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Reconstructing Classroom Interaction Structures: Artificial Intelligence as a Discursive Actor in Educational Technology

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Abstract: Given that an increase in the number of intelligent devices at home has prompted teachers to consider managing classroom interations swiftly now. Traditional discourse models usually assume that there will be a two-way interaction of Teacher-Student, which is hard to accommodate in terms of non-human participation. Therefore, this paper holds that the functions of artificial intelligence systems in class are discursive agents who can participate actively in reshaping interactional structures. Based on Actor-Network Theory (ANT) and Conversation Analysis (CA), combining with data from OECD PISA 2022, Stanford HAI (2024) and EdWeek Research Center (2023), an original human-AI-human (HAH) discourse triangle framework is proposed to explain the three-dimensional interactive model generated by AI-integrated classrooms. The findings indicate that the disruption of information release linearity; The generation of recursive inquiry loop: Redistributing discursive authority; Significantly impact teachers' agency and education equity.

Keywords: Classroom Discourse, Artificial Intelligence, Discursive Actor, IRE Model, Actor-Network Theory, Educational Technology.

1. Introduction

Artificial Intelligence has been integrating with formative educational settings at an increasingly rapid rate in recent years. As shown in the report by OECD on AI and Education [9], more than 45 per cent of schools worldwide have been using some form of artificial intelligence (AI)-aided teaching tools as of 2022; this number is tripled compared to 2015. Based on the Stanford-HAI AI Index report (6), international investment in artificial intelligence education technology exceeded $20 billion in 2023, demonstrating a high degree of institutional confidence and market interest in AI-assisted teaching. Both improvements in technical terms and changes to the centre around which knowledge is created, shared or discussed within education show up clearly on this path.

However, the main discourses in educational technology research have long remained primarily instrumental. According to Zawacki-Richter et al. [13] (2022), after a systematic review of 146 studies conducted worldwide, most research focused on outcomes, personalisation and evaluation; The interactional and discursive effects brought by non-human entities entering the social environment of classrooms were not adequately addressed. This gap has theoretical basis. Classrooms are not merely neutral transmission devices but rather Structured communication environments that transmit Patterns of Talk to encode Relationships of Authority, Identity, and Epistemology Access. When the AI system enters this environment and starts participating in communication with students and teachers, it is not merely adding to their current exchange but rather reshaping these conversations.

Most classical models of classroom discourse are based on the Initiation-Response-Evaluation (IRE) sequence discovered by Sinclair and Coulthard in 1980 and further developed by Mehan in subsequent years; The teacher asks a question, the students respond to it, and then judges their answers. The Triangular pattern has been proven effective in all kinds of education outside China and is used to describe Classroom English as a model. However, it is based on the strict bilateral relationship of a human authority figure and a human learner. Introducing an artificial intelligent agent that can participate in natural language conversations by initiating dialogue, giving responses, generating the following sentence segment; it falls outside of this category.

Three core issues were addressed by this study: Firstly, how has AI changed the old IRE/IRF discussion pattern during class activities? Secondly, what kind of different Interactional System have emerged with the participation of AI as a Discourse Actor? Thirdly, Based on the above Changes to Teachers' role and educational Equity. To answer these problems, this study builds up an original theoretical system of the human-AI-human discursive triangle based on actor-network theory and operationalise it with conversation analysis.

2. Research Review

Research on Classroom Discourse has established its own theory system. Sinclair and Coulthard [11] determined that the IRE sequence was the core structure of pedagogical talk; therefore, teachers' questions-children's responses-teachers' evaluations are central to formal teaching in all disciplines at every level.

After IR E was dominant, subsequently many more dialogical classroom Models have been put forward. Mercer (2017)[8] raised the concept of "exploratory talk"; Participants interact positively towards their own thoughts; Give objective reason for rebuttal and strengthen comprehension together through long discussions. [1] Alexander formulated this as the pedagogical Framework of Dialogic Teaching and stressed that effective Classroom Discourse should be Cumulative, supporting, Purposeful, and Co-operative.

The appearance of AI in the field of educational Technology has added another group to participate in this discussion. Since the late 1980s, intelligent tutoring Systems

(ITS) have existed in multiple forms and were one of the first AI-based applications for education. Van Lehn (2018)'s well-known meta-analysis showed a learning effect size of comparable importance to that obtained from human one-on-one tutoring, as well as significant interest in its applications. Recently, with the development of large-language-model-based generation-able-ai tools, more and more advanced capabilities for dialogue construction have been added to educational AI. Lucky[5], for instance, argues that if there is an AI capable of modelling learners' cognitions and making adaptive changes to the teaching plan, then it has reached a new level in education technology - genuinely collaborative pedagogy. OECD [9] believes that generative AI offers a range of personalised interactive tools and thus blurs the lines separating these from traditional tutors.

Even though many studies have been conducted on AI participation over the years, a deficiency remains in understanding both structural and discursive elements at play for these participants. This deficiency drives the proposed theoretical refocusing in this study. Based on Latour's actor-network theory [4], which holds that non-human entities have agency within the system of social network through mediation, translation and transformation of others' behaviour; thus re-constructing artificial intelligence is not simply passive instrumentality but an active agent in shaping the social and discourse life of classrooms.

