成果和显著动机方面有显著改善。研究结果表明，根据“注意力、相关性、信心和满意度”模型，实验组表现出更好的学习和显著的动机。这表明将移动学习纳入翻转课堂方法可以成为提高学

习者学习动机和参与度的有效方法。

关键词：注意力、相关性、信心和满意度。

Introduction

Today, information and communication technologies mark the world and bring a revival in the field of education, especially in the way of teaching. These technologies process information in different forms through processing, storage, retrieval and distribution via electronic and digital devices.

The impact of this innovation is critical on the progression of education, it is totally different from the traditional model of education which is based on indoctrination and memorization, and on the teacher, considered as the center of the educational process, and the textbook, as the main source of knowledge, but thanks to this technological development a range of types of pedagogical learning has emerged over time as blended learning, as a model of integration of innovative pedagogical techniques, such as e-learning that offers a combination of interaction and participation derived from the best practices of face-to-face learning [1] distance learning (D-Learning). Similarly, the digital learning model emerged with the use of computers and networked communication in education (E-Learning). It has contributed to making distance learning possible, and with the development of digital and wireless technologies, it has led to the emergence of a new model of portable or mobile learning (Mobile Learning "M-Learning"). This model is based on the use of wireless electronic devices in distance learning, such as cell phones and tablets, resulting in a shift from a wired learning environment to a wireless learning environment.

Mobile learning is the online learning via materials available on the Internet and a digital exchange space (platform). The teacher's role here is to direct the learner to the required information and tasks. Second, mobile learning is based on a well-structured learning model through a discussion forum, construction activities, and video vignettes via the available communication media, so that the teacher and the learner are connected and interacting in this type of learning.

The improvement of learning is our main objective from which it is necessary to energize and motivate learners. To do this, we have approved an innovative pedagogical approach called "Flipped Classroom" based on the execution of courses and interactive activities via mobile applications available on the means of communication used by the learners. To address this new pedagogical approach and answer our research question, we need to verify the quality and effectiveness of this pedagogical approach via M-

Learning and its impact on learners' motivation. What is the impact of using this pedagogical approach via this teaching model on the learning and motivation of the learners?

To answer our question, we used two types of data collection tools: the evaluation test and the questionnaire.

1. Analysis Framework

1.1. The Flipped Classroom

The flipped classroom was created by Professor Eric Mazur in the early 1990s and he made it one of his core principles as a basic system where he made the classroom, not only a source of information, but also a field of cognitive assimilation, there is also talk of a change in the mission of the teacher, from a teleprompter to a companion and oriented learner, and this means following the pace of the learner to make him/her acquire concepts that he/she is able to absorb and discuss with his/her peers, which is called according to Mazur "peer education" [2].

Jonathan Bergman and Aaron Sams discovered in 2006 that their learners were missing several classes due to the distance between school and home. To solve this problem, they decided to use a program that creates a slideshow in the PowerPoint application with the addition of audio and written content in the form of comments that were shared via a YouTube channel starting in 2007. The real emergence of the idea of a flipped classroom came after teachers decided to make the pre-recorded lessons they offered to students as activities to complete with the goal of identifying difficult concepts and explaining them during the lesson.

Finally, American Salman Khan and after his experience in 2004 propelled the idea of the flipped classroom in 2006 by creating a platform - Khan's Academy - for learning based on tutoring in mathematics via computers and graphics tablets connected. Thus, this academy offers 4500 free educational videos in English on various topics. From September 4, 2013, a set of videos (about 250 videos) is created for the French-speaking public from the official site of the NGO.

The flipped classroom is a pedagogical technique refocusing learning around the learner, empowering them to be autonomous [3] and an environment in which they take responsibility for their own learning under the guidance of the teacher [4]. It is also an original model that facilitates the learning of learners

[4].

On the other hand, the flipped classroom allows for an increase in motivation and engagement of learners regardless of the level of education considered, a strong growth in grades and academic results, and a change in mentality in schools [5].

