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Evaluating Cultural Representation and Epistemic Bias in AI Generated Multimodal English Teaching Materials

Jainish Roy[1]*, Rajesh Sehgal[2]

[1]Assistant Professor, Department of English, Kalinga University, Naya Raipur, Chhattisgarh, India
[2]Assistant Professor, Department of Management, Kalinga University, Naya Raipur, Chhattisgarh, India

Author's Email 🆔 :
ku.jainishroy@
kalingauniversity.ac.in,
ku.rajeshsehgal@
kalingauniversity.ac.in

Author's Orcid 🆔 :
0009-0003-7116-9137,
0009-0002-0344-403X

ABSTRACT

This paper assesses the cultural presentation and epistemic bias in AI generated multimodal English teaching resources. The paper states that the prevalence of Western cultural norms and epistemologies is high, and AI-generated content mostly represents the Western views and does not represent other cultures. These prejudices deprive students of the opportunity to see the world from different perspectives all over the world, which supports stereotypes and creates a very one-sided perception of the world. The study uses a mixed-methodology, as it examines 500 pieces of AI-generated educational content, such as interactive lessons, multimedia materials, and grammar, created by many different AI-driven systems. The results have indicated that although few materials contain global examples, most tend to present non-western cultures in a westernized way and reduce their authenticity. Epistemic bias also manifests in the same way when the knowledge in these resources is highly concentrated on Western scientific and education models and other forms of epistemology, including Indigenous knowledge systems and the Eastern philosophies are barely depicted. The imbalance has major effects on educational equity because students might not get a balanced, inclusive education that will be representative of the diversity of the global society. The paper suggests that AI developers should incorporate different cultural frameworks and knowledge systems into training data to overcome these problems so that the AI-created materials will be more representative. Moreover, the studies carried out in the future must consider the creation of AI systems to encourage cultural and epistemic diversity in education material. Longitudinal research would also be useful to understand the effect of these AI-generated materials in the long term on the cultural and epistemological perspective of students and, ultimately, make the learning process more inclusive and equitable.

INTRODUCTION

Multimodal English teaching resources of AI-generated materials apply artificial intelligence to generate educational content, which is a combination of multiple modes of communication, including text, images, videos, and audio and interactive elements.[1] The purpose of these materials is to stimulate the learning process by presenting a wide range of inputs to learners that would suit their different learning profiles and can bring a more engagements and immersive experience to them.[3, 9, 18] The significance of assessing cultural representation and epistemic bias of AI-generated content is in the role played by these technologies on the perceptions of the world that learners develop. The tendency of AI systems to be trained with particular data sets makes them unconsciously have biases that are indicative of cultural and epistemic constraints.[7, 10] These materials need to be culturally represented so that they are inclusive of the various global points of view, as opposed to the expression of a single, dominant point of view. In the absence of the diversity of cultural representation, students might acquire a biased perception of the world, which will support the stereotyping and cultural zhegemony.[2]

Epistemic bias, in its turn, is a restriction of knowledge that is provided by AI systems.[21] Such systems usually have dependence on Western systems of knowledge and therefore may not give a comprehensive and all-inclusive education. The assessment of epistemic bias also provides that the knowledge will be displayed in a manner that is reasonable, unbiased, and respects the plurality of ideas among various cultures [16]. Epistemic bias and cultural representation in AI-generated multimodal English instructional materials is a highly significant problem in terms of education technology. These biases need to be dealt with in order to promote equity and fairness in AI-assisted learning, which will help create an inclusive, globally conscious, and intellectually diverse learning environment.[17]

Key Contribution

1. Their analysis reveals cultural representation and epistemic bias of AI-generated multimodal English teaching materials, which is dominated by Western views.

2. Exemplifies loopholes in current AI-powered learning text, especially concerning the lack of representation of non-Western cultures and other forms of epistemology.

3. Recommends on how to enhance cultural diversity and epistemic equity in AI training data to come up with more inclusive and balanced educational tools.

The paper is organized in the following way: First, it has an introduction that describes the importance of cultural representation and epistemic bias in AI-created English teaching materials. The literature review focuses on the past studies of cultural and epistemic biases in AI. The methodology section elaborates on the mixed methods method that was applied to collect and analyze data. The results are provided in the form of cultural representation and epistemic bias, and the implications and recommendations on how it can be better are discussed. The paper is closed with the conclusion and recommendations on the future research.

