ISSN: 4811 - 2683
Volume 9, Number 2, 2022
International Journal of Innovations in Management and Development Studies

ADAPTIC LEARNING AND LEARNING ANALYSIS

Oguzo, Ndubuisi and Akpelu, Frankline Ekwueme Ph.D
[1]Ph.D Student, Department of Business Education, [2]Department of Educational Management, [1&2]Faculty of Education, Ignatius Ajuru University of Education, Port-Harcourt, Rivers State, Nigeria

ABSTRACT
Adaptive learning, also known as adaptive teaching, is an educational method which uses computer algorithms as well as artificial intelligence to orchestrate the interaction with the learner and deliver customized resources and learning activities to address the unique needs of each learner. The goal of utilizing Adaptive Learning was to increase student retention levels, and increase efficiency for both students and teachers. Learning analysis on the other hand, was found to be aimed at addressing "how to learn." According to the activity theory, learning can be divided into three levels hierarchy: activities, actions, and operations. The learning activity can be seen as a sequence of learning behaviors. Due to the differences in individual characteristics such as the learner's learning style and knowledge level, the learning activities are also different. Exploring the learner's potential learning patterns with techniques such as educational data mining and machine learning is the key to achieving the recommendations of a personal learning path. This paper thus discussed the core concepts of adaptive learning and learning analysis.

INTRODUCTION

For many years, education has been thought of as a process led by teachers or tutors, who set expectations that students have to meet. Today, a shift towards the concept of learning is underway. Literature attributes the cause of this evolution to the changing desires of learners, which of course is adjusting the training process to better suit the students (Riseup, 2022).This change is summed up by the rise of adaptive learning, an approach that focuses on personalising educational content so as to address each individual's needs and preferences (Riseup, 2022).

Adaptive learning arrived on the educational scene in the 1950s. Behaviorist, B.F. Skinner, is credited with creating the method. Skinner constructed a teaching machine that focused on effectively teaching new concepts instead of reinforcing memorization (Teasley, 2015). The machine worked by allowing the student to practice new concepts by answering questions. If the question was answered correctly, feedback and positive reinforcement was given. If the answer was wrong, instead of just having the student try again, smaller steps were taken towards the right answer through a series of small hints. This allowed students to not only study at their own pace, but also receive immediate feedback so they could see how they were doing. Since then, adaptive learning has been integrated into various different fields outside of just education (Teasley, 2015).

Understanding the characteristics of learners can help shape the design of the course. Thus, learning analysis comes into play, which entails the process of identifying critical aspects of the learner, including demographics, prior knowledge, and social needs (Adams Becker et al., 2014).

Definitions

Adaptive learning, also known as adaptive teaching, is an educational method which uses computer algorithms as well as artificial intelligence to orchestrate the interaction with the learner and deliver customized resources and learning activities to address the unique needs of each learner (Kaplan, 2021). According to Riseup (2022), adaptive learning is all about personalising education so as to meet the needs of learners. This is made possible through artificial intelligence, and is additionally informed by findings from neuroscience.

Adaptive Learning (AL) is a method that uses software as an intelligent interactive teaching mechanism that combines the provision of resources according to the unique and essential learning

requirements of each student (Jonsdottir, 2015). Computers adapt the presentation of educational material according to students' learning needs, as indicated by their responses to questions, tasks and experiences (Kaplan, 2021). The technology encompasses aspects derived from various fields of study including computer science, AI, psychometrics, education, psychology, and brain science. Generally speaking learning analytics is referred to the collection and analysis of data about learners and their environments for the purpose of understanding and improving learning out-comes. It is where big data meets traditional quantitative method in education.
It is also the measurement, collection analysis and reporting of data about learners and their contents for purposes of understanding. A learner analysis ensures that the learners benefits from a productive learning environment that can leave a lasting impact on their life long learning.
It is an area of research and practice e that uses computational analysis of learning process data to better understand and improve learning.

