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Agent Based Computational Model For Memory Retention: A Focus On Children With Dyslexia

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Abstract

Memory retention can be defined as a process by which both working memory and long term memory preserves knowledge so that it can locate, identify and retrieve it in the future. Children with dyslexia suffer from lack of memory retention. They suffer from reduced mental ability, which affects the series such language acquisition, mathematical difficulties and many more. Different interventions have been implemented using computing technologies to aid memory retention among the dyslexic children. Computing techniques such as gaming, assessments and motivation are employed to improve the reading and spelling skills of learners. Unfortunately the computing techniques tend to address either one or the other of these needs being either enabling or instructional. Such computing technologies up to now, have not been designed to respond to personalized feedback from the learner and to personalize the system in line with the user's performance. In view of this, the paper discusses, the use of Intelligent Agents that will help design an adaptive learning support system together with key memory strategies to enhance memory retention. This study will design an Agent-based computational model that will be implemented using a computational tool that will be used by dyslexic learners. The computational tool will be used to test grade 3 students in a school in Nairobi County. Data will also be collected using a questionnaire. Results from the computational tool will be analyzed using descriptive statistical techniques.

Keywords: Dyslexia, Memory Retention, Agent Based Computational tool.

1. Introduction

Learning disability (LD) causes a person to have trouble learning and using certain skills. The skills most often affected are reading, writing, listening, speaking, reasoning, and doing math[1]. There are different types of learning disabilities, the most common ones include dyscalculia, dyslexia and dysgraphia as stated by [2] Research by [3], states that dyslexia is defined as an unexpected difficulty in reading and spelling in relation to cognitive ability, education, or professional status". Children with dyslexia suffer from lack of memory retention. They suffer from reduced mental ability, which affects the series such language acquisition, mathematical difficulties and many more [4]. Memory Retention is the ability the skill of the human mind to hold information in the brain for various durations, depending upon the type of memory and stimulus, repetitions in recall, levels of attention, and emotion [5]. Memory retention is used both in the working memory partly and the long term memory. The distinction between immediate memory (or working memory) and long-term memory has been fundamental to understanding how the brain has organized its memory functions [6]. Immediate memory refers to the limited amount of information that can be held in mind when material is presented for learning. Working memory refers to the capacity to maintain this limited amount of information through active rehearsal, usually

across a relatively short time interval [7]. Long-term memory refers to what can be recalled from the past when the information to be learned no longer occupies the current stream of thought, either because immediate memory capacity was exceeded or because attention was diverted from the memoranda. They're 2 main types of memory as follows: short-term memory is the competency to store evidence, data, and information momentarily for seconds before it is amalgamated into the long-term memory ,which is the used for competency to learn new material and recall this material after some time has passed[8]. Holmes et al [9] describes that Poor Working Memory impairments are associated with a wide range of developmental disorders of learning. Children with poor working memory function are at very high risk of educational underachievement. Working memory is used for many functions among many others problem solving and remembering tasks. Working memory is key for academic performance, and a useful prospective indicator of academic performance [4]. Study shows that without appropriate intervention, poor working memory in children, which is thought to be genetic, can affect long-term academic success and prevent children from achieving their potential [4]. The aim of this study to propose an agent-based computational model for pupils with dyslexia, this will be achieved by reviewing existing models and memory retention techniques. The objective of this research is to come up an agent-based memory retention computational model that will help in memory retention and implement it on dyslexic children.

2. Problem statement

One of the key levels of learning is knowledge. Knowledge is the level where the learners can remember and recall what they have learnt. Dyslexia is a neurologically-based, often familial, disorder which interferes with the acquisition and processing of language and manifests as a difficulty in reading written word and spelling (Barton 2015). Children with dyslexia suffer from lack of memory retention which affects their learning (Archibald &Gathercole, 2007). Memory retention can be defined as a process by which both working memory and long term memory preserves knowledge so that it can locate, identify and retrieve it in the future as stated by (Linda, 2012). Reading is a cognitive process that involves constructing meanings of words. Reading forms a way of school going children to learn (Eric, 2018). Memory retention allows the preservation of learning, which means without memory retention there is no learning. Different memory strategies are applied by teachers in the classroom to enhance memory retention, which includes practice at retrieval**,** repetition, memory cues, visual images, assessments, chunking information (Thorne, 2006; Halpen, 2003). Different interventions have been implemented using computing technologies to aid memory retention among the dyslexic children. Computing techniques such as gaming, assessments and motivation are employed to improve the reading and spelling skills of learners, this is according to (Rello et al.,2014; Lexia,2017; Nessy,2017). Unfortunately the computing techniques tend to address either one or the other of these needs being either enabling or instructional. Such computing technologies up to now, have not been designed to respond to personalized feedback from the learner and to personalize the system in line with the user's performance (Schmidt 2018).

