Pedagogical Approaches in Adaptive E-learning Systems

1st Humam K.Majeed Al-Chalabi
Automatics Computers and Electronics Faculty
University of Craiova
Craiova, Romania
hemoomajeed@gmil.com

2nd Aqeel M.Ali Hussein
Automatics Computers and Electronics Faculty
University of Craiova
Craiova, Romania
aqeel.hussein.it@gmail.com

***Abstract*—the mass individualization in training communities and education is the next big development in the system of education. In the contemporary world, this school of thought and practice is generally accepted in most education systems across the world where the performance of the students is enhanced via the available numerous e-learning platforms to fit various individual requirements. The e-learning platforms have allowed the students to get the knowledge as dictated by their passion and talents. Putting the interest of the students at heart while creating the e-learning platform has not only enabled success in the performance in class but has also enabled an interactive session with the various stakeholders who are keen to understand the very context of talent growth. Through analysis of many studies, this excerpt investigates the various pedagogical approaches to distance education techniques like the micro-conforming methods, the macro accommodative approaches, personalized adaptive education systems, the constructivism approaches, and the aptitude– management interface methodologies.**

Keywords— personalized adaptive learning approach, micro-adaptive approach, macro adaptive approach.

I. INTRODUCTION

In the past decade, the mass individualization in training communities and education was seen to be the next big development in the system of education. In the contemporary world, the school of thought and practice is generally accepted in most education systems across the world where the performance of the students could be enhanced via the various personalized e-learning platforms [1]. Distant learning platforms have allowed the students to get the knowledge as dictated by their passion and talents. Putting the interest of the students at heart while creating the e-learning platform has not only enabled success in the performance in class but has also enabled an interactive session with the various stakeholders who are keen to understand the very context of talent growth [2] [3]. The learning platforms have also created an environment of extensive research where the students billions of research materials to engage them in in-depth research and analysis [4]. Even, in the dispensation of various skills and knowledge across the various students, it is imperative to look into the pedagogical approaches to adaptive distance education [5]. One of the major challenges is as a result of the compatibility of such approaches to the effectiveness in the learning process. The contextual analysis of such approaches will bring on board their pros and cons in addressing various educational system issues with keen attention to the role of trainers and students in developing and reaping more from such learning systems. In this analysis paper, therefore, there is an investigation into the Pedagogical Approaches in Adaptive distance learning education. Accordingly, the educational techniques like the micro-conforming methods, the macro accommodative approaches, personalized adaptive education systems, the constructivism approaches, and the aptitude – management interface methodologies are discussed in detail. The similarity and differences of such approaches are discussed with keen attention to their contribution to the improvement of the e-learning systems.

II. THE PEDAGOGICAL APPROACHES TO ADAPTIVE E-LEARNING SYSTEM

A. The macro accommodative approach

This approach considers the notion of adaptation by permitting various alternatives for the choice of curriculum content, learning objectives, and the distribution channels founded on the student's outline and traits [6]. These features are such as learning or cognitive styles, delivery systems, the students' learning goals, levels of detail, and achievement levels. Accordingly, these features do relate to the context of acceptable distant learning education modes from the various processes, for example, the analysis of a precise learners wants, predefining the preconditioned learning materials for the student and the provision of the instructional prescription for such students [7] [8]. It is also quite important in the definition of the learning content and creation of an adaptable environment for the students with regards to the construction and achievement of students' goals and objectives that suit the students' abilities and needs [9].

The early efforts to subject the instructional process to various students in the school educational system were undoubtedly macro level since the students were simply categorized or monitored by the scores or the grades from the ability test [10]. This ancient homogenous grouping had a small impact since the group rarely received a different kind of instructional treatment [11]. In 1900, however, various adaptive systems were brought to existence to help accommodate different student abilities [12]. These systems could go ahead to segregate the students according to their abilities, objectives for learning, and the type of skills they are interested in [13]. Accordingly, the Dalton Plan, the Burke plan, and the Winnetka plan were brought to existence in the early 1900s where their major adaptive feature was to allow the student experience and understand the various educative resources at their speed and ability [14]. The creation of the macro-adaptive instructions is usually utilized within a course to help in the variation of lesson set-up's, especially where there are huge sections of guidelines [15]. Usually, it entails the repetition of the order of narrative processes introduced by the instructor's behaviour within the context of the classroom [16]. This notion would, therefore, for example, entail a typical teaching pattern where; the explanation or representation is done through specific information, questions

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are asked to gauge the student learning and, the provision of the appropriate feedback for the responses of the students [17].