PANORAMA IN EDUCATION
The panorama teacher survey is designed for school administrators looking to collect feed back from teachers. Administering surveys on these topics can help strneghten the rapport between teachers and leadership and build stronger relationships within a school building. The survey ask questions that provide information on social and Emotional Learning (SEL) such as school climate, environment, teacher's performance, students performance, outcome such as results, challenges, what is lacking and what is needed etc.

LEVEL OF LEARNING ANALYTIC
(1) Measurement
(2) Evaluation
(3) Advanced evaluation
(4) Predictive and prescriptive analytics
They may all be classify as analytics but each of them are correctly referred to a analytics. They mean vastly different things in terms of complexity difficulty and power.

Examples of Learning Analytics
- Track your students process and give more, better and targeted feedback.
- Monitor your students activities in your course on-line discussion forums
- Know your students before the first class.
- Monitor students and class activity in the course site in real time

Benefits of Adaptive Learning
- **Students**

Studies continue to show the increased benefits of adaptive learning. Students felt like they had more control over their learning and demonstrated more perseverance in program tasks (Kurt, 2021). Students also show more confidence and are less dishonest in their academic work through adaptive learning (Kurt, 2021).
As reported by Kurt (2021), there are many reported benefits for students if course content is taught using the adaptive learning model:
- Students were able to choose the speed or pace at which they worked.
- Students were more motivated to complete their work due to visible progress charts.
- Students also enjoy the teacher's support and explanations during practice problems.
- Students reported learning more if the content was taught using adaptive learning.
- They experienced less stress due to the adaptive pace, as students must be ready to move on before new concepts are introduced.

- They experienced greater overall success due to their dedication to the content. Their study skills also greatly improved as they were able to control the pace and level of difficulty because of the self-paced and just-in-time nature of it.

Studies have continued to examine the benefits of the adaptive format alongside other customized learning models. These studies have shown that:

- Students have more confidence due to the personalized feedback provided, which benefits their metacognition.
- Students have a greater sense of autonomy in their learning as the custom learning plan is catered specifically for them.
- Minorities or first-generation students experienced smaller gaps in achievement. See also: Inclusive Teaching
- It is less expensive to supply resources, mainly due to the sharing of open content online as opposed to textbooks supplied by a publisher.
- There is less cheating or dishonesty; each plan is personalized to the student.
- Students are more engaged in their learning and consistently demonstrate higher levels of perseverance – Vygotsky's zone of proximal development provides an appropriate level of difficulty for each student.

It is assumed that the process of adaptive learning itself contributes to greater overall success in certain disciplines (Kurt, 2021). The adaptive model allows a variety of activities and evaluations, many opportunities for practice, and descriptive feedback from the instructor. The teacher is able to spend more time with the students one-on-one to further develop specific skills (Kurt, 2021).
The assessments are also personalized to the students based on their learning goals (Kurt, 2021). The open content used for adaptive learning usually offers data directly through web-based applications. These reports may highlight where students are struggling and which skills they have achieved. Teachers can monitor the performance of each of their students with only a quick click of a button, which enables them to spend more time with the students themselves (Kurt, 2021).

- **Organizations**

Another aspect of adaptive learning is that individual beliefs, behaviors, and understanding must be integrated into the team experience for deep learning to happen. Authors have also tested the hypothesis that "continuous adaptive learning will mediate the relationship between beliefs and individual contribution to the team" (Meisel, 2012).