1.2. M-Learning

Mobile learning is generally viewed as simply an augmentation of online learning, but quality e-learning can only be delivered with a perception of the particular limitations and privileges of mobile devices. Mobile learning benefits from the advantages of mobility and its supporting platform. Mobile learning is a learning model that uses mobile technology to provide learners with educational tools, information, or assistance [6]. Mobile learning is not limited to local spaces [7]; it also gives students the ability to schedule courses. Rapid advances in neuroscience and interdisciplinary collaboration between neuroscience and psychology provide valuable insights into the dynamic and hidden nature of human motivation by identifying the neural mechanism of motivation [8].

Mobile learning (M-Learning) is an emerging concept as the development and adoption rates of mobile technologies are rapidly increasing worldwide. M-Learning could be an existing form of D- and E-Learning. It is a subset of E-Learning and D-Learning. This is represented in Figure 1. Historically, distance learning has more than a hundred years of experience and tradition. Its main characteristic is that the gap is the time of separation between the teacher and the learners.

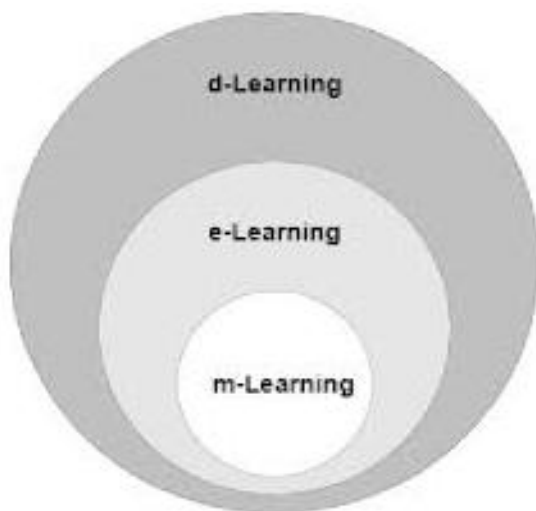


Fig. 1 Relationship between e-learning, m-learning, and d-learning

According to Kothamasu [9], mobility allows teaching and learning to be extended beyond the standard classroom, and M-Learning can increase flexibility while opening up an alternative opportunity within the classroom for teachers and learners. M-Learning could even be a way to enhance the broader learning experience and a robust method to allow

learners to interact on their own terms - according to Quinn [10], "Mobile learning is learning through mobile computing devices."

- Mobile learning is defined as the transfer of learning content to learners via mobile computing devices [11]. Mobile learning is not possible without a mobile device. These devices vary widely in capacity, size and cost. A common capability to integrate them is the ability to understand mobility and wireless connectivity. The main mobile devices used in the teaching process are:

- *Laptops*: they should be characterized by an adaptable configuration, i.e., a reasonable storage capacity with a small size and capable of supporting wireless operations. This type of device also provides an upgrade possibility in it.

- *Tablet*: it presents a device very known and used by learners because of its small size compared to the laptop. It also has a very adaptable configuration and is capable of performing any type of wireless operation. It may well be relatively expensive.

- *Smart Phones*: Generally, they do not have a full keyboard and can recognize handwritten characters. They use Windows Mobile (Android) or another operating system. Since they need Internet browsers, they can be used successfully in mobile multimedia education.

Several researches have shown the impact of M-Learning on learners' motivation, so they felt motivated by its use in their learning, acceptance and positive attitude toward this tool considering it as an effective tool [12], their performance and skills were well improved [13-15] and learners are becoming more independent [15, 16]

Its effectiveness has been well proven in teaching computer science to primary and secondary school students [17] and has been considered as a new learning paradigm.