3. Theoretical Framework

Based on this, a theoretical system integrating actor-network theory with discourse analysis will be constructed to explore how artificial intelligence impacts changes in classroom interaction Patterns. The essence of this system is to redefine artificial intelligence as a discursive agent; no longer a passive support for human expression, but an active constructor of forms, rhythms and Directions in Language Use by itself.

Ant's ANT [4] offers an ontology that underpins this new re-conception. ANT breaks down traditional boundaries between humans and non-humans' agency, claiming that any entity that changes the situation of other entities in the network through modification can be regarded as an agent. In educational scenarios, it can be applied such that an AI system with the function of producing questions, giving out adaptive evaluations, and steering conversation paths does not merely remain in the possession of teachers or learners but instead becomes an actor participating in the reshaping of the network structure for education and training.

Based on this, the present work presents the original analysis tool for HAH: The human-AI-human (HAH) Discourse Triangle. The AHH model demonstrates that there is a three-dimensional Interaction system mediated by Artificial Intelligence among teachers, Students and Others; It responds to All kinds of inputs generated by this party. This is entirely different from the two-way Teacher-Student dyad assumed in classical IRE analysis [11][7]. In the HAH triangle, discourse authority is distributed among teachers and others at different levels; Anyone can start a discussion and give their own views on it.

The framework identifies the following three analytical directions of examination for AI-integrated classroom discourse from different angles: turn-taking structure; Feedback mechanism; Authority Distribution. Traditional IRE classrooms have poor turn-taking, slow feedback mechanisms, limited evaluation options, and centralised control of authority. Through analysis of AI-included classrooms using the HAH model, turn-taking has become disperse and negotiated; Feedback is timely and flexible responses to situations vary among humans and machines.

4. Methodology

Using a combined approach involving systematic literature synthesis and secondary examination of vast amounts of publicly available data. Given that this research has two objectives: first, to build a theoretical system that can account for the structural variation in classroom language; And secondly, based on empirically collected data from recorded educational environments, verify this theory.

The quantifiable part of this study uses data from three publically available databases. OECD PISA 2022 database [10] provides a set of index data on students' learning experience in over 80 countries; including indexes about Digital Tools, Quality of teacher-student interactions and Socio-Economic Factors impacting the School Participation Rate. Studied by [6], which has collected long-term information about how artificial intelligence is applied in education, including its rate of use, expenditure amounts, behaviour patterns at different levels of education. EdWeek Research Center's national sample of US educators provided data in an EdWeek study (2017). K-12 teachers provide practitioners' reflections on how AI has affected their instruction and the state of their classes.

In terms of the quality part, based on an extensive survey in classroom Observation Research related to integrated Learning Environment with artificial intelligence applications, as well as Analysis;

5. Analysis of Findings

The empirical and analytical results of this study are organised as follows: the disruption of the IRE pattern; The rise of a new discourse order; And Finally, reconstituting Teacher Agency and Implications for Equity.

Based on a review of the relevant research literature, it was found that all participants' interactions with AI systems have disrupted the three-part system previously proposed by Sinclair and Coulthard [11] and subsequently elaborated upon by Mehan [7]: Classical IRE has it that teachers' evaluative turns serve as boundaries to split up an exchange; thus, they open the door for another round. The evaluative closure, which gives a specific Rhythm to IRE and concentrates Discourse Authority at the Teacher's End. Introducing an artificial intelligent system usually results in either a missing conclusion or being cut off at some point. Bommasami, K., Liu, Y.-S., Yang, J.Q. (2021) based on their detailed analysis of artificial intelligence systems and particularly large-scale language models structures; Responses to these systems usually lack evaluative definitiveness but rather provide more explanation through elaborated questions, expanded inquiry suggestions, etc. Transforming the three parts of the IRE sequence into an open-ended exchange with no predetermined evaluative third turn, distribution, or elimination. According to data provided by EdWeek Research Center [3], as verified at the teacher level practice shows that: AI tools have made changes to how students respond to questions in class; 54 per cent of respondents indicated an increase in student discussion intensity under AI-assisted feedback conditions.

From this disturbance, there will be new discursive patterns:

The triad-mediated model, recursivity of questioning loop; And the distributed authority system. Triadic mediation refers to a situation where the AI plays the role of mediator among teachers, students, and their relationships; It translates or reshapes the teacher's initiation before students respond, explains students' responses to others in advance, etc. Recursive inquiry loop occurs when the AI's feedback leads to a student's need to modify their answer and resubmit it again, repeatedly forming an iterative dialog sequence with no parallel for traditional IRE analysis. These cycles help to prolong the productive duration of a single starting point, thereby promoting more extensive exploration of complex issues in line with Dialogical Theory as proposed by Alexander [1] and inquiry-based discourse analysis based on Mercer's work [8]. The decentralised authority structure is formed due to the AI generating authoritative-sounding responses that question teachers' dominant position of epistemological endorsement - a systematic phenomenon observed in the AI deployment data published by Stanford HAI [6] - thereby providing Conditions under which students might view AI feedback as more authoritative than their teacher's assessment.