Conceptual Overview

Intuitively, adaptive learning focuses on individual differences which, mainly individual characteristics, is the purpose of differentiated instruction. The definition of the Association for Supervision and Curriculum Development (ASCD) is the interpretation of this purpose: differentiated instruction is a kind of instruction that educators actively plan for the differences of students so that all students can learn best. In a differentiated instruction classroom, teachers assign their time, resources, and energy to students with different backgrounds, preparations, skill levels, and interests to teach them effectively (ASCD 2018). According to the definition of the US Department of Education, in the differentiated instruction, all students have the same goal, but the teaching methods are different (U.S. Department of education, office of educational technology 2010). It is easy to make the conclusion that both personalized learning and adaptive learning contain the concept of differentiated instruction, which in the past has been reserved for special needs students.
Furthermore, adaptive learning include two parts: individual characteristics and non-individual characteristics. The latter is actually one aspect of personal needs and personal development. According to the definition of personal needs, the gap between the current situation and the intended state of a learner, the difference of students needs is determined by the current state and the intended state. The former can be part of individual characteristics, and the latter can be

attributed to personal development. In this way, the core elements of adaptive learning can be refined into two aspects: individual characteristics and personal development. One new aspect of personalized adaptive learning is the recognition of individual learner interests and desires as relevant to education.

The above definitions of adaptive learning do not show it emphasizes the personal development of students. Therefore, individual differences in adaptive learning are mainly related to the differences in individual characteristics. Thus, the core elements of adaptive learning can be modified into individual characteristics, individual performance and adaptive adjustment. Comparing the new core elements of both learning methods, personalized learning does not mention the implementation strategies, but adaptive learning does (adaptive adjustment). A second new aspect of personalized adaptive learning is an emphasis on designs and implementations that in fact support individual development.

Adaptive learning is a computer-based education method that organizes and plans the trainings in the most appropriate way, taking into account the different needs of each student. The computer presents the educational material in the most appropriate way to the learning needs of the learner by using learning analytics. In order to reach the best practices, it monitors the behavior and experiences of the learner in their previous education and gets to know the learner. Adaptive learning environments identify learners' learning preferences and characteristics and offers appropriate learning content and interface; traditional, where the same type of teacher passes content on by leaving the model, learning is individualized to a student with the understanding of a teacher (Ocepek, Bosnic, Serbec & Rugejl, 2013). Adaptive learning environments are individualized, providing the user with a more effective learning experience thanks to the artificial intelligence algorithms they use in parallel with new web technologies offers learning opportunities (Kim, Lee & Ryu, 2013; Vandewaetere, Desmet & Clarebout, 2011). Individualized learning support, determining the personal characteristics of the system and the presentation of information is the feature of adjusting according to; hypermedia systems, intelligent teaching systems, and learning / content management systems are adaptable environments that offer individualized learning options. Mampadi, Chen, Ghinea& Chen (2011) designed a hypermedia learning environment adaptable to learners' cognitive styles. The cognitive styles of learners are based on Pask's linear-holisticserialistic classification. Learners who adopt the approach can be provided with the knowledge that can be obtained from the transfer of learning to learning experience, while the learner can finish one topic and move on to another. Individuals who prefer both approaches after entering their enterprise with the learning environment learning performance and two learning perceptions were examined, and the individuals who preferred each cognitive style indexes are included. It was revealed that there was an increase in their prior knowledge level and their positive perceptions about the environment.

The assumption behind the core concept of adaptive learning is, namely, the appropriate is the best (Zhu et al., 2018). Because each individual is different in all aspects and is in a state of constant change, it is necessary to personally monitor them in real time and adjust the teaching in an adaptive manner to ensure that the teaching strategy is always suitable for the individual student. In addition, this concept, like smart education, needs to adhere to the view that "technology promotes education rather than leads education" (Zhu et al. 2018). This is because, so far, few technologies were created for teaching, and the convenience pursued by technology is not what education seeks (Zhu and Wei 2018) which is the effectiveness of promoting human development.

Constructing the relational diagram among related learning methods

It can be concluded from the above, there is no limit to the number of students for adaptive learning, and differentiated instruction (Peng et al., 2019). Therefore, they are not individualized instruction. Adaptive learning technologies are more concerned with the specific situation of each individual than the other two methods. In addition, from the perspective of personality, learning

analysis, focusing on the difference of individual characteristics, has the lowest personalized level; adaptive learning comes second, it rises to the level of individual performance; personalized learning is the highest, reaching the pursuit of personal development (Peng et al., 2019). These are visually depicted in Fig. 1.