Intelligent Agents based approach have also been used in memory retention among the dyslexic learners. The Intelligent Agents become key in learning environment because of its adaptive nature as it automatically customizes itself to its users based on previous experience. Their nature allows to evaluate the learners understanding to adapt the lessons accordingly. They also have the ability to work together with other Agents to achieve a common goal .Their collaborative nature allows them to modify request, ask clarifications to certain request which is important in a learning environment. Agent becomes key in the

learning environment because of its dynamic nature, which allows them to make intelligent decisions based on each learner (Essay, 2013). The Intelligent Agent tools are Intelligent Assistive Reading System which can help school-aged readers who have dyslexia to improve their reading and understanding (Andreas, 2007). Different studies have been carried out on the deployment of Intelligent Agent on enhancement of memory retention (Schneider et al, 2007; Kelly, 2012).The studies showed that Intelligent Agents plays a key role during learning by ensuring adaptive approach to the learners 'needs, providing them with feedback as well as motivating the learner. However for memory retention to take place, key memory strategies such as repetition and practice at retrieval are significant. (Park et al, 2016).

3. Objectives

The general objective of this study is to develop an agent based memory retention computational model that will help in memory retention and implement it on dyslexic children.

Specific Objectives

a) To propose an agent based computational model for pupils with dyslexia, this will be achieved by reviewing existing models and memory retention techniques.

b) Implement the model as a computerized learning tool and test it using experimental method.

c) To determine the effect of memory retention strategies on dyslexic children

4. Literature Review

Researchers have associated successful memory retention must have key memory strategies, they are (a) Retrieval practice (b) Repetition and (c) Feedback according to[30]. Retrieval practice is the act of trying to recall information without having it in front of you. Cognitive psychologists have been comparing retrieval practice with other methods of studying strategies like review lectures, study guides, and re-reading texts. Research shows that nothing cements long-term retention as powerfully as retrieval practice [11].Different studies have shown great impact of retrieval practice on memory retention. The studies includes [12] [13] [14] however retrieval practice works better with other key memory strategies [15] [16] [17][18]. According to Maria et al. [19] defines feedback as information regarding performance outcomes and learning processes and plays a major role in educational performance. It is an essential component of learning [20] and the most powerful single influence on student achievement and one of the most frequently applied psychological interventions [21]. Agrawal [16] suggests that if students retrieve the wrong information, the practice won't be much good unless they find out the right information, so be sure to give them feedback as they go.

Repetition is another very important memory strategies that should be used with the other key strategies in enhancing Memory Retention. According to Willis [22] explains that through repetition of learning more dendrites are developed and strengthened in an area of the brain relevant to this learning and as an outcome we become more efficient in applying this knowledge and it is also argued that practice and rehearsal make learning stick [23].

Research has shown that implementing key memory strategies in educational settings can dramatically improve memory retention in student learning [24].However research shows that these key memory strategies have never been incorporated together and implemented

in Dyslexia learners. One significant aspect of memory retention is the ability to enhance memory retention to normal students [25] as well as learners with learning disabilities [26].

Intelligent Agents then becomes crucial because of its characteristics [27] [28] and the nature of in the dyslexic learners. This study concentrates on how Intelligent Agents can be integrated together with the key memory strategies to enhance memory retention.

a) Use of Intelligent Agent on feedback:

Intelligent agents are preferred due to their high degree of self-determination capabilities and their capability to decide for themselves when, where, and under what condition to perform their actions, Feedback is critical for facilitating a comfortable learning environment and assists learners during their learning. Research shows the importance of feedback using intelligent Agents to learners, intelligent Agents can be used to provide feedback in collaborative learning. Feedback in the study is an essential help in collaborative learning by motivating the students and encourage group discussions. Intelligent Agents can use feedback to measure the level of participation of learners' As well as acts as an intervention by the instructor as well as allowing the students to gauge themselves and improve their engagement[29].This study explains that learning process in classic understanding is teacher versus learner (fulltime studies) relationship. This learning process brings the best results on the condition that the teacher is able to respond to all the questions and provide immediate feedback. Immeadiate Feedback can be integrated into Intelligent Tutoring System, thereby making sure that the learner has really mastered the material and not just guessed the previous answer [30]. If the feedback between Intelligent Agent and the learner is provided, better training results are achieved [31] [32].The Intelligent Agents will instantly corrects the mistakes made by the learner, knowledge of the student becomes deeper and wider [33].