LITERATURE REVIEW

Many works have been conducted to analyze how AI models, particularly natural language processing (NLP) and machine learning (ML) reinforce cultural biases. These researchers have determined that AI systems tend to overpower the dominant cultural discourse, sidelining the minority voices. The inherent bias of AI to large datasets which are marked mainly by the Western cultural norms leads to this problem .[4] As an example, the language models generated by AI can utilize references, examples or idiomatic expressions according to a Western concept of the world that might not be agreeable or relevant to non-Western users.[11, 22] This cultural homogeneity of AI-generated content has also led to the proposal of systems that are able to acknowledge and honor as many cultural situations as possible. This type of systems might prevent the issue of cultural hegemony and make educational material based on AI more inclusive and universal.[5, 14]

The epistemic bias in AI happens when incomplete datasets or biased datasets affect the knowledge or decision-making process in an AI system, and they represent specific worldviews.[6] This is particularly

noticeable in the AI models that are trained on data that is mostly representative of western, scientific, or technological paradigms.[12] As a result, these AI systems can introduce knowledge as universal, without considering other systems of knowledge, including Indigenous or non-Western knowledge.[19] This is potentially problematic in the framework of AI-generated educational material, where students will be provided with a very small and tunnel image of the world. Epistemic bias may have an influence on the taught information, as well as on the means of presenting the same information, which will result in an incomplete perception of crucial topics.[20, 24]

Although there is a considerable body of research examining cultural and epistemic bias in AI, the majority of studies do not consider the problem in the particular case of the AI-generated multimodal teaching resource of English.[13] This literature gap is vital, because the essence of the multimodal contents (when text, images, audio, and interactivity are combined) creates an additional level of complexity to the way in which cultural and epistemic biases may be enacted.[8] Although AI-generated materials used in language learning can seek to be interactive

and engaging, they do not always succeed in being able to embody various cultural views and knowledge systems.[23] This gap is what this paper will aim at fulfilling through the assessment of how AI-created multimodal English educational resources incorporate various cultural perspectives and whether they offer a balanced and inclusive presentation of knowledge across cultures and epistemologies.[15]

The literature demonstrates cultural and epistemic bias in AI, with systems usually being shaped by overwhelming Western views and fail to acknowledge marginalized ones. The paper fills this gap in the research on such biases in AI-generated materials on multimodal English instruction, assessing their cultural representation and epistemic fairness.

METHODOLOGY

Data Collection Process

The research design used in this study is mixed-method data collection as it will guarantee a thorough analysis. The sample will include 500 AI-generated multimodal English teaching resources on different platforms, such as interactive lessons,
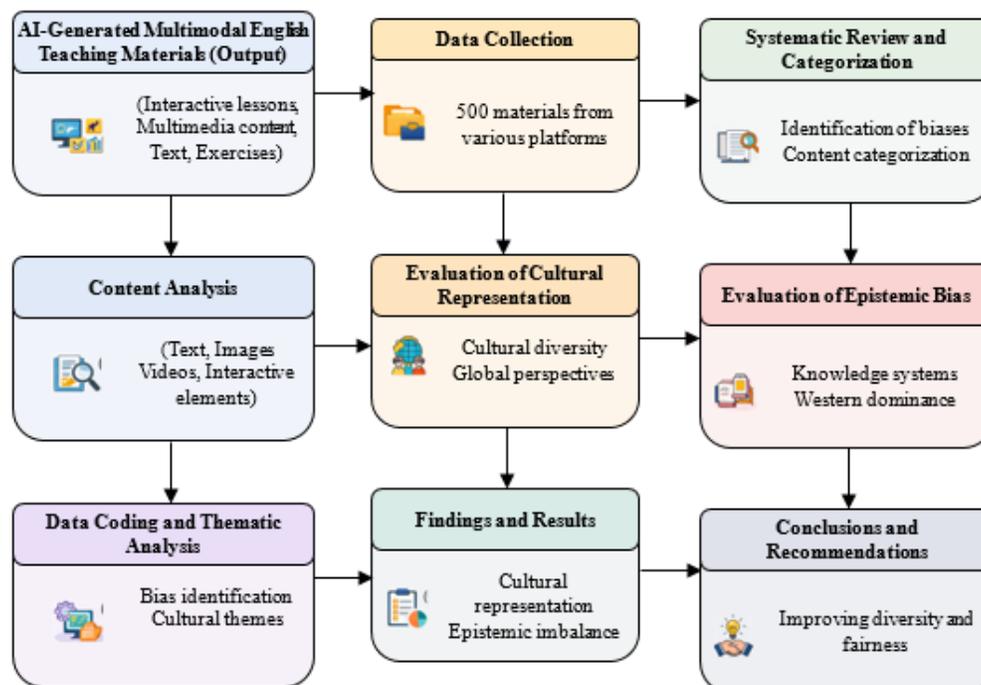