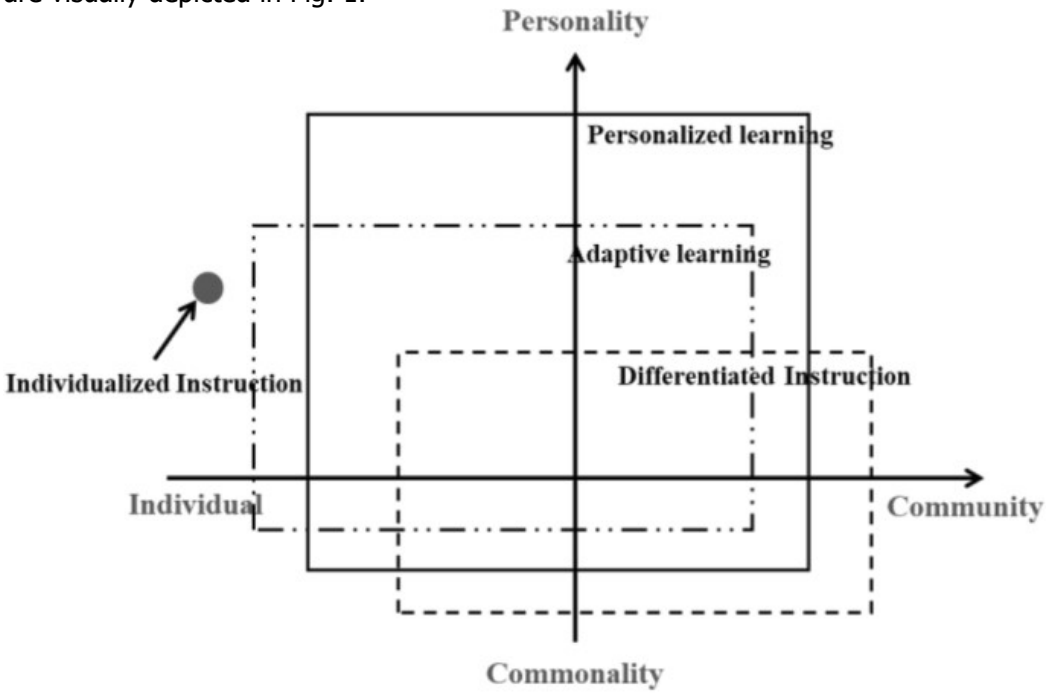

Figure 1: Relationships among related learning methods (Peng et al., 2019)

Adaptive Learning Framework

Based on the core elements and core concepts mentioned above, a framework of adaptive learning is constructed. As shown in Fig. 2, the horizontal axis acts as an adaptation axis to characterize the current individual performance and the vertical axis is used as a personality axis to characterize the personal development. The two-axis intersection acts as individual characteristics to represent differentiated instruction shared by personalized learning and adaptive learning (Peng et al., 2019).