Within context learning, therefore, the macro-adaptive approach creates an essential part in the provision of the knowledge to the students at a basic level where almost all the students fall in such categories [18]. The instructional design as connoted within the e-learning platform is almost the same to address a specific learning point to the masses of students across the institutions of learning [19]. Specialization at this point is not warranted as most students are at their basic level where they are supposed to gain basic knowledge that would guarantee a whole lot of fundamental skills across the board [20]. For example, in the university context, there are various common units that the students must take before going through their specialization. Accordingly, the macro-adaptive approach has been quite essential in making the teaching and learning of such units a success due to its broad-based nature across all the student fraternity [21].

B. The Aptitude–Treatment Interaction (ATI) Approach

The suggestion brought out in this approach emphasizes the different instructions and media for different students. Accordingly, this approach is very instrumental when dealing with specialization for the students with regards to skills, abilities, and talents they own across the board [22]. The fundamental basis for this approach is that the learning effectiveness and forecast of educational results are enhanced when the student's aptitude is paired with the appropriate treatments [23]. The approach, therefore, acknowledges the need to put the students' preferences and tastes into consideration during the academic process. [24]. Proper growth and progression of talent across the board would, therefore, be substantially important when it comes to the implementation of the adaptive learning system [25].

Therefore, the major proposition of the ATI is to create a profound link between the student's learning and aptitudes. Accordingly, the major aim of the skill management interface approach is it aids in dealing with means of mechanism on the study methods [26]. It is advantageous and efficient to put boundaries on scholars with limited previous information [27]. Some aptitude classes acknowledged in the ATI research across various studies are such as; intellectual abilities (mathematical abilities and reasoning abilities) and the student prior knowledge [28]. In the comprehensive research about the impact of various variables like the control and feedback among students, it was found that the metacognitive abilities are also deemed to be of great significance to the ATI system [29]. The recent lessons on the ATI approach also confirm that the cognitive processing capacity has a substantial effect on the skill's interaction. Hence, the advancement of the distant education methods has incorporated in the effects of intellectual burden philosophy into the various instructional designs being developed [30].

The transformation in the aptitudes among the students during the process of learning suggests that the power of diagnostic of the presumed aptitude variables for assessing the learning needs, inculcating treatment of instructions, decline as learning continues [31]. However, the on-task performance diagnostic power would increase since it revealed major integrations, updated replica skills, and the various challenges experienced during the educative process. The job presentation standard when beginning sessions are usually lower than at the end of the same sessions [32]. The major reason for this for most students is the gap of knowledge at the beginning and the end of the session. The difference is as a result of the limited perception of the instructional and unfamiliarity with the design before or after the learning process, this creates the distinctions required to boost the knowledge of students across the board [32]. Work presentation in the earlier educative processes is not as formidable as they would be in the advanced stages, this is because the scholar's knowledge is limited as to the requirements and the expectations arising out of it. They may also doubt their capabilities with the duties at hand. [33]. As a result of the various factors, it would be important to embrace logical skills and experience over job performance during the start of the tutoring to maximize outcomes for the scholars.

C. The Micro-Adaptive Approach

Here, there is the investigation into the specific needs of the students and tailoring the instructional design and prescriptions and tactics that suit such needs across the board. Accordingly, the micro-adaptive instructional systems usually rely on the task as opposed to pre-task measures. One of the most appropriate examples of this approach is the Intelligent tutoring systems (ITS). When considering the macro accommodative approach, differentiation of various tutorial activities is utilized across expansive sections during training [34]. Besides that, micro-conforming instructions usually utilize the constantly changing student abilities and character, particularly the actively transforming like the response errors, affective states, and feedback expectancy. Observing the scholar's performance and behaviour can be utilized to enhance educational recommendations like the sequences and also the treatments at a redefined measure.

