Emerging tensions around learning with LLM-based chatbots: A CHAT approach

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Abstract
This paper investigates the tensions introduced by the introduction of large language model (LLM)-based chatbots in higher education, particularly within a distance university that embraces a networked learning approach. LLM-based chatbots such as ChatGPT are applications that simulate conversations with humans, powered by AI-trained large language models. The study is grounded in a socio-material perspective, considering the digital as inherently intertwined with social, material, and broader contextual factors. Utilising cultural-historical activity theory (CHAT) as a framework, the research examines the changing human-technology relationship and the emerging tensions within the learning activity system.

A survey conducted in Spring 2023 at OnlineUni (name changed) revealed that while students appreciate the immediate, personalised responses from LLM-based chatbots, there is significant distrust in the output, and they raised concerns about the quality of learning and the value of their diplomas. Teachers share these concerns and question the evolving roles and responsibilities in education due to such chatbots. The survey, which included responses from 584 students and 171 teachers, highlighted the use of LLM-based chatbots for various purposes, such as obtaining quick answers to generating content, and underscored the need for support in integrating them into learning and professional activities.

The CHAT framework allows for an analysis of the activity system, identifying tensions in tool mediation, division of labour, and rules. Students are grappling with the balance between human and AI contributions to learning, the potential for chatbots to undermine the learning process, and the need for clear guidelines on using these technologies. The paper discusses the implications of these tensions on the learning objectives, the role of the community, and the division of labour within the educational setting.

The findings suggest that the introduction of LLM-based chatbots is forcing a re-evaluation of what should be taught and how learning could be facilitated. There is a call for critical AI literacy and a better understanding of the redefinition of the division of labour between students, AI, and the community. The study highlights the necessity for collaborative rule-making to navigate the complexities of integrating LLM-based chatbots into higher education, ensuring fairness and accessibility while maintaining the quality of learning.

In conclusion, the paper emphasises the need for ongoing research to understand the evolving dynamics of human and non-human actors in the learning process. It calls for a closer examination of the interactions within the learning activity system, particularly the instrumental genesis of student-tool relationships, to inform the development of pedagogical strategies that leverage the capabilities of LLM-based chatbots without compromising the collaborative values of education.

Introduction

"We should have by the year 2020, or shortly thereafter, computer-assisted instruction courses that have the features that Socrates thought desirable so