ADAPTIVE EDUCATION – A SYSTEMIC VIEW
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Abstract
From ancient times, it was observed that students react differently when they interact with a teacher, namely, some need encouragement, other have to be scowled, others can concentrate better whereas others cannot, students are unique, as human beings, but also from a cultural and educational point of view. At the same time teachers have their own characteristics as a human being but also from an educational and cultural stand point. A class is represented by a group of individuals who are unique in their own way, students and teachers alike, who are gathered together for the same purpose. The teacher, abiding by the curriculum, must adapt its method of teaching according to the class, the objective being, to determine students to learn to adapt to any given instruction. By employing his own methods of thinking and understanding, the student must go beyond the information given by the teacher. The cycle of adaptation, teaching and self-teaching is essential towards the long term development of the academic skills.

The adaptive edusystem is composed from adaptive teaching and adaptive learning, the adaptive teacher and adaptive class/adaptive student. The adaptive edusystem is useful for students, teachers and institutions, both in order to support the educational process, as well as for facilitating the process of integration into society, of the students that have finished their studies.

The objective of this paper is to analyse the educational system as an adaptive system in which the inputs in the educational system are the students, who have different educational and cultural background, and the outputs of the educational system are the workers that are adapted to the current requirements of the labour market.

The analysis will be made using the following methods: 1) historical, through which adaptive education will be tracked from the beginning until the present day; 2) theoretical, through which will be explained both adaptive education as well as the adaptive management theory; 3) the comparative method, were the traditional education will be compared with adaptive education; 4) the economic factors, political factors, social factors, the internet etc. such factors that influence the educational system will be analysed; 5) analytic, through which the adaptive professors, the adaptive students and the adaptive class will be describe.

The expected result of the analysis is to show that the educational system due to the internal and external uncertainties that it faces, must become an adaptive system. Thereby, the student when he enters this new system he notices that the training is uncertain, the direction to which they are heading is unclear, legislation in the field is constantly changing and the teachers have great expectations for the students. At the ending of the studies, the uncertainty degree rises due to the economic, social and politic situation that does not allow easy access to jobs in the field they trained in. The adaptive edusystem constitutes a way of improving the current situation of the educational field, so that we can have adaptive teaching and learning but also adaptive teachers, students and classes.

Applying the principles of adaptive theory and creating the adaptive edusystem can be a good treatment for remedying certain problems that the higher educational system faces, but cannot be considered a panacea.

Keywords: Education, adaptive edusystem, adaptive theory, adaptive teacher, adaptive student.

1 INTRODUCTION
For the question “what is learning?”, authors Murray and Pérez answered that it is a "pithy question" and that researchers and philosophers have investigated and debated the numerous nuances of this question and at the same time "learning theories and teaching methods must evolve in concert with our brains as technology mediates our interaction with an increasingly complex, information-rich world."[1]
What is the learning environment? Although the learning environment can be defined as physical locations, contexts, and cultures in which students learn, to answer this question we still start from the example given by authors Cayer, Baker and Weschler, "in the swamp, the legs are uncertain, the direction is unclear, the land is constantly in motion, and the alligators are hungry"[2] and we also compare the learning environment with life in a swamp due to the uncertainties that the student faces. Thereby, when the student enters the education system (information-rich world), observes that the training is unsure (the legs are uncertain), the direction to which they are heading is uncertain (they do not know if they will find jobs after finishing school), the legislation (sand) in the field is constantly changing and the teachers have high expectations from their students (alligators are hungry). Adaptive learning systems “adjust to a learner’s interactions and demonstrated performance level, and subsequently anticipate types of content and resources learners need at a specific point in time to make progress”[3], at the same time the system itself is permanently adaptable, it “responds in real-time to each individual’s performance and activity in the system and that maximizes the likelihood that a student will obtain his learning objectives by providing the right instruction, at the right time, about the right thing.”[4] Adaptation inside the framework of adaptive learning systems "is achieved through multiple loops of feedback, creating possible continuous improvements of the internal processes of learning and accountability". [5]

In the described context, the paper presents a short history of adaptive learning, some theoretical aspects of adaptive learning and of adaptive management, the factors that influence learning, the definition of the terms adaptive teacher, adaptive student and adaptive class and in conclusion a comparison is made between the traditional and adaptive methods of teaching.