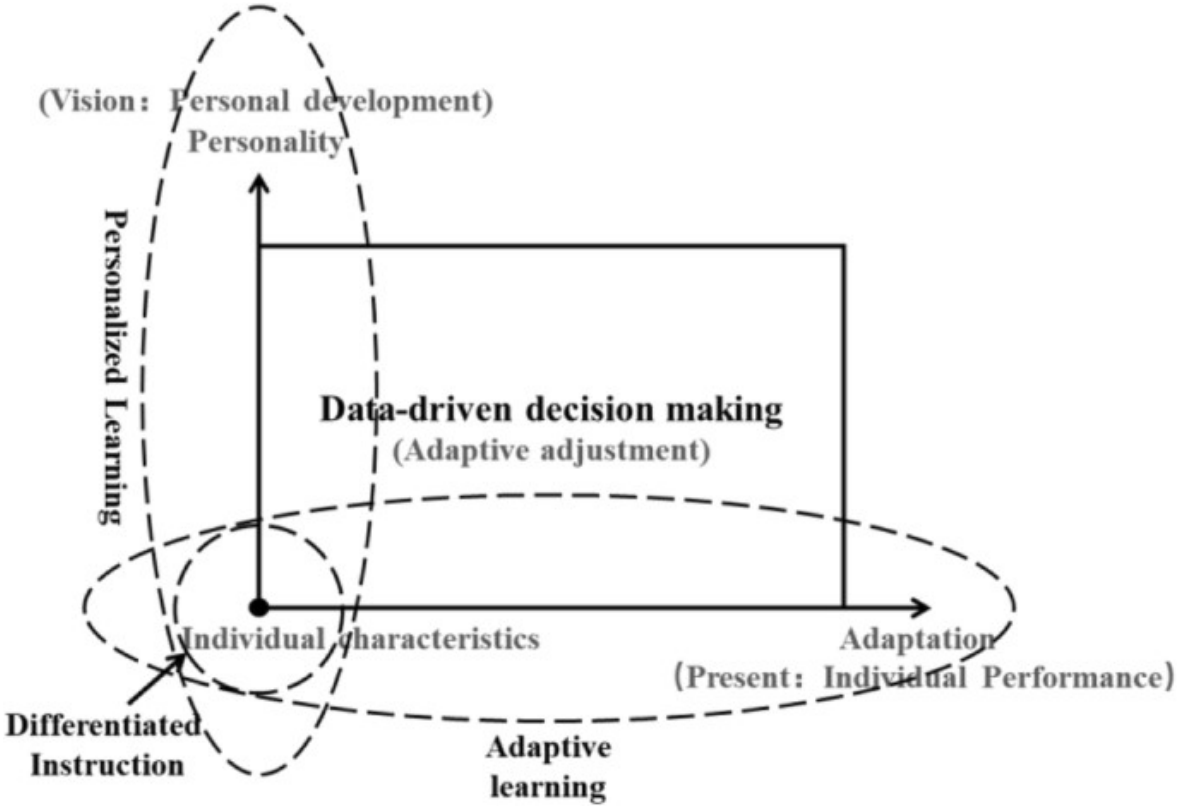

Figure 2: Adaptive Learning Framework (Peng et al., 2019)

Learning analysis

Learning analysis model is a learning sequence composed of learning cells, it depicts the processes of the occurrence and development of learning (Peng et al., 2019). Exploring the learner's potential learning patterns with techniques such as educational data mining and machine learning is the key to achieving the recommendations of a personal learning path. Currently, learning path recommendations has shifted from focusing on in individuals' characteristics of learners, such as learning preferences and cognitive styles, to focusing on learning process and learning patterns (Peng et al., 2019). Considering this issue, a new learning portrait model is proposed to solve the problem of the precisive recommendation of personal learning path from a new perspective (Peng et al., 2019).

The learning analysis model, also called the learning portrait includes a learning cells sequence and a learning time sequence (Peng et al., 2019). The cells sequence, also called the learning pattern, is a directed graph which its nodes are composed of learning cells. The time in the node of the learning sequence represents the effective learning time spent on one learning cell and the time on the side represents the time interval in which the learner starts a new cell for the last one (Peng et al., 2019). The former time can reflect the degree of learning engagement. The longer this time, the bigger engagement the learner has in a certain part of the learning content. The time interval can reflect the learner's learning motivation. The smaller this time, the stronger the learning motivation. Therefore, the learning cell is an important element in learning portraits. The internal structure of the learning cell is shown in Fig. 3. The learning cell depicts the learner's micro-learning situation, which consists of three parts: learning content, learning activities and learning effects (Peng et al., 2019).

