Using Adaptive Intelligence and African American Learning Styles to Improve literacy of African American Students of Low Socioeconomic Status

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Abstract

Standalone traditional approaches to administering education are quietly disappearing. Teachers no longer rely on traditional tools such as chalk, chalkboards, and flip charts to convey their ideas, thoughts or to teach lessons. Instead, they rely on an amalgamation of teaching techniques, which include, Adaptive Intelligent Technology (AIT) coupled with traditional tools. Within the public elementary school settings in communities of low socioeconomic status, even with all that technology has to offer, few models exist that include African American learning styles. For the years 2015, and as recent as 2017, The National Center for Educational Statistics, reported that in these communities, African American students lag behind their Caucasian and Asian counterparts where literacy is a concern; students are failing city and state-wide examinations. In light of the literature on African American learning styles, this research seeks to demonstrate how hybridizing African American learning styles and AIT into the curriculum might encourage engagement and thereby improve literacy. Moreover, merging AIT and African American learning styles will enable educators to respond to a community of students that have been historically overlooked and undervalued in the classroom and society. This research uses Action Research Methodology, which is a method of validation without physical implementation that will be used to develop, test and validate the new educational model proposed by this research. This model will be used to bridge the racial literacy gap among elementary school students. The main objective of this research initiative is to produce outcomes that scholars and practitioners of culturally sustaining pedagogy will embrace in the future.

Keywords: Low Socioeconomic Status, Low Socioeconomic environment, Adaptive Intelligent Technology, African-American, Technology, Learning Style, African-American Learning Style, Learning space, National Center for Educational Statistics (NCES), Maryland Department of Education (MDOE) Active Research Methodology, Hybridization Model, culturally sustaining pedagogy

I. INTRODUCTION

A. Overview

African American students of low socio-economic status take the back seat where literacy is concerned. They lag behind their Caucasian and Asian counterparts in Science, Mathematics, and Reading [1]. With this said, some may blame low literacy rates on the teacher’s performance, and others may blame such rates on the student’s inability or unwillingness to learn. Some may blame the failed literacy amongst these African American communities, on a flawed and outdated educational model. The current educational model is committed to making students memorized simply to past tests, rather than employ the use of things learned naturally, from day-to-day [2].

B. Problem Description & Objectives

This research argues that the educational model used today is designed using standards that do not necessarily consider learning styles and best practices of African American students. This research also suggests that African American children cannot be reached academically because what they are taught is not only difficult to relate to their own lives and cultures but what they are taught also disregards the way that they make connections in the communities in which they exist. Learning is a natural process...
[2]. In other words, what Stevenson is suggesting is that students may find assignments and classwork uninteresting because the current model apprehends their creative side, and this prohibits what is natural to be displayed.

II. CONCEPTUAL DESIGN

While learning styles are not new, this research found a method of developing African American learning styles using existing learning styles as a template, then it took African American learning styles and integrated them with significant features from an Adaptive Intelligent System (AIS) to produce a Hybrid System. The Hybrid system as defined by this research is a system, which conjoins, features from an AIS with African American learning styles. The adaptive system of interest here is IReady. As the Conceptual model in Figure 1 below depicts, there is a literacy problem that the AIT model nor the Traditional educational model combined can mitigate. With this said, an introduction of the Hybrid Solutions Model as a remedy for improving low literacy rates amongst African American students, is both appropriate and justifiable. Please note that the AIS and the AIT model, in this case, are the same.

III. BACKGROUND/LITERATURE REVIEW

The assessment of adaptive intelligence confirms that the idea of integrating adaptive intelligent technology with the traditional educational model was no new initiative. After a review of past literature, several establishments were made, two of which are mentioned here. One group [3], put confidences in adaptive intelligent techniques to help repair literacy, while another group of
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(IJSTE/ Volume 6 / Issue 6 / 003)

experts, [4] relied on what was naturally produced from students’ culture and the environment as a means of aiding with literacy repair. What is meant by this is that one of the experts, embedded lessons into the curriculum, that mimicked what students did as part of their natural, daily routine. Although these investigations did not confirm that adaptive intelligence solely provided a solution to the literacy problems, it was obvious that this technique, used as a part of today’s educational model, did offer access to an adaptive learning experience that was unique and specially designed for each student. While adaptive technology is beneficial to the goal of introducing a system that can issue assignments based on a student’s academic threshold, these approaches still fail to consider the cultural, environmental, and linguistical areas that are proven to be necessary for learning and development amongst these students. These areas, often unchartered due to the lack of understanding, inability to relate, and dedication to formality, make up the rationale behind the development of African American learning styles as defined by this research.

IV. PROPOSED SYSTEMS SOLUTION

A. Methodology/Approach

This research uses a combined methodology in the systems development process. This methodology consists of taking a process called Action Research Methodology (ARM) and integrates it at the Systems Analysis Phase of the System’s Development Life Cycle (SDLC), as illustrated in figure 3. ARM is a process by which two groups of experts work collaboratively with the researcher and/or principal investigator to design, develop and validate a model. As shown in figure 2, two expert groups were used at two different phases of the ARM. The first group labeled “Expert I” found on the left, make their contributions to systems development at the beginning of the SDLC process. This group of experts is responsible for aiding with the design and development of the Dynamic Hybrid model, while the group referred to as “Experts II” validate and sign-off on the model. ARM is significant because it is a process that is used by many disciplines, and a process that is respected in such that it permits implementation of the model/system minus the development of a physical prototype. Figure 2 below is a depiction of action research methodology and how the process works throughout system development.