The internal and external uncertainties that the present educational system is facing, contributes to the necessity of adapting this system to the present and future realities, this adaptation being also the purpose of this paper.

2 SHORT HISTORY OF ADAPTIVE LEARNING

From ancient times it was observed that students react differently to the education system and so teachers must adapt their teaching techniques according to the differences between students, in this sense Corno cites Quintilian "who wrote this passage in the 5th century BC: Some students are slack and need to be encouraged; others work better when given a freer rein. Some respond best when there is some threat or fear; others are paralyzed by it. Some apply themselves to the task over time, and learn best; others learn best by concentration and focus in a single burst of energy. (Quintilian, trans. 1921).”[6]

The bases for learning adaptively, although it was not named so, have been established by Cronbach, he showed teachers, that similarly to genuine doctors, they must “find for each individual the treatment to which he can most easily adapt”. [7]

Anderson uses the term “adaptive education” and she shows that the idea of adaptive education is simple, thusly “Suppose, as is the case in the vast majority of schools, that students enter a particular instructional setting possessing a wide variety of abilities, skills, knowledge, attitudes, and values. Some students possess the abilities necessary for success in the instructional setting; others do not.”[8], but, at the same time the learning environment is a complex structure “that includes many students who have different characteristics. They physically and mentally are different, so do their preferences. Thus, adaptation to these differences in educational environment is a necessity and adaptive learning environments provide systems to achieve this.”[9]

3 THEORETICAL ASPECTS OF ADAPTIVE LEARNING AND ADAPTIVE MANAGEMENT

The adaptive learning theory, according to Murray and Pérez, “can be conceptualized within the informing science theory framework. In this light, an adaptive learning system can be seen as an expression of an informing system wherein the informer is the instructor, the client is the student, and the rule-based adaptive engine both informs and is informed by interaction with the client” [1], at the same time adaptive management can be characterized as learning from practicing teaching and it "is a formal iterative process of resource management that acknowledges uncertainty and achieves management objectives by increasing system knowledge through a structured feedback process.” [10]
In adaptive systems there is a unique relationship between theory and practice “theory and practice are not separate or different, but are interconnected, being two faces of the same process, and are dependent upon each other”. [11]

In the field of education, adaptive management (fig. 1) has 2 steps, in the first step decisions are taken (the teacher plans his activities, deals with the curriculum, with the methods and teaching strategies and decides what he must do, and the student deals with establishing what he wants to do, what goals he wants to reach, he also establishes his own evaluation criteria for the work he will do and makes a decision) and the second step is learning from practice (the teacher deals with teaching, with monitoring and evaluating the students and also deals with adjusting the applied teaching methods and strategies, and the students attends courses, seminars, he documents himself and learns, he also monitors his actions and activities, he self-evaluates and according to the results of the evaluation he adjusts his future actions through feedback).

4 FACTORS THAT INFLUENCE ADAPTIVE LEARNING

Adaptive educational systems are influenced by a series of factors, like the following: the government, the students, the study disciplines, infrastructure, evaluation, the teachers, the technique and technology etc.

The government interferes “in educational practices through his educational policies which are often more political than educational.”[12] The political parties that are part of the ruling coalition impose their vision in formulating, developing and implementing the education curriculum and only slightly taking into consideration the future needs of the society. The legislation in the educational field is modified every time the ruling coalition changes or when the minister of education changes. Authors Ikwumelu, Oyibe and Oketa note that also by monitoring the teachers by the government through specialized institutions leads to the bureaucratization of the education and to encouraging rigidity and conservatism in teachers.