Fig.1: Research Methodology for Evaluating Cultural Representation & Epistemic Bias in AI-Generated English Teaching Materials

multimedia content (videos, images), and grammar exercises. Such materials are created through various AI-based systems, which guarantees a wide range of representation of the way AI tools create educational materials. To assess the cultural diversity and epistemic fairness, the data collection process would include a systematic review of such materials. Both materials are evaluated in terms of the integration of the global cultural perspectives and the dominance of epistemological perspectives. In this step, the identification of whether the content provides diverse cultures, traditions, and languages and whether the knowledge systems provided in it reflect the multiple worldviews, not only dominate cultures are involved.

This figure 1 demonstrates the research design to evaluate the cultural representation and epistemic bias of AI-generated multimodal English pedagogic materials. It describes the main steps in the process, which begins with data collection of 500 materials of different AI platforms. Article survey and classification are the next steps of the methodology process, which is then succeeded by the assessment of cultural representation and epistemic bias. The figure defines the steps of content analysis, data coding and thematic analysis that will eventually result in findings and recommendations that seek to enhance diversity and equity in AI generated educational content. The graphical design is based on color-coded forms and notations to indicate the data collection to conclusion flow.

Assessing criteria of Cultural Representation and Epistemic Bias.

In order to consider the cultural representation, the paper concentrates on three key elements, namely inclusion of the global worldviews, application of the culturally differentiated examples, and the non-use of cultural stereotypes. The materials are analyzed so that they may include the views of different regions as well as non-Western cultures and do not promote the overall culture. The paper evaluates the content in terms of its balanced expression of different cultures and lacks simple and stereotypical depictions. In the case of epistemic bias, the criteria used in the evaluation is the extent of knowledge being presented. This involves determining whether AI systems give priority to Western knowledge systems compared

with others and whether the content could only represent some particular disciplinary perspectives (e.g. scientific, technological, or literary). Moreover, the language of these materials is also considered to determine whether it is rather formal or technical as it is commonly referred to in the context of Western academic practices or incorporates more informal and heterogeneous linguistic immersions that might help to make the material easier to learn by students belonging to different backgrounds.

Analysis Techniques

The data is analyzed using some of the methods to determine and evaluate the cultural representation and epistemic bias. The main methodology is content analysis, which is applied to review the materials systematically in terms of certain topics connected to cultural diversity and epistemic fairness. This will include coding and classifying the content to bring out the occurrence of cultural representation, stereotypes, and bias in knowing. Also, sentiment analysis is undertaken to determine the tone and emotional background of the content and establish whether the content has neutral or biased views. Lastly, the differences between the materials that are created by different AI platforms are analyzed through the comparative approach. Whether some systems are more inclusive and balanced than others can be brought to the fore with the aid of this comparison, which identifies the differences in how various systems respond to cultural representation and epistemic diversity.

Findings

Analysis of Cultural Depiction in AI-generated Multimodal English Instructional Content

It has been assessed that a major majority of AI-generated multimodal English teaching materials promotes Western cultural values to a large extent. As an example, the cultural practices, the holidays and even the societal norms that are mostly West-centric like Christmas, Thanksgiving and the common Western family set-ups are typical in the lessons. Though there are certain sources that strive to make global views, the given examples are often viewed

Table 1: Evaluation of Cultural Representation in AI-Generated Multimodal English Teaching Materials

Material Type	Primary Representation	Raw Count (n)	Percentage (%)	Cultural Bias Level
Interactive Lessons	Western-centric	410	82%	Heavy bias towards Western norms
Multimedia Content	Limited Global	345	69%	Global examples oversimplified
Grammar Exercises	Primarily Western	465	93%	Stereotypical non-Western roles
Textual Content	Western Ideals	390	78%	Limited non-Western heroes

through the prism of Westernization. When depicted, non-Western cultures either are watered down or simplified to better fit a story more acceptable and understandable to Western norms and views. Such a display of the accurate part of cultural realities weakens the authenticity and richness of the non-Western cultures and exposes students to a limited number of existing cultural viewpoints and perpetuates cultural hegemony.