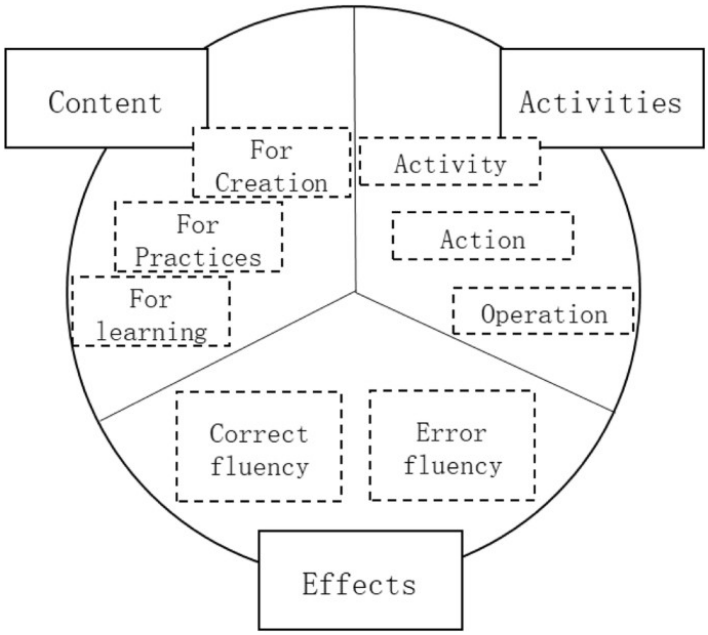

Figure 3: The Internal structure of a learning cell (Peng et al., 2018)

Learning content is to solve the problem of "what to learn", and it includes materials for learning, materials for practices and materials for creation (Anderson et al. 2001). Based on Bloom's taxonomy of cognitive goals, a hierarchical structure of learning content was constructed, as shown in Fig. 4.

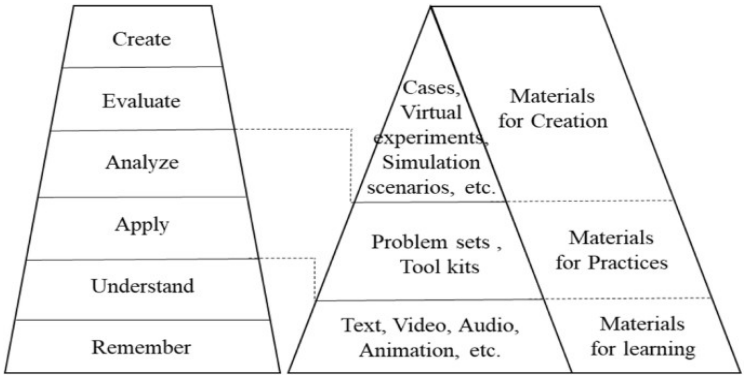

Figure 4: Hierarchical Structure of a learning cell (Peng et al., 2018)

The materials for learning are at the lower level, that is the remembering and understanding level. This kind of materials includes various multimedia learning resources related to the learning content, such as text, video and audio, animation, etc.. The materials for practices, at the level of "apply" and "analyze", are for consolidating and internalizing learning content. It includes problem sets and tool kits, etc. Materials for creation are used for the transfer of learning content. They are at the level of "evaluate" and "create" and mainly include virtual experiments, simulation scenarios, cases, and the software or hardware of design and development.

Learning activities are aimed at addressing "how to learn." According to the activity theory (Sun and Liu 2015). Activities can be divided into three levels hierarchy: activities, actions, and operations. The learning activity can be seen as a sequence of learning behaviors. Due to the differences in individual characteristics such as the learner's learning style and knowledge level, the learning activities are also different.