1.3. Motivation and the ARCS Model

In the learning literature, motivation is a key concept [18]. There are many definitions of the term "motivation"; Huitt [19] synthesized those proposed in many works of psychology and deduced that motivation is an internal state or condition that serves to activate or energize behavior and give it direction [5], as well as a well-structured group of actions directed toward a specific outcome [20] or, more precisely, a "theoretical concept that defines physical and mental processes" [21]. In general, it can be defined by internal and/or external influences that can act on an individual, depending on whether or not he or she is moving from a directive situation toward a goal. To summarize motivation is the presence of a process caused by an internal attitude that refers to personal characteristics and by an external motivation that corresponds to the strength of commitment and the

external of the person himself. The level of motivation of individuals varies between weak and strong depending on the circumstances at fixed times [21]. The learner's motivation is defined by his or her situation and how he or she distinguishes it, it is bypassed by three factors as soon as the interest distinguishes, for a task, the ability to achieve as well as the tools used to control the course and its results [22], This concept is consistent with Deci and Ryan's theory of motivation [23], which shows that the needs of self-determination, drive and affiliation influence a learner's motivation in a directive way.

ARCS is an educational model developed by John Keller [24] that focuses on measuring motivation. It is important to motivate learners and ensure the continuity of that motivation during instruction. This model is especially important for online learning because it is more difficult to motivate learners in an online course in face- to-face courses.

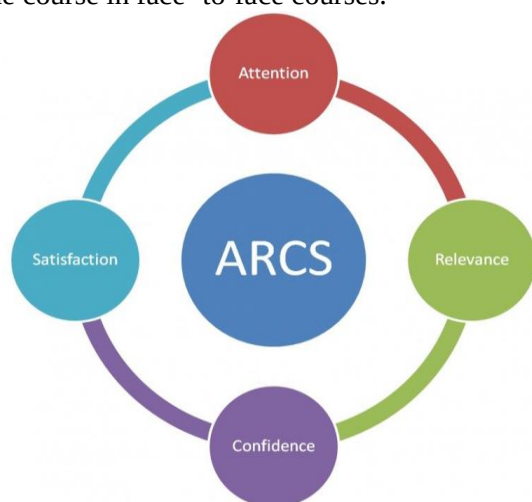


Fig. 2 The ARCS model of motivational design

The ARCS model has four components: Attention, Relevance, Confidence, and Satisfaction.

1.3.1. Attention

This refers to the interest of learners. It is essential to generate and maintain learners' interest and attention. Relevance: The learning process must show the usefulness of the content so that learners can bridge the gap between the content and the real world.

1.3.2. Confidence

This component focuses on developing an expectation of success in learners, and the expectation of success allows learners to control their learning processes. There is a correlation between the confidence and the expectation of success. For this, it is important to provide learners with an estimate of the probability of success.

1.3.3. Satisfaction

There is a direct relationship between motivation

and satisfaction. During the learning process, learners should be satisfied with what they have accomplished.

2. Research Methodology

We chose two classes of second-year secondary school students as a sample for our study :as a sample for our study: 2 classes of 2nd year secondary school students, one class considered as a control (A) and the second as an experimental class (B).

The authors worked face-to-face following the content pedagogy with group A and experimented with the flipped classroom pedagogy via the M-Learning model with group (B).

We worked on a digital space via mobile devices to provide an effective aid to the production of learning situations and to know at any time the level of learning of each learner via an evaluation that is done as each part of the course sequence unfolds.

The scenario is based on the realization of distance learning courses integrating activities to be carried out by the students, a series of tasks carried out in the classroom, and a set of activities in the form of quizzes in the digital space at the end of each theme. The execution of these quizzes is time limited (three days to complete the test) with two attempts. Thus, learners provide feedback to reinforce their knowledge and for a good continuation and progression of learning.