The number of students that go to courses has grown in the last period of time, fact which hinders “the teacher in giving adequate attention to individual learners in the classroom interactive sessions” [12], this raised number in students makes applying adaptive education almost impossible.

The emergence of new problems at an international level, like: the refugee crisis, terrorism, the exploitation of children, hunger etc. have led to the appearance of new disciplines in the curriculum, that explain these problems, although “this infusion though relevant to the society has caused content overload in education system.”[12]
The educational infrastructure, that includes class rooms, furniture, library, the education technique and technologies etc., do not allow the development of an adaptive educational system because they cannot be arranged and rearranged in order to answer "to the varying educational needs and competencies of the learners."[12]

The classic evaluation is the same for all students, and the evaluation methodology is established in time, these facts does not allow it to be so that "each learner’s assessment to be based on his or her level of understanding and at the same time present him or her with an opportunity to choose from a number of evaluation/assessment methods."[12]

Insufficient training and also adding the small salaries in the state education system, leads to low quality in teachers “Adaptive teaching requires highly motivated conscientious and efficient classroom teachers that must be constantly and appropriately trained and re-training via seminars, workshops and in-service course in the contemporary global trends in pedagogic practices.”[12]

Through the sophistication of the educational technologies “available to a personalized learning approach, it has become easier to deliver student instruction and make accurate assessments on a continuous basis.’[13]

5 THE ADAPTIVE TEACHER, THE STUDENT AND THE CLASS

In the educational system an important role has the teacher, he deals with the planning, the curriculum, the teaching methods and strategies, but also „his psychological disposition, socio-economic status as well as the level of his physiological wholesomeness and educational background influence and sometimes even determine what an educational practice is or should be” [12], all this contributes to the increase of uncertainty of the educational system. The adaptive teacher according to Borich “applies different instructional strategies to different groups of learners so that natural diversity prevailing in the classroom does not prevent any learner from achieving success”[12] and at the same time he “wants as many students as possible to benefit from the instruction provided to the whole group”[6] by making “a symbolic area at the centre of the teaching ground, a space for easiest teaching; adaptive teachers aim to keep the most number of students within that centre to capitalize on skills across the class, challenge students to share experiences, and develop aptitude.”[6] At the same time the non-adaptive teacher “tends to remake tasks or items to fit what they were doing” [6].

A student is essential for the functioning of the educational system, he is unique in terms as race, gender, development, culture, intellectual capacity, socio-emotional personality, linguistic environment, socio-cultural environment, and he has special educational need. The adaptive student is vulnerable, when faced with pressure and social authority, he searches to solve problems not to create them, and he uses his own methods of thinking and understanding and looks to go beyond the information given by the teacher by using his own methods of thinking and understanding. For a student to learn that he must learn from practicing learning and to learn to negotiate are fundamental abilities in life.

A class represents a sum of unique individuals, students and teachers, brought together for a common purpose. The teacher, abiding by the curriculum, must adapt its way of teaching according to the class, the objective being to determine students to learn to adapt to any given instruction. If teachers do not give proper attention “to aptitude development in classrooms, then students remain dependent on teachers for knowledge building throughout schooling.”[6]

6 COMPARISON BETWEEN THE TRADITIONAL EDUCATION AND THE ADAPTIVE ONE

In a traditional class “much of the work that the students do is invisible to the teacher. For some aspects, such as homework problems, teachers can observe the results but are often severely limited by time constraints. In other cases, such as comprehension of assigned readings, the students’ work is invisible to the teacher and can be observed only indirectly and with significant effort.”[14] At the same time the educational system is considered adaptive “if it is capable of: monitoring the activities of its users; interpreting these on the basis of domain-specific models; inferring user requirements and preferences out of the interpreted activities, appropriately representing these in associated models; and, finally, acting upon the available knowledge on its users and the subject matter at hand, to dynamically facilitate the learning process.”[15]
The authors Papousek and Pelanek mention that "adaptive educational systems have the potential to make learning more engaging by keeping students in the concentrated flow state" [16] unlike the traditional education system.

