An Overview of Adaptive E-Learning Systems

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Abstract*: There are a number of different ways to implement adaptive e-learning systems. One common approach is to use a learner model to track the learner's progress and identify their strengths and weaknesses. The learner model can then be used to select appropriate content, provide personalized feedback, or adjust the difficulty of the material. Another approach is to use adaptive navigation, which allows learners to choose their own path through the learning material. This can be based on the learner's interests, prior knowledge, or learning style. Adaptive e-learning systems are a promising new technology that has the potential to improve learning outcomes. However, there are a number of challenges that need to be addressed before adaptive e-learning systems can be widely adopted. One challenge is the cost of developing and implementing adaptive e-learning systems.*

Keywords: Adaptive learning, e-learning, context parameters, learner characteristics, intelligent tutoring systems, adaptive hypermedia systems.

I. INTRODUCTION

Adaptive e-learning is a type of e-learning that uses artificial intelligence and machine learning to adapt the learning experience to each individual learner. This is done by collecting data on the learner's progress, preferences, and learning style, and then using this data to personalize the content, activities, and assessments.[1]. There are many benefits to using adaptive e-learning. First, it can help learners to learn more effectively by providing them with content that is tailored to their individual needs. Second, it can help to increase learner engagement by making the learning experience more personalized and interactive. Third, it can help to improve learner outcomes by providing them with the support they need to succeed.[2]

In this perspective, the contextualization of learning is a new paradigm for adaptive systems in order to remedy the traditional learning limits [3] which is no longer able to provide interactivity, real-time execution, self-control, personalization of educational content, adaptive format of presentation and learning navigation. Adaptive systems aim to adapt the learning's traditional approach in order to satisfy the learners' needs [4].

The main objective of this paper is to study the concept of adaptive learning, to define its dimensions and to analyze the systems developed since 1960 up to 2023. To achieve this objective, we must ask the following questions: What is an adaptive learning system? What is the architecture on which any adaptive e- learning system is based? What are the approaches that we can use to implement these models and architectures? And finally, what are the typical solutions for each approach?

II. ARCHITECTURE OF ADAPTIVE E-LEARNING SYSTEMS

We have summarized the main components of adaptive e- learning systems that we present in the following diagram(figure 1):
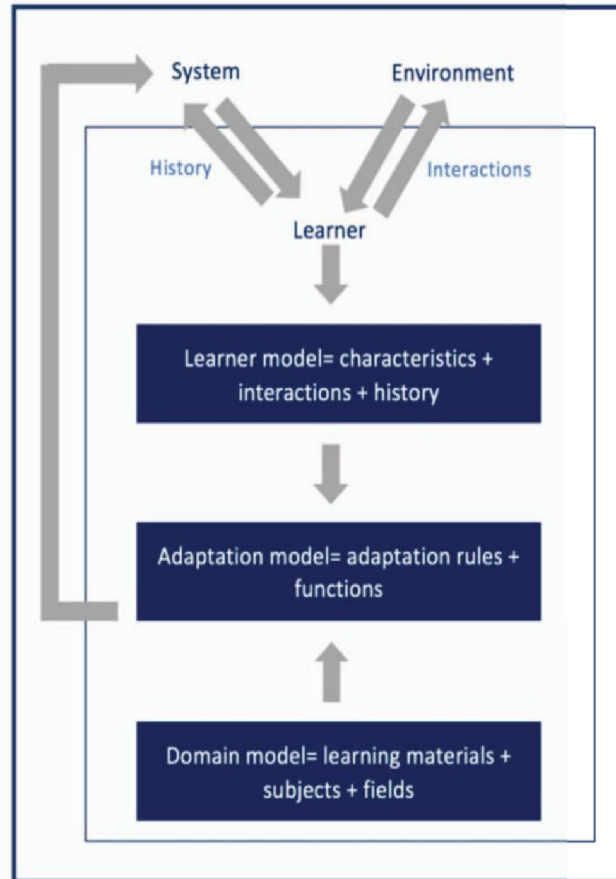

Figure 1: adaptive e-learning systems' components

III. CONCLUSION

In this paper, we have presented the mechanism of adaptive e-learning systems based on the concept of contextualization. We have highlighted the main components of adaptive e- learning systems represented in the source, target and adaptation path. We have also discussed the architecture of these systems composed of three main models (learner, domain, adaptation). Adaptation approaches were also presented by detailing the different theories and existing implementations. Finally, we have discussed an overview of the contributions made in this research area during the 2010- 2017 period.

We can conclude that the development of information and communication technologies, and in particular internet and web technologies have a great impact on the educational sector, making adaptive e-learning possible and necessary. However, the huge number of available resources makes learners lost. In the majority of cases, they become demotivated since their first use of the system. Furthermore, learners are most of the time in mobility, which slows their learning process down when they use an e-learning system.

In this context, the authors in [14] state that the challenge of adaptive e-learning developers is to find the learner characteristics that are crucial for an effective learning and to show the influence of these characteristics on the process and the learning performance. Currently, there are several methods and techniques to model the learner. The choice of methods depends on the solution's objective and the desired result as well as the effectiveness of the technique.

Concerning mobility issue, researches are currently oriented toward mobile learning (m-learning) which can provide learning resources anywhere and at anytime [17]. It represents a modern-day generation which prefers the use of mobile devices. This topic will be discussed in our future work

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