A Study on Identifying and Categorising Students based on Personal Learning Traits for Adaptive Learning Systems

[1] Aryaman M, [2] T. Anoop Sai, [3] Dr. Sandhya N

[1][2] Students, Dept. of AIML, Dayananda Sagar Academy of Tech. & MGMT, Bangalore, India
[3] Faculty, Dept. of AIML, Dayananda Sagar Academy of Tech. & MGMT, Bangalore, India
Email: [1] 1dt20ai010@dsatm.edu.in, [2] 1dt20ai007@dsatm.edu.in, [3] dr.sandhya1909@gmail.com

Abstract— Sending messages automatically without the involvement of human input is known as Message Automation or Text Automation. This study aims to identify and Categorise students based on Personal Learning Traits for Adaptive Learning Systems. Despite the growing academic research in the field of adaptive learning, its various applications and implementations, the field lacks a comprehensive literary analysis that categorises users of adaptive learning apparatuses depending on independent understanding abilities in these settings. This study provides an overview of various student personality attributes and methods for grouping them together to provide better and improve adaptive learning environments and systems to cater to a larger user base.

I. INTRODUCTION

Adaptive Learning systems /environments find their roots from the Adaptive and intelligent Web-based educational systems (AIWBES) (Brusilovsky & Miller, 2001).

Brusilovsky & Miller state that AIWBES seeks to be adaptive by developing a framework of the objectives, inclinations and understandings of each individual user and employing these frameworks all through the interaction with the users in order to tailor to the demands of said user. Brusilovsky & Miller's paper omits the individual traits and learning techniques of users, hampering it from being a truly "adaptive" system.

The study looks into - categorising students based on their learning abilities and techniques to provide a more personalised learning experience as well as grouping them based on their learning techniques and abilities.

II. ADAPTIVE LEARNING

The adaptive learning environment are a component of a next-generation machine learning system that provides e-learning tutorials. This environment provides learners with a personalised learning experience based on their previously gathered information about the users insights, understanding levels, logical or analytical potentials, understanding potential and other factors as indicated by Liu et al., 2010. Discrete learners favour non-identical methods of studying, understanding, receiving, and refining information(data and instruction) (Truong, 2015). Assimilating an adaptive learning system with personality attributes into a learner framework / model can help students by tailoring assignments to the learning plans and goals.

Shute & Towle (2003) elaborate on Brusilovsky & Miller's concepts of adaptive learning systems consisting of models and state that adaptive learning systems mainly consist of four frameworks, namely, learner framework, domain framework, adaptive engines(framework) and instructional framework.

This study is focusing on the learning framework which includes various components for creating a learner profile consisting of information about the learners knowledge and learning style.

III. RELATED WORKS

This section details personality traits and the identification method used to determine personality traits in learner models. The personal characteristics are divided into four distinct domains, three constructed on Bloom's taxonomy or Metacognition (Forehand, 2010) (Vandewaetere, 2011) and includes

i). perception, awareness and intelligence (cognition) ii). visceral, emotional, intuitive (affective) and iii). conduct, practices, actions(behaviour), the fourth domain is referred to as the mixed learning category in which researchers combine two or more traits / domains. The characteristics are chosen in such a way that it reflects the distinction between learning categories.

3.1. Individual Characteristics:

The preliminary procedure for formulating and establishing the learner framework is to choose suitable characteristics for the learning environment / model. This study recognises personal traits and classifies it into four categories. The first three are established on Metacognition / Bloom's taxonomy which are namely intelligence, emotion, conduct and the fourth category consists of overlapping categories.

The cognitive category is established on understanding and the intuitive category is established on interpretation.
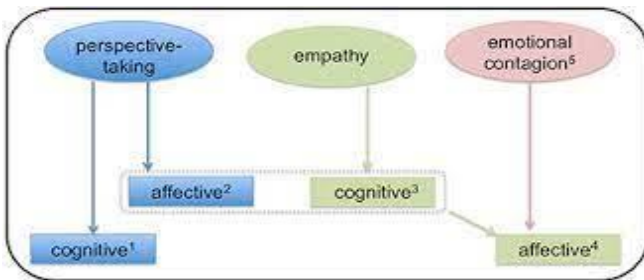
Figure 1: Learning domain Category based on Bloom's Taxonomy.

Cognition is coupled to the sequence of Data Processing using coherent thinking to produce and obtain knowledge.

The affective learning framework categories describe how learners change with regard to attentiveness, sentiments and perspectives during the learning process as described by Paireekreng and Prexawanprasut, 2015.

Sentiments are an individual characteristic of this classification. It can be classified as constructive or pessimistic as established by Andrie, 2011.

Constructive sentiments are to be related with enthusiasm, participation, pleasure, challenge, aspiration, contentment, comfort, and self-esteem stated by Sandanayake and Madurapperuma in 2013.

Pessimistic emotions are usually associated with frustration, boredom, confusion, shame, hopelessness, anxiety, and anger. (Andrie, 2011).