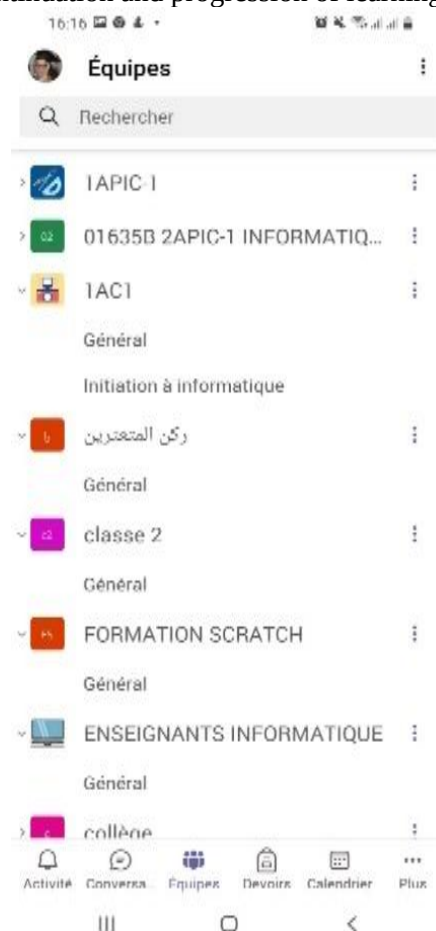


Fig. 3 The interface of the MS Teams mobile application

Before the start of our study, we conducted a diagnostic learning assessment for both groups of students to get an idea of their starting levels.

Five face-to-face sessions were conducted for group (A). The same number of face-to-face sessions was conducted for the experimental group (B).

To measure the evolution of learning and the degree of motivation among the learners after the integration of the flipped classroom using M-Learning, we opted for two types of data collection tools, namely the learning test and the questionnaire.

1. The purpose of the learning assessment test before and after the experiment was to measure the rate of change in the learning of each learner.

2. The questionnaire measures the degree of motivation among learners.

It was developed according to the ARCS model [18], which is based on 4 criteria: Attention, Relevance, Confidence, and Satisfaction rated on a scale of 1 to 3 (3 = "agree" - 2 = "Neutral" - 1 = "disagree").

3. Results and Discussion

3.1. Contribution of M-Learning and the Flipped Classroom to Learning

To measure the contribution of M-Learning and flipped classroom on learners' learning, we assessed their learning before and after teaching the course in question for both control and experimental groups.

Table 1 Mean and standard deviation of the tests for two groups

	The control group		Experimental group	
	Before	After	Before	After
Mean	11,56	10,6	11,49	15,03
Standard deviation	3,27	3,11	4,1	2,56

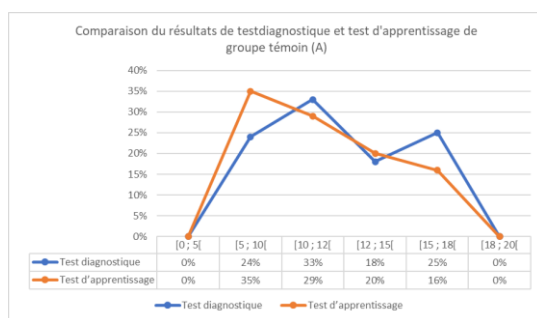


Fig. 4 Results of two tests in the control group

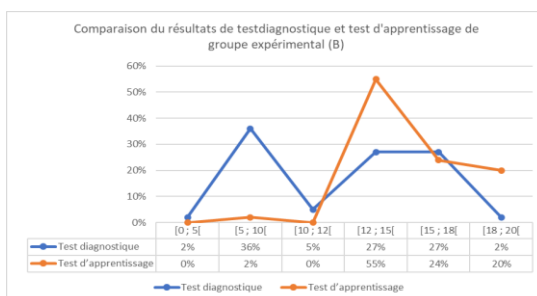


Fig. 5 Results of two tests in the experimental group

The results of the grades of the students of both groups (figures 4 and 5 and table 1) showed:

► The average grades of the two groups, control and experimental, are almost equal so the 2 groups have the same level of acquisition of knowledge related to the new course, which level remains acceptable to acquire new ones.

► There is no remarkable increase in the learning of students in group 1.

However, we note a significant increase in the level of learning among all (standard deviation = 2.56) of the students in the experimental group with an increase in the average grade from 11.49/20 to 15.3/20, especially for students who obtained a grade between [12; 15[(+28%) and [18; 20[(+18%) with a disappearance of the grades between 0 and 10.