The reconstituted form of teacher agency in AI-embedded classroom environments has not been straightforwardly defined. According to OECD data [9], teachers in AI-integrated schools spend much more time facilitating learning, providing mentorship, and asking higher-order questions; there is a decrease in routine transmission and an increase in complex pedagogical activities (see Table 1). PISA 2022 [10] also provides data indicating that in schools where more teachers have used AI tools, there is a marginal improvement in reported teacher-instructional autonomy; In some cases, the use of AI might even expand rather than restrict professionals' judgments. In addition, based on Ed-w-week Research Centre data [3], 41% of teachers feel that they have reduced control over classroom discussion because of the active participation of students with AI; There is a discrepancy between delegating authority and maintaining professional ethics.

The equity dimension in AI-mediatised discourse restructuring needs special focus. According to the PISA 2022 data, there are noticeable disparities across different socio-economic levels for using AI tools (ref.[10]). Students in the highest social economic category are on average 2.3 times as likely as students from the bottom to regularly utilise AI-supported learning resources globally according to this study. The difference corresponds one-to-one with different access points to the new discourses offered by AI participation. Regular engagement of students with artificial intelligence in educational settings helps them become familiar with the recursive inquiry loop and the iterative reinforcement mechanism mentioned above; However, those lacking such experience remain bound by traditional IRE frameworks. Stanford University's "Human-centred AI" initiative [6] defines this gap in AI accessibility as a key inequity issue across current educational Technology rollout. In this way, there is an additional risk of widening existing educational gaps due to different access points for children in the emergence of new discourses; This issue falls into the category of structural problems not merely caused by specific technicalities but which future policy response will need to tackle.

6. Discussion

This article can make a certain extent' theoretical and application breakthrough in connection with this scenario: introduction of artificial intelligence into classrooms. According to a theoretical standpoint, the HAH Discourse Triangle Model, which builds upon tradition-discursive theories with wider applications. Integrating a non-human discursive agent into the structure of classroom interaction can break through the anthropocentrism inherent in IRE analysis [11-7], its subsequent dialogic extensions [1][8], etc. Mercer (2004) and Alexander (2017) explore classroom discourse to redistribute the voice among people; Meanwhile, in the HAH model, which expands the concept of audience participation beyond human beings. Aligning with the development trend of social theory, this move is consistent with those made by ANT [4]; Meanwhile, it provides a solid basis for education technology practice observed by Luckin et al. [5] and the Stanford HAI [6].

Several recommendations based on these results from the teachers' training perspective are as follows: If the systematic transformation of discourse Structures by artificial intelligence involves a teacher's preparation beyond technical proficiency; they must also learn to handle and lead these new modes of communication effectively. It suggests a kind of pedagogical competence - discourse coordination - which is not reflected sufficiently in teachers' professional education programmes; This gap can be seen from the practitioners mentioned in EdWeek Research Centre's reports. Curriculum designers should consider the structural affordances and limitations brought about by AI integration when designing courses; They need to build some specific Opportunities for recursive, distributed inquiries that are consistent with the kind advocated by Luckin et al. [5] While at the same time ensuring that AI does not reinforce or exacerbate teachers' centralization of control mechanisms. Through the 2022 PISA data, the equity implications revealed have emphasised that equitable distribution of AI-mediated discourse should be taken seriously in education policies, not considered merely as an adjunct issue.

There are still some deficiencies in the research scope of this paper. Because of this reason, there may be certain biases in the selected qualitative evidence bases after filtering through analysts' analyses or researchers' reports. The PISA 2022 [10] and Stanford HAI [6] datasets, while authoritative and comprehensive, were not designed specifically to capture discursive interaction data, requiring inferential interpretation. In addition, the HAH framework has been developed mainly based on an English education context and needs to be adjusted in view of the different discourse norms and interactional rules of non-Western educational systems; this issue was also identified as a concern among Zawacki-Richter et al.'s study [13].

7. Summary

This paper argues that AI Systems working in classrooms are Discourse Agents and have a significant role in reconfiguring the interactional Architecture of pedagogical Talk. Based on the proposed HAH Discourse Triangle framework, which is based on actor-network theory and operated by conversation analysis; This paper has shown that AI participation breaks the linear evaluation closure of IRE sequences, generates new recursive and dispersed discourse patterns, reorganizes teachers' agencies as discursive coordinators rather than authoritative information providers, and introduces new directions of educational inequality due to different access rights to AI-mediated interactive

capabilities.

Therefore, depending on where AI is applied in terms of structure or content change for educators' influence, two types can be classified.

In the future, a long-term study of how AI-mediated discourse Structures change as teachers and students become more familiar with its use is needed. Multicultural and multi-lingual explorations are required to evaluate the universal applicability of the HAH model in non-Western educational environments outside those already studied in academic research. Moreover, in-depth discourse analysis at a fine-grained level of reality-based AI-mediated classroom interaction (real-time conversation data rather than self-reported results) can enhance the empirical support for the framework that is presented here.

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