Murray and Perez [1] have made a comparison between the classical and adaptive system, they have studied two groups of students that have enrolled at an introductory course of digital alphabetization that took place over a period of 2 academic semesters. The first group composed of 105 students used adaptive exercises and tests, and the second group composed of 113 students used traditional exercises and tests. At the end the results obtained were compared. The results did not differ significantly between the two methods of teaching. From the comparison, according to the authors, results that the adaptive education has a negligible impact on the education results.

At the same time Hollister, an assistant professor, who implemented the MyMathLab's Adaptive, powered by Knewton, says that in order for the adaptive education system to be successful "it's important that the Adaptive Study Plan is set up correctly". [17]

Learning from practice and from mistakes represents the essence of the adaptive edusystem, in contrast to the classical teaching that does not allow errors and does not note them as experiences from which students and teachers can learn.

The adaptive edusystem is composed from adaptive teaching and adaptive learning, the adaptive teacher and adaptive class/adaptive student. The adaptive edusystem is useful for students, teachers and institutions, both in order to support the educational process, as well as for facilitating the process of integration into society, of the students that have finished their studies.

To avoid the uncertainty of finding a job and in order to offer students a good quality education both theoretical and practical, the universities can sign contracts with public institutions or private firms and so ensuring an "administrative convergence" [18] for a common purpose, in order to ensure the practical training of students and a bigger compatibility with future work places. Thereby an externalization of values is achieved and not an “internalization” [19] of these values. In this sense authors Pool-Funai and Hansen, from the Southern Utah University, mention that "students become engaged in personal learning outside of the classroom environment by applying knowledge in practical, hands-on ways, and critical thinking plays an important role in learners' success" [20] through Kolb’s learning cycle (Experience, Reflection, Thinking and Acting). Students, "relate each step to experiential learning opportunities in public administration." [20] The student, during his internship, he can become aware of existing problems, in the public institution, these problems will be analysed in an activity report, report that will be presented to the leader of the institution. In case the analysis made by the student represents a failure, this problem "can be a tremendous launching pad for new and better ideas."[21], the failure being also the essence of the adaptive system, namely, that failure has value. Failure is not something someone wishes to happen, but everyone can learn from a failure and it follows that failure, in this context has value. The internal policy for reforming teaching through practice, of the Southern Utah University can be taken also by other universities because "valuable lessons can be transferred even if the conditions are not always similar". [22]

7 CONCLUSIONS

The objective of this paper is to analyse the educational system as an adaptive system in which the inputs in the system are the students, who have different schooling and cultural background.

The aim of this paper is to underline the necessity of adapting the present educational system to the present and future realities.

The classic educational system faces multiple uncertainties, these are felt, firstly by the students that do not have the insurance that at the end of school they will find jobs in the filed they have studied and secondly by the teachers that must adapt their teaching according to the particularities of the students. In the face of these problems, there is not a single answer; they cannot successfully transplant functional structures to replace the non-functional ones. Before implementing any solution, it is a needed, to see what works and what does not work and most importantly, is the recognition of the fact that there is uncertainty, that there are errors. For reducing uncertainty, adaptive management must be used and also adaptive systems must be build that have as a foundation the reduction of uncertainties, and the errors that result from the education process must be firstly recognized and secondly analyzed through feedback, the results of the analyses must be used to avoid making similar mistakes in the future. The studies based on the errors that appeared as a result of the educational
process and the solutions found for avoiding them must be published in order for the decision makers, from all over the world, that are responsible with education, to be made aware of them and to not repeat them. Applying the principles of the adaptive theory constitute a good treatment for remedying some problems that the education system faces, but, according to an analysis, this is only a panacea.

The building of adaptive educational systems will continue in accordance with the development of new technologies, this fact is very important, but, the essence of the future of adaptive education is constituted by evaluating these systems, not only “building a boat and not taking it in the water”: [23] In building adaptive educational systems the most important aspect is that not technology must be primordial but pedagogical science must be.

REFERENCES