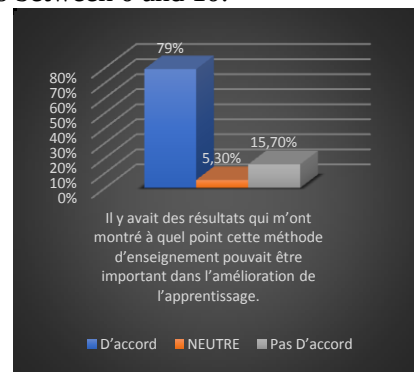


Fig. 6 The results obtained from the first criterion of the ARCS model "attention"

3.2. Evaluation of Online Motivation

In order to measure the impact of the integration of the flipped classroom via M-Learning on the students' motivation to learn more and in a continuous way, we distributed a questionnaire to the students who participated in our experiment (86 students); 57 students answered our questionnaire. The design of this questionnaire was made according to the ARCS model and includes four criteria: Attention, relevance, confidence, and satisfaction. The results are presented in Fig. 3-6 below.

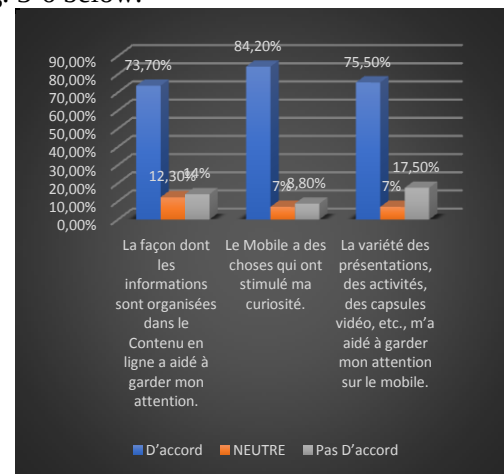


Fig. 7 The results obtained from the 3rd criterion of the ARCS model "confidence"

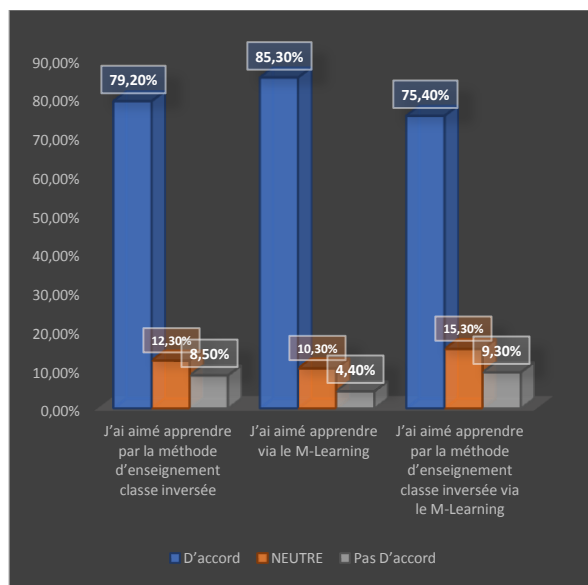


Fig. 8 The results obtained from the second criterion of the ARCS model "relevance"

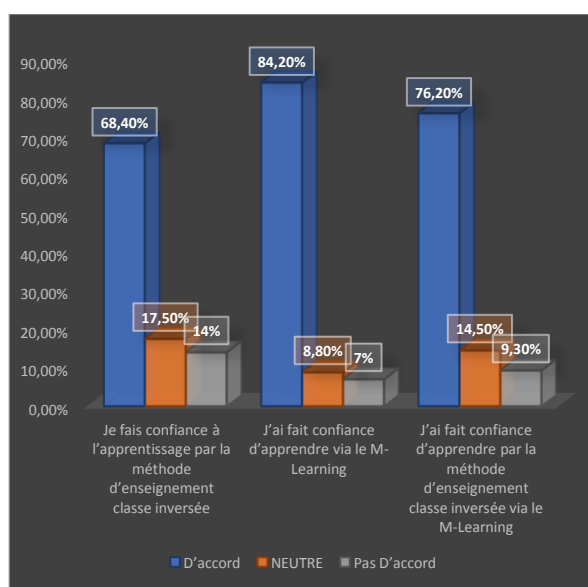


Fig. 9 The results obtained from the 4th criterion of the ARCS model "satisfaction"