b) Use of Intelligent Agent on repetitions:

Children with dyslexia have special learning skills and most of the time only specialized institutions can support their reading difficulties. The study used intelligent Agents to propose a reading system for dyslexic children with personalized attention, through customized presentation of reading materials [34].Intelligent Agent provides personalized assistance. This proves to be really helpful for children with dyslexia, as it combines speech recognition, state recognition via image and error type profiling via adaptive and personalized support. Intelligent agent can offer standardized training with a certain number of repetitions for all of the words. This training was inflexible and in a certain sense also inefficient. Some users might need more repetitions, while others might require fewer. It is important to take care of important facts during training such as cognitive abilities as well as impeding factors such as dyslexia [35].

c) Use of Intelligent Agent on retrieval at practice:

Research shows that for the students to learn better, the students were given less or more materials, deepening on their performance. The study showed that by allowing the undergraduate students to perform students practice exercises before given a new set of questions. The Intelligent Agent as a teacher Agent monitored the students throughout their learning, even after doing more exercises and the student was still not performing as accepted, the teacher will physical have sessions with students. This study emphasizes that students learn better by practising more exercises as opposed to any other learning strategies [36]. According to Tumenayu et al. [37] shows the educational games development with an Agent-Based Technology by using intelligent pedagogical agents can

intervene to offer hints, assistance and suggestions when the learner is lacking knowledge. In this paper he describe the possibilities of using pedagogical agents to infer learner's motivation and emotional state as they allow communication and interaction in a digital learning environment.

The study presents the relevance of Pedagogical agent's technology as an approach in enhancing the interactive learning in a game based environment. The agents uses competence activations interventions ,which activates the temporary inactive skill eg remembering, as well as competence acquisition interventions, which allow the educational game Agent to conclude lack any skills, which the Agent provides on behalf of the learner. This Agent also provides problems solving support via hints and indications that will bring the learner closer to the solution as well as progress back. It uses games to enhancing learning among by providing assistance by giving answers to learners when they can't answer questions as well as motivate learner by appraisal. The benefits of Artificial Intelligence in education have been lauded for many years [34].Different intelligent tutoring system has been used in education both through mobile and web based application, encompassing different learning strategies. Despite Intelligent Agents been key in learning, research shows that no study has been done on Intelligent Agents using memory strategies on dyslexic learners.

d) Agent base computational Model

The facilitations discussed above where used to develop an Agent based computational Architecture shown below. The architecture consists of the student model as well as the Domain Model. Different Knowledge Data Base Module will work together with agents to create the Agent based computational Model. The two module Domain Models and Student Model. In the Student Model the knowledge the system has about the student (profile and interaction with the system) is represented. The model is composed of two knowledge databases (KDBs). (1) The Profiles KDB that stores the necessary personal information of the student to control his access to the system. They also store the level as well as the presentation styles of the students. The students are assigned different levels depending on their learning rhythm. (2) The Learning KDB stores parameters such as the exercises and tests proposed so far to the students, the exercises, the pages of notes visited and the scrolls performed on those pages and the reinforcement material prepared by the Pedagogic Module. In the Domain Model the knowledge about the contents to be taught is stored. This model consists of four KDBs: (1) the game KDB incorporates the gaming pages that have been prepared for teaching on the matter, (2) the Tests KDB stores the battery of test questions related to the matter, (3) the Exercises KDB stores the battery of exercises on the matter, and, (4) the Reinforcement KDB contains the information used by the Pedagogic Module to prepare the material to be shown when a student needs to be reinforced.