Learning effects refer to the learning outcomes after the learner completes a learning activity. For measuring the learning outcomes, fluency is used as the measurement index instead of traditional

test score (Binder 1988), it can reflect the accuracy and speed of the learner's test (Peng and Zhu 2017). Therefore, fluency can better represent the learner's true learning effect. Fluency consists of correct fluency and error fluency, which is the correct or incorrect test score divided by the time it takes. By introducing the test time dimension, the efficiency of fluency can be greatly improved. For example, the learner took less time can be marked better by fluency than the one who has the same score but took more time.

CONCLUSION

Adaptive Learning provides an effective way to quickly view assignment results before class and tailor lectures and class activities accordingly. This is beneficial for both instructor and students in that instructors are not wasting time covering material students already understand, while drilling into the material that students find challenging. By implementing the appropriate tools with adequate adaptive content and objectives, both for computer concepts and Microsoft Office skills, student exam scores, pass rate, and grade distribution will be improved. Various literature also reports that Instructor efficiency also improved. Students report that using adaptive simulation is an effective approach to gaining office applications skills. When Adaptive Learning is implemented correctly with learning analysis, it could yield efficiency improvements that benefit both students and faculty and maximize the most efficient use of time. In addition, adopting the right software tools, helps faculty define specific metrics that they can work toward achieving in the future. Adaptive Learning has the potential to make teaching and learning massive amounts of content as well as advanced office software skills manageable within limited time and resources.

Suggestions

- Teachers should track their students process and give more, better and targeted feedback.
- Teachers should Monitor their students activities in their courses on-line discussion forums
- School Administrators should set up an agency to get targeted feed back from the teachers and students.

REFERENCES

Adams Becker, S., Caswell, T., Jensen, M., Ulrich, G., and Wray, E. (2014). Online Course Design Guide. (n.d.). Cambridge, Massachusetts: Massachusetts Institute of Technology. Retrieved https://edtechbooks.org/-Snvzp

Andreas Kaplan (2021). Higher Education at the Crossroads of Disruption, The University of the 21st century. Emeral Publishers. ISBN 9781800715042.

Arthurs, J. (2007), "A Juggling Act in the Classroom: Managing Different Learning Styles", Teaching and Learning in Nursing, 2, 1, 2-7.

C. Binder, Precision teaching: Measuring and attaining exemplary academic achievement. Youth Policy **10**(7), 12–15 (1988)

H.M. Sun, P.F. Liu, Learning activity in view of activity theory. China. Educ. Technol. **8**, 29–35 (2015)

Jonsdottir, A. H. (2015, July). Development and Use of an Adaptive Learning Environment to Research Online Study Behaviour. Retrieved from Semanticscholar.org.

Kolb (1984), "Experiential Learning: Experience as the Source of Learning and Development", Prentice Hall, Upper Saddle River

Peng, H., Ma, S., & Spector, J. M. (2019). Personalized adaptive learning: an emerging pedagogical approach enabled by a smart learning environment. *Smart Learning Environments*, *6*(1), 1-14.

Peterson, E.R., Deary, I.J. & Austin, E.J. (2003), "The Reliability of Riding's Cognitive Styles Analysis", Personality and Individual Differences, 34, 881–891.

Ramsden, P. (1992), "Learning to Teach in Higher Education", London: Routledge.

Slaats A., Hans G. L., Lodewijks C. & Johan M. M. van der Sanden (1999), "Learning Styles in Secondary Vocational Education: Disciplinary Differences", Learning and Instruction, 9, 5, 475–492.

Smith, M. K. (1999),"Learning Theory", The Encyclopedia of Informal Education, www.infed.org/biblio/b-learn.htm, 15.01.2010.

Teasley, B. (2015) Adaptive Learning: Definition, History & Methodology. Retrieved from: https://study.com/academy/lesson/adaptive-learning-definition-history-methodology.html

Vermunt, J. D. H. M. (1992). "Learning Styles and Regulation of Learning in Higher Education—Towards Process-Oriented construction in Autonomous Thinking", Amsterdam/Lisse: Swets and Zeitlinger.