This table 1 is an analysis of the cultural representation in different kinds of AI-generated English teaching materials. It classifies both types of materials according to their dominant cultural representation and gives the raw number and percentage of the frequency of occurrence of any given cultural representation in the sample. The column of Cultural Bias Level marks how much bias the materials have, and heavy bias implies that there are more Western norms and stereotypical non-Western roles refer to the little or distorted portrayal of non-Western cultures. This table points out that the content will be more biased in the sense that it mostly presents a western cultural point of view whereas less or simplified examples in the rest of the world will be presented which is likely to affect the perception of learners towards different cultures.

Analysis of Epistemic Bias in AI-Successive Multimodal English Instructional Resources

Regarding epistemics bias, the study revealed that majority of AI-generated teaching materials in English mostly relied on Western scientific and educational paradigm. The information that is provided is usually in a Eurocentric perspective, focusing on scientific approaches, historical accounts, and school systems in the West. Other systems of knowledge, like Indigenous knowledge, Eastern philosophies or other forms of scientific practices, which are not Western epistemologies are barely present in these materials. The epistemic prejudice restricts the exposure by the learners to a variety of approaches to knowing and knowing the world, which may result in a small and possibly biased perspective of the world. Moreover, the exclusion of other epistemologies may unintentionally discriminate the epistemic inequality pushing aside precious traditions of knowledge throughout the globe in terms of education.

Table 2: Evaluation of Epistemic Bias in AI-Generated Multimodal English Teaching Materials

Material Type	Epistemic Bias	Examples	Dominant Knowledge System	Representation of Non-Western Epistemologies
Interactive Lessons	High	Scientific methods, historical narratives	Western scientific frameworks	Rare representation of Indigenous or Eastern philosophies
Multimedia Content (Videos)	Moderate	Focus on Western historical figures, events	Eurocentric historical context	Limited or stereotypical depictions of non-Western cultures
Grammar Exercises	High	Language usage, based on Western linguistic theories	Western linguistic models	Little to no representation of non-Western linguistic theories
AI-Generated Textual Content	Moderate to High	Content based on Western thinkers, philosophies	Western-centric philosophical ideas	Barely any representation of Eastern or Indigenous epistemologies

This table 2 assesses the epistemic bias, which exists in different forms of AI-generated multimodal English instructional resources. It classifies every type of material according to the degree of epistemic bias, although with a preference towards Western scientific and philosophical systems. The examples point out the fact that the information tends to represent Eurocentric historical backgrounds and Western-centric linguistic and philosophical trends. Also, in the table, the fact that the non-Western epistemologies, including the Indigenous knowledge systems and Eastern philosophies, are minimally represented in these materials is presented. This skew can be a source of a limited view of the world, where learners are not exposed to the different modes of knowing and cognition of the world.

Comparative Resolution of Cultural Representation and Epistemic Bias Results

In a comparison of the results of cultural representation and epistemic bias, one can easily see a correlation. Resources, which demonstrate poor cultural diversity, are typically characterized by a strong epistemic bias, which puts into priority Western knowledge and paradigm. These sources are not only centered on the cultural norms of the West, but the western epistemologies are also centralized, which is the source of bias. Conversely, those materials that have a more inclusive range of cultural representation are expected to include more varied systems of knowledge, such as non-Western epistemologies. Yet, the latter are still quite scarce, and there is still a critical shortage in AI-generated

Fig. 2: Comparison of Cultural Representation and Epistemic Bias in AI-Generated Materials

content. This relationship insinuates that as the culture representation improves, there is a possibility that the teaching resources will be more epistemically diverse, however, dealing with cultural and epistemic biases at the same time is a challenge.

This figure 2 is a bar graph of the level of cultural diversity and epistemic bias in different kinds of AI-generated educational materials. The X-axis has the materials divided into Interactive Lessons, Multimedia Content, Grammar Exercises and Textual Content. The Y-axis is a scale of 1 to 10 where 1 is the least diverse or bias and 10 is the most diverse or bias. The bars show the variation of various materials in their ability to reflect cultural diversity, and their congruence with Western epistemic models.