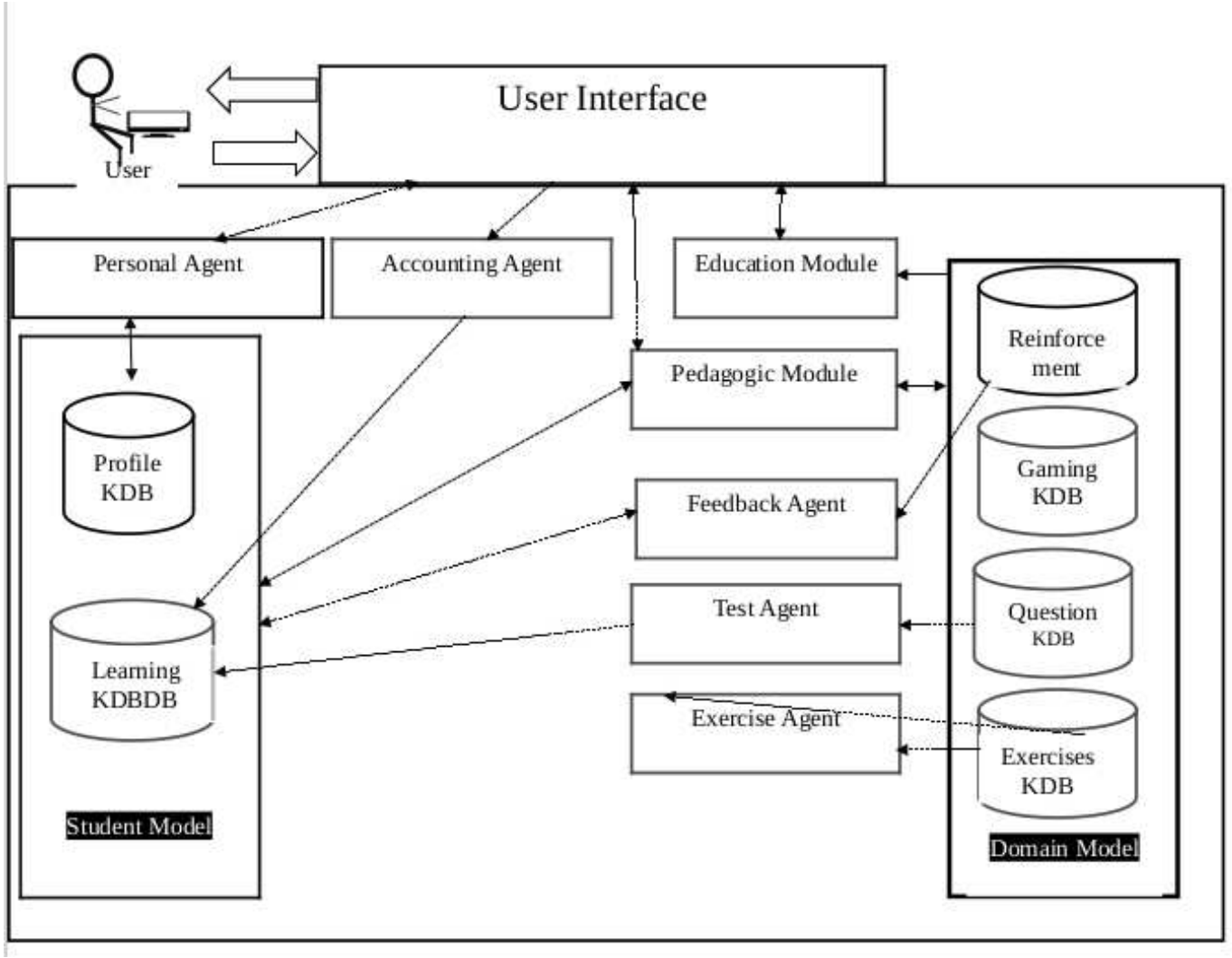

Fig 1. Agent based Computational Architecture

Available online http://ir.kabarak.ac.ke/handle/123456789/1

5. Methodology

This paper will adopts two different types of research design:

Experimental design aims to establish the existence of a cause and effect relationship between variable. This study determines to show the correlation between the independent variables (Repetition, Feedback and retrieval practice) and the dependent variable (Memory retention).The experiment will have two groups, one will be the experimental group and the other group will be the control group. The research intends to put in a place an agent based computational tool for dyslexic learners, the learners will use the tool for exercises, tests and exams .The learners will undertake pretest at the beginning of the study and then a post test at the end of the study. The results of the both the control group and the experimental group will be analyzed using ANOVA and then results will be represented in form of tables.

Descriptive design -The researcher will design an open ended questionnaire which will be rolled out to the teachers. These questions will relate on what the teacher observed with the children during learning, when using Agent based computational tool. Interviews (with the teachers) will also conducted before the experiment with the aim of gathering data on what processes entails learning on a day to day basis .This will include;

a) Curriculum development,
b) Mode of teaching and learning,
c) Usage of technology with children with dyslexia,
d) Learning materials and content,
e) How lessons are conducted

6. Results

Results for this study will be mainly from the agent based computational tool. We intend to document the entire process, exercises, quizzes and then the main exam. The study intends to contribute to computational models for dyslexic learners. The study will employ the agent based computational tool on dyslexic learners to determine whether memory retention will be realized. The study aims to help dyslexic learners realise their dream of achieving their academic success.