From the analysis of the 4 figures above, we have raised the following results:

➤ In relation to the criterion of "Attention"

1. The diversification of digital media attracted the attention of learners (75.5%).
2. The organization of the online content attracted the attention of the learners (73.7%).
3. The ML aroused learners' curiosity (84.2%).

Thus, attention is well achieved in the case of using flipped classroom-based instruction via ML in the case of our study sample.

➤ In relation to the criterion of "relevance"

1. Flipped classroom teaching via mobile devices plays an important role in better learning (79%)

Thus, the criterion of relevance was obtained when using a flipped classroom via ML in the case of our

study sample.

➤ In relation to the criterion of "Confidence"

2. The learner trusts learning via ML (84.2%)
3. Learner trusts learning via flipped classroom (68.4%)
4. The learner trusts flipped classroom learning via M-Learning (76.2 %)

Thus, the criterion of confidence was obtained when using the flipped classroom via M-Learning in the case of our study sample.

➤ In relation to the "Satisfaction" criterion

1. The learner likes to learn via M-Learning (85.3%)
2. The learner likes to learn via the flipped classroom (79.2%)
3. The learner likes to learn via the flipped classroom via M-Learning (75.4%)

Thus, the satisfaction criterion was obtained when using the flipped classroom via ML in the case of our study sample.

The data we collected from the evaluation results and questionnaire responses show that learners are positively engaged in this experience. In addition, mobile-based activities promote positive behavioral engagement among learners.

The flipped classroom allowed learners were more attentive at a distance [19] and to be autonomous [18]. M-Learning has well-improved learners' performance [21-23] and has become more autonomous [23, 24]. On the other hand, mobility and other characteristics of mobile learning make this type of learning more stimulating without forgetting the element of play and fun [16].

The results showed that learners in the flipped classroom group had significantly higher learning scores and demonstrated greater motivation and satisfaction than learners in the traditional course group [26].

Finally, this study showed that the flipped classroom approach via the use of mobile devices improved learner motivation and learning compared to the traditional classroom approach [27].

4. Conclusion

The results showed a strong motivation of the learners integrated in an innovative pedagogical approach and a learning model that focuses on them to conduct its activities and tests online via a mobile application, which guides us to the help that learning with the flipped classroom via M-Learning has promoted the motivation of the learners and created appropriate situations for learning. This perspective of learners summarizing the existing impact on their learning and motivation explains the crucial role of innovative pedagogical practices that integrate ICT in learning and educational performance. The results showed a strong motivation of the learners integrated in

an innovative pedagogical approach and a learning model that focuses on them to conduct its activities and tests online via a mobile application, which guides us to the help that learning with the flipped classroom via M-Learning has promoted the motivation of the learners and created appropriate situations for learning. This perspective of learners summarizing the existing impact on their learning and motivation explains the crucial role of innovative pedagogical practices that integrate ICT in learning and educational performance. Similarly, the experimental results of Lin's study [25] show that a learning system based on tests delivered online via mobile was useful for learners to improve their cognitive engagement. The same study [25] highlighted that this pedagogical approach generated motivation and positive perception among learners toward the use of innovative tools for learning support.

In addition, some students in our study did not have sufficient financial and material means to follow this type of teaching properly, which influenced their commitment to follow the course easily according to this approach. Thus, a complementary study on a sample of students from the private sector will be conducted later to overcome this parameter of social inequality in our research.

However, teacher training on active pedagogies, especially on flipped classrooms and flipped mobile learning, is essential to the success of this type of teaching. A commitment and investment from the Moroccan Ministry of Education is essential to succeed in this type of teaching in order to guaranty the appropriate environment to do so.

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