DISCUSSION

Implications of Cultural Representation and Epistemic Bias in AI Technology

The student lack of cultural diversity and the widespread use of epistemic bias in AI-generated teaching resources on English have far-reaching consequences on education equity. When the content of the education is heavily based on the western views, it can be diluting stereotypes, alienating non-Western culture and offering a one-sided view of the world. It is possible that students who have been exposed to a very Western, low-context way of thinking are not exposed to the depth of other cultures and other ways of thinking in the world, which is necessary to train the ability to think critically and understand the world. In addition, epistemic biases supporting some forms of knowing and knowing the world especially the Western science and philosophical paradigms can contribute to epistemic inequality. These latitudinal defeats the aim of the comprehensive education which means that students are unable to have holistic knowledge of the multifacetedness and diversity of human knowledge. As such, these biases need to be tackled so as to secure a balanced, inclusive and globally conscious educational practice.

Proposals to enhance Cultural Representation in AI-Generated Multimodal English Teaching Resources

To enhance culture, developers of AI are advised to strive to incorporate different cultural models in the
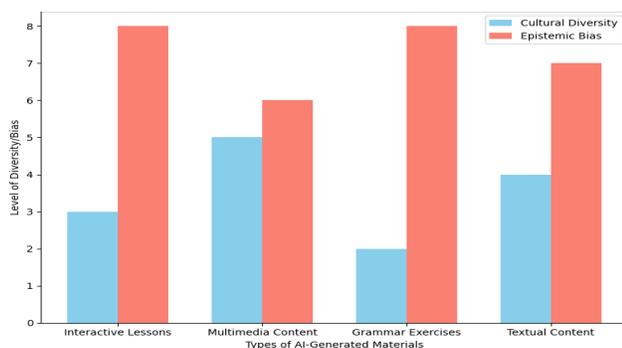
training data employed in developing multimodal educational content. This involves drawing pedagogical materials in other parts of the world especially non-western nations so that the information contained is in a multicultural setting. The developers must make sure that these materials do not provide superficial or even stereotypical examples of non-Western cultures. The AI systems are to be made to identify and value the cultural peculiarities, such as traditions, values, and social norms, so that the content could be close to learners with different backgrounds. Also, AI is to be conditioned not to support stereotypes, which might be detrimental but to enable a more nuanced and more realistic existence of various cultures. AI can also help design inclusive and globally conscious teaching material by introducing cultural diversity in the process of creating teaching resources.

5 Recommendations on Minimizing Epistemic Bias in Multimodal English AI-Generated Teaching Materials

Epistemic bias of AI-generated multimodal English teaching materials should be minimized by increasing the diversity of knowledge sources to be applied during AI models training. The diversity of perspectives in epistemology that the AI systems should incorporate ought to encompass non-Western cultures, Indigenous systems of knowledge, and other scientific paradigms. It will need a willful attempt to inject variety of disciplines, worldviews in the training data, in such a way that the training content can depict a more balanced and broader picture of human knowledge. Moreover, AI systems need to be created so that they can recognize the constraints of their knowledge and the situation in which they were developed. Instead of making an effort to offer a single dominant epistemology as the truth of the matter, AI-generated content must have many sides, particularly regarding contentious or challenging issues. This practice will assist in reducing epistemic disparity and enhancing a more accommodating and diverse learning process to learners across the globe.

CONCLUSION

The culture representation and epistemic bias of AI-generated multimodal English teaching resources were assessed in this paper, and the results showed that there were profound biases toward the Western culture and epistemologies. The evidence shows that such sources usually follow the Western lines, not only in the cultural practices and knowledge systems but also overrepresent or simplify the non-Western cultures and other possible epistemologies. This prejudice is noticeable in different forms of educational material, interactive lessons to grammar exercises where the Western ideals and frames prevail. This small-scale approach may restrict the exposure of students to other cultures and other forms of knowing, which may encourage stereotypes and epistemic inequality. Such an imbalance has far-reaching consequences on the equity and inclusivity of AI-assisted learning as this may deny learners a balanced, and education with a global character.

The cultural representation and epistemic bias that the AI technology presents is an urgent issue that requires addressing in order to make AI-driven education systems more equal and inclusive. With the focus on cultural diversity and epistemic fairness, AI systems can provide more balanced learning experiences which would mirror the intricacies of the global society. The further investigation must be based on creating AI models that will be specifically aimed at spreading cultural and epistemic diversity in educational material. In addition, longitudinal research on the long-term outcomes of AI-generated teaching resources on student's perceptions of culture and knowledge may serve as an important source of information on the overall influence of such technologies on education. This kind of research would lead to the enhancement of AI-based teaching devices and to their further functionality in support of students with different cultural and epistemological orientations.

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