![Fig. 2: Action Research Methodology Process](image1)

![Fig. 3: Systems Development Life-Cycle](image2)

B. Data Analysis Model

A sophisticated approach was used to first establish which features from the heritage system should be salvaged; to determine which learning styles should be juxtaposed with these features, and then eventually, determine how the two would work together harmoniously in a system setting. Before explaining the process by which features and African American learning styles are united, it is necessary to define what it means to be a feature and understand the source of these features. Features in this research represent subjects, these subjects are expressive of those used in the AIS for Reading called “IReady”. It is important to note that the actual data is extracted from an aggregate of city and statewide test scores having comparable content to what is found in the IReady system. The process by which system content and tests content was compared, is known as the Content-to-Tests Association. The Content-to-Tests Association is one of the 4 data analysis classifications established as a contribution of this research. The Content-to-Tests Association also qualifies the data that is being used in place of the IReady system to confirm its suitability.

V. RESULTS

The next classification, the Content-to-Systems Association, establishes means scores for each of the schools and each of their corresponding subjects. For example, mean scores were taken for Alexander, Abbottston and Beechfield Elementary, etc., in each
of the 7 subject areas. The 7 subject areas are represented by variables: P, PA, RC, V, HF, F, SW, and G. These mean scores are weighted against a metrics as a way of determining the areas in which students exhibited the most strength; these strengths were eventually used to influence weaknesses in other subjects. Once the areas of strength were identified, a Sparse Matrix was used for each of the schools and their corresponding features; the sparse matrix was done as a way to isolate and remove all non-zero variables. The variables that remained were tallied. The feature variables having the highest total of aggregate scores were the feature variables deemed most significant. See Table 1 for example. Table 1 considers scores from Beechfield, Abbottston. The variable “1” represents the correlation between the schools and the subject. It essentially depicts whether the school performed well in P, PA, RC or F. Based on what is illustrated in the table, feature variable PA has a sum of 3, which means that each of the associated schools performed well in it, making it most significant. This classification which involves applying values to the feature variables is known as the Feature Variable-to-Value Association.

The Feature Variable-to-Value Association is also represented mathematically. The mathematical model is identified as equation “1” below; it is representative of a classification in which correlations and relationships are established between feature variables, and values developed from school mean scores. The mathematical representation of the Feature Variable-to-Value Association is as follows:

1) Mathematical Representation

X represents a Boolean variable to indicate mapping between school and feature.

i => Schools = [1,2,3,4,5,..n]

j => Best performing features (subjects) that correspond to i.

d => Degrees and years

“i” is a numeric encoding for schools that perform well in a given subject. There is not a guarantee that there will be a complete set of integers between 1 and n; the set depends on the variable d. What this means is that not every feature will be used. A feature will be used, only if it has a school/score associated with it.

“j” is a numeric encoding of subjects whose position in the vector, corresponds with the numeric representation of schools in the associated position [5]. The formula used for the Feature Variable-to-Value Association is as follows:

\[ P = \sum_{k=0}^{n} X_{ikd} \rightarrow \text{for all entries where } j = 1 \] (1)

P represents feature variable vectors, and feature variable vectors are represented by numbers 1-8. \( X_{ijd} \) as mentioned above, represents the schools and their corresponding best-performing features. In other words, every place that \( j \) is present is equal to a number between 1 and 8.

With this said, identifying where a variable vector exists is extremely imperative to this process because it is necessary for establishing which feature variable-to-value associations are most significant. In this case, a mathematical model was used in efforts to demonstrate how significance is determined. The Mathematical representation is as follows

\[ P = \sum_{k=0}^{n} X_{ikd} \rightarrow \text{for all entries where } j = 1 \] (2)

\[ P = \sum_{k=0}^{n} X_{ikd} \rightarrow \text{for all entries where } j = 1 \] (3)

something important to note about the formula above is that “i”, and “j” are vectors that specify which index within the vector is needed, “k” is a subscript, which will represent a way to get to this particular vector. Vector “k” is consistently used because the same location is being referenced, and “n”, represents the total number of schools. What is depicted in this formula is as follows: feature variable P is equal to the sum of all of the associations that exist between the schools and a particular feature variable. In other words, all variables where \( jk=1 \) exist should be computed.

Understanding the significance of each feature variable makes it possible to find relationships between feature variables and the most crucial attribute of this research: African American learning styles. The process by which these African American Learning Styles are identified is known as the Feature Variable-to-Learning Style Association. African American learning styles used by this research were developed by establishing qualitative and quantitative parameters set through a comparative analysis of feature content versus learning style content to identify relationships that were specific or unique to each student using the Hybrid system.

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**Table - 1**

Performance Score-card

<table>
<thead>
<tr>
<th>School Name</th>
<th>P</th>
<th>PA</th>
<th>RC</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abbottston Elementary</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Alexander</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Beechfield</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

**The Feature Variable-to-Value Association** is represented mathematically. The mathematical model is identified as equation “1” below; it is representative of a classification in which correlations and relationships are established between feature variables, and values developed from school mean scores. The mathematical representation of the Feature Variable-to-Value Association is as follows:

\[ P = \sum_{k=0}^{n} X_{ikd} \rightarrow \text{for all entries where } j = 1 \] (1)
VI. CONCLUSION

African Americans of low socioeconomic status lag behind their Caucasian counterparts where literacy is a concern. While this research in no way suggests that the Hybrid system will solely act as a mitigation strategy for improving literacy rates amongst African American, it does suggest that if a student learns using such an application that they can relate to, they will become more interested, more likely become engaged, and as a result, produce more meaningful results. The Hybrid System is a proposed solution for improving engagement as it provided a formula that would be used to take a student’s weakness, using things that they can relate to such as African American learning styles to strengthen areas of weakness. While this research was conducted with African American learning styles in mind, the models developed throughout this research apply to any subject area and in any discipline.

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