The third category of learning frameworks, behavioural or psychomotor, relates to student activities using dexterity, physical activity, and collaboration. Learner aptitude most commonly included in conduct include agile, reactive, inconsistent behaviour, help seeking, and learner control.

3.2 Distinguishing Individual Characteristics

The prominent methodologies employed to distinguish individual characteristics are classified into three classes:

i)Examination or questionary method.

ii) Computer established observation. and

iii) Both computer established detection and examination methods.

Examination method is a traditional method for obtaining data about an individual's qualities. The questionnaire technique involves asking students to fill out a questionnaire that distinctly discloses their personality characteristics (Tlili et al., 2016). However, this technique has limitations in a computer assisted environment. The results are obtained by a one time review, however individual characteristics and attributes can change over time and are not uniform for individuals .

Computer established observation is the most common and frequent methods used to identify the personality traits of a student and to create the learning profile by analysing implicit user inputs. Computer based detection uses various programs and algorithms designed to identify the traits of the individual automatically without the need for human interactions. The computer established observation technique is contemplated to be further detailed when compared to the examination method as it works in real time and responds to real time changes.

The computer established methodology is generally grouped into predictive analytics techniques and non-predictive analytics techniques and hybrid techniques based on the approach used for detection.

Predictive Analytics is defined as the utilisation and evolution of computer systems that can learn, understand and adjust to situations without following explicit directives, by using algorithms and statistical representation to analyse and construct inferences from sequences in data. Some of the common algorithms used are regression algorithm instance-based algorithm, clustering machines, artificial neural network and deep learning algorithms to name a few.

Non Machine learning techniques involve using traditional programming techniques and methods and specifically mentioning what the computer must do with the information provided to it.

It is noted that the computer based techniques are more effective and are preferred over the questionnaire approach as initially the data is insufficient to make a learner profile. However it is also noted that most predictive analytics techniques require large quantities of training data to provide accurate results for the personality trait, which may initially be difficult to obtain.

Classification of Students

The initial process for classification of students involves gathering information about their method of learning and personality traits from the learning model. The students with similar knowledge, personality traits and learning methods can be grouped into "peer groups".

Peer groups can be defined as students having similar learning methodologies, personality traits and knowledge. Age, not being a criteria for selection of students.

Students of peer groups are allowed to interact with each other and facilitate peer education.

Peer education is a form of education in which learning is brought about by one's peers.

Some advantages of the peer based grouping system are

i). Improves student aptitude.

ii). Incorporates a more personalised learning experience, adding to the already personalised learning methodology of adaptive learning systems. However research regarding incorporation of peer based education systems within adaptive learning systems is sparse and its effectiveness is yet to be proved.

IV. CONCLUSION

4.1 Summary Of the review and challenges

This study provides an insight into adaptive learning systems and methodologies used to categorise students based on their understanding / educational abilities and personality traits highlighting the sparsity of research in the field of adaptive learning using peer based education systems due to limitations in the study.

Another issue that the study does not address is the acquiring and handling of large amounts of training data for training the machine learning models used to categorise the students / users of adaptive learning systems based on their learning methodology and personal traits.

4.2 Limitation of the review

The vast number of papers published regarding this topic led to some relevant papers regarding the topic not being considered,

The document also only considers papers written in English and does not take into consideration relevant articles regarding the topic. The review also considers articles written and published after 2002.

REFERENCES

[1] Peter Brusilovsky (2003). "Adaptive and Intelligent Web-based Educational Systems". International Journal of Artificial Intelligence in Education. 13 (2–4): 159–172.

[2] Andrie, A. M. (2011). Positive And Negative Emotions Within The Organizational Context. Global Journal of Human Social Science, 11(9), 26–39.

[3] Forehand, M. (2010). Bloom's Taxonomy. Emerging Perspectives on Learning, Teaching and Technology Bloom's (Vol. 41).

[4] Santos, O. C., Boticario, J. G., & Pérez-Marín, D. (2014). Extending web-based educational systems with personalised support through User Centred Designed recommendations along the e-learning life cycle. Science of Computer Programming, 88, 92–109.

[5] Shute, V., & Towle, B. (2003). Adaptive E-Learning. Educational Psychologist, 38(2), 105–114.

[6] Truong, H. (2015). Doctoral Consortium: Integrating Learning Styles into adaptive e-learning system., 645–647

[7] Forehand, M. (2010). Bloom's Taxonomy. Emerging Perspectives on Learning, Teaching and Technology Bloom's (Vol. 41). Retrieved from

[8] Vandewaetere, M., Desmet, P., & Clarebout, G. (2011). The contribution of learner characteristics in the development of computer-based adaptive learning environments. Computers in Human Behaviour, 27(1), 118– 130.

[9] Identification of personal traits in adaptive learning environment: Systematic literature review Nur Baiti Afini Normadhi, Liyana Shuib, Hairul Nizam Md Nasir, Andrew Bimba, Norisma Idris, Vimala Balakrishnan.