Consequently, a lot of the micro-conforming methods fine-tune the materials for learning (amount, demonstration, and structure) when passing instructions arising from the measurable depictions of the student's characteristics. Research confirms that the micro adaptive models usually depict a superior power of diagnostics on the on-task performance measures to pre-task measures and the bigger impact for response reactive schemes associated with various ATI (Aptitude treatment Interaction) techniques [33]. Learner's working response and performance on a given issue is a depiction of the joint impact that includes variants, both unidentifiable and identifiable, encompassed by the scholars' response generation during the learning activity. One of the disadvantages of ATI approach is the adaptation

ATI approach is the adaptation of the directional procedures on both or either of the chosen skill variables, this is without considering the learning outcomes caused by the combined results of various unrecognizable and recognizable skill variants in various contexts of connection with the multifaceted educational needs. It is also worth noting that some skill tenets found in the learning activity are temporal, whereas some are stable. Noting down every variable of aptitude coupled with consequential connections with the educational assignment needs is seemingly difficult.

D. The Constructivist–Collaborative Approach

This approach emphasizes on the constructivism in learning which indeed, incorporates the suitable design mechanism of knowledge representation, decision, and reasoning. Additionally, it accentuates the collaboration through grouping at an adaptive level [35]. The computerized collaboration has been promoted by social media and network 2.0 implemented in customized education. One of the

essentials in collaborative learning the fact that the students can interact in real-time and discuss the pertinent matter on educational activities and come to a consensus on such issues that enhance education from different levels of investigations [26]. The community platform created for discussion purposes has created a platform where the students learn from their fellow members and carry out research on various aspects of the learning curriculum independently and discuss such issues jointly. The instructor in this context becomes the moderator and gives professional directions on the context and scope of discussion in a scheduled manner. The students would then research the topic of discussion and give their opinion about the same [34]. The students would also be allowed to give responses to the various discussion points of the fellows with keen attention to correcting and improving on such issues as they may affect the learning process.

III. Personalized Learning Approach

One of the most emerging issues in the world of technology is personalized learning as a salient approach to adaptive learning [36]. Personalized learning is spearheaded by two types of smart learning technologies which are smart devices technology (internet of things and wearable devices) and intelligent technologies (like cloud computing and learning analysis). These two sets of technologies have been quite crucial in enabling personalized learning where every student has access to various learning materials that can be accessed in real-time regardless of geographical location as long as these students have the right device [37]. Accordingly, the smart learning environment has enabled the inception of a situation where the students can have features of recognizing learning scenarios, tracking learning processes, connecting with the learning communities, awareness of the physical environment, natural interaction, and adaptive function [38]. This move allows the students to have more effectiveness, flexibility, adaptation motivation, engagement, and feedback [36].

The coming up of the personalized adaptive learning is because of the increase in big data technology, information is generated in multifaceted ways and at faster speeds than before with exponential spread abilities [39]. Under the impact of a scientific data-intensive environment, personalized adaptive learning has been ranked as the fifth-generation educational technology research paradigm. Laying the foundation on the big data, personalized adaptive learning has become a critical part of the digital learning environment [40]. Through the inception of the capabilities of the big data, the students can gain much from the educational system with regards to being exposed to numerous sets of important information across the internet [38]. The world of technology has enabled the fastest access to billions of datasets that are accessible via the internet platform without regard to any geographical distance [41]. Accordingly, much emphasis is laid on the personalized adaptive learning where the learners can gain access to the information that suits their preference with regards to the knowledge base they would need for their consumption and improvement of their skills and talents [42].

IV. Conclusion

In summary, educational and learning platforms have undergone numerous transformations as influenced by various factors such as technology and the growth in knowledge across the board. In adaptive learning, various pedagogical approaches to adaptive learning such as micro and macro-adaptive approach have been discussed in detail with keen attention to how they affect the learning process. The personalized adaptive approach is brought to existence as a result of the big data that promotes not only diversity in knowledge empowerment but also creates an ambiance of specialization in the learning process and talent growth. The use of intelligence systems as noted in the ATI approach is also noted to have a far-reaching effect on both talent development and knowledge empowerment among the students with keen attention to the desired objectives and goals of such students.

This study found that there are three main adaptation methods are widely used in adaptive e-learning systems. They are Macro-adaptation, Micro-adaptation and aptitude treatment adaptation. Macro-adaptation is a static adaptation that allow students to learn at their own pace. Micro-adaptation on the other hand, is a dynamic adaptation that monitor student's behaviour in the time of using the application and the system will adapt accordingly such as changing links or colours. Finally, the Aptitude treatment adaptation method is the approach where the students see different materials based on their skills and level. Which makes the combination of these methods deliver fully adaptive systems.

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