7. Recommendations and future works

The Architecture works well for collaborative mobile learning based on Moodle Learning Management System. While there is room for improving this architecture, we will also consider implementing it on other mobile learning platforms. Also the architecture may be modified to capture the aspect of agents working together by sharing their information to improve the learning effect on collaborative platforms. Results for this study will be mainly from the agent based computational tool. We intend to document the entire process, exercises, quizzes and then the main exam. The study intends to contribute to computational models for dyslexic learners. The study will employ the agent based computational tool on dyslexic learners to determine whether memory retention will be realized. The study aims to help dyslexic learners realise their dream of achieving their academic success.

8. Conclusions

One of the most recent policy documents in education is Sessional Paper No. I of 2005 on a Policy Framework for Education, Training and Research, through this document the government intend to ensure that all children eligible for primary schooling have opportunity to enrol, remain in school to learn and acquire quality basic education, based on its commitment to achieve Education for All (EFA) by 2015.To achieve this there is need to ensure that learners with learning disabilities especially dyslexia can achieve their dreams achieve and reach their life potential. The Agent based computational model will ensure successful transition of dyslexic learners through education. .

References

[1] National Dissemination Center for Children with Disabilities (NICHCY) Available: https://www.fhi360.org/projects/national-dissemination-center-children-disabilities-nichcy.

[2] Learning Disabilities Association of America (Online).Available: https://ldaamerica.org/types-of-learning-disabilities.[Accessed on 15th May 2019]

[3] Lyon, G.R., Shaywitz, S.E. & Shaywitz, B.A. Ann. of Dyslexia (2003) 53: 1. https://doi.org/10.1007/s11881-003-0001-9

[4] Archibald, L.M.D., & Gathercole, S. E. (2007). The complexities of complex span: Specifying working memory deficits in SLI. *Journal of Memory and Language*, *57*, 177–194.

[5] Endel Tulving(2002)Episodic Memry:From Mind to Brian.Annual Review of Psychology,53,1-25

[6] Larry.R.Squire (2009). Memory and Brain Systems: 1969–2009. Journal of Neuroscience 14 October 2009, 29 (41) 12711-12716; DOI: https://doi.org/10.1523/JNEUROSCI.3575-09.2009

[7] Baddeley, A. and Hitch, G. (1974). Working memor. *The psychology of learning and motivation: advances in research and theory*, 8.

[8] Reber P.J., Beeman M., Paller K.A. (2013) Human Memory Systems: A Framework for Understanding the Neurocognitive Foundations of Intuition. In: Schmorrow D.D., Fidopiastis C.M. (eds) Foundations of Augmented Cognition. AC 2013. Lecture Notes in Computer Science, vol 8027. Springer, Berlin, Heidelberg

[9] Joni Holmes , Susan E. Gathercole ,Maurice Place , Darren L. Dunning , Hilton, Julian.(2009), Working memory deficits can be overcome: Impacts of training and medication on working memory in children with ADHD, https://doi.org/10.1002/acp.1589

[10] https://www.verywellmind.com/great-ways-to-improve-your-memory-2795356

[11] McDaniel, M. A., Thomas, R. C., Agarwal, P. K., McDermott, K. B., & Roediger, H. L. (2013). Quizzing in middle school science: Successful transfer performance on classroom exams. *Applied Cognitive Psychology*, *27*, 360-372. *A journal article on how retrieval practice improves students' transfer to new information in 7th and 8th grade Science.*

[12] Roediger HL , Butler AC. The critical role of retrieval practice in long-term retention, Jan;15(1):20-7. doi: 10.1016/j.tics.2010.09.003. Epub 2010 Oct 15.

[13] Jeffrey D.Karpickle, Henry Roediger, (2008).The critical importance of Retrieval For Learning.

[14]Jeffrey D .Karpicke, Janell F.Blunt,Megan A.Sumeracki(2016)Retrieval-Based Learning: Positive effects of Retrieval Practice in Elementary school Children. Frontiers in Psychology 7(104), DOI: 10.3389/fpsyg.2016.00350

[15] Steven C. Pan &Timothy C. Rickard.(2017) Does Retrieval Practice Enhance Learning and Transfer Relative to Restudy for Term-Definition Facts? American Psychological Association 017 1076-898X/17/$12.00 http://dx.doi.org/10.1037/xap0000124

[16] Roediger, H. L. III, Agarwal, P. K., McDaniel, M. A., & McDermott, K. B. (2011). Test-enhanced learning in the classroom: Long-term improvements from quizzing. *Journal of Experimental Psychology: Applied, 17*(4), 382-395.http://dx.doi.org/10.1037/a0026252

[17] Pooja Agarwal, Patrice M Brian, Roger Chamberlain **(**2012) The Value of Applied Research: Retrieval Practice Improves Classroom Learning and Recommendations from a Teacher, a Principal, and a Scientist Educational Psychology Review 24(3) DOI: 10.1007/s10648-012-9210-2

[18] Nicole A.M.C Goossens,Gino Camp, Peter PJ; Verkoeijen,Rolf A Zwaan, (2014)The Benefit of Retrieval Practice over Elaborative Restudy in Primary School Vocabulary Learning, Journal of Applied Research in Memory and Cognition 3(3) DOI: 10.1016/j.jarmac.2014.05.003

[19] Maria cutumisu, Daniel L Schwartz. (2017) The impact of critical feedback choice on students' revision, performance, learning, and memory. Computers in Human Behavior DOI: 10.1016/j.chb.2017.06.029

[20] Emma Mulliner, Matthew Tucker (2015) Feedback on feedback practice: perceptions of students and academics Assessment & Evaluation in Higher Education. DOI: 10.1080/02602938.2015.1103365

[21] Yigali Attali, Don Powers, (2010) Immediate Feedback and Opportunity to Revise Answers to Open-Ended Questions, Educational and Psychological Measurement 70(1):22DOI:0.1177/0013164409332231

[22] Shula chiat,Penny Roy(2007) The Preschool Repetition Test: An Evaluation of Performance in Typically Developing and Clinically Referred Children Journal of Speech Language and Hearing Research 50(2):429-43 DOI: 10.1044/1092-4388(2007/030)

[23] Yigali Attali, Don Powers, (2010) Immediate Feedback and Opportunity to Revise Answers to Open-Ended Questions, Educational and Psychological Measurement 70(1):22-35 DOI: 0.1177/0013164409332231

[24] Nate Kornell, Lisa.k son (2009) Learners choices and beliefs about self-testing.

[25] Jeffrey D Karpicke(2016) A powerful way to improve learning and memory

[26] Gagne Theories (2008). *Conditions of learning* (R. Gagne). http://tip.psychology.org/gagne.html

[27] Charles R. Dyer [2003] Intelligent Agents

[28] Russell, S. J. and Norvig, P. (2003). Artificial Intelligence: a Modern Approach. Prentice Hall, 2nd edition

[29] Njenga, Stephen & Oboko, Robert & I Omwenga, Elijah & Maina, Elizaphan. (2017). Use of Intelligent Agents in Collaborative M-Learning: Case of Facilitating Group Learner Interactions. International Journal of Modern Education and Computer Science. 10. 18-28. 10.5815/ijmecs.2017.10.03.

[30] Janis Dabolins, Janis Grundspenkis, (2014) The Role of feedback in Intelligent Tutoring system.

[31] Giannandrea, L. (2013). A literature review on Intelligent Tutoring Systems and on student profiling . Atee Conference.

[32] Ido Roll, Vincent Aleven, Bruce M. McLaren, Kenneth R. Koedinger. (2014) Improving students' help-seeking skills using metacognitive feedback in an intelligent tutoring system

[33] Manuela Macedonia, Iris Groher, Friedrich Roithmayr (2011) intelligent virtual agents as language trainers facilitate multilingualism Front Psychol. 2014; 5: 295. Published online 2014 Apr 14. doi: 10.3389/fpsyg.2014.00295

PMCID: PMC3995038

[34] Drigas, Athanasios & Ioannidou, Rodi-Eleni. (2012). Artificial intelligence in special education: A decade review. International Journal of Engineering Education.

[35] Gascueña, José & Fernández-Caballero, Antonio. (2005). An Agent-based Intelligent Tutoring System for Enhancing E-Learning/E-Teaching. Int J Instr Technol Dist Learn. 2

[36] Jose Gacuena,Antonio Fernandez-collabero,(2005) Anagent-based Intelligent Tutoring System for Enhancing/e-Teaching.

[37]Ogar Ofut Tumenayu, Olga Shabalina, Valeriy Kamaev and Alexander Davtyan (2014)Using Agent-Based Technologies to enhance Learning in Educational Games1. International Conference e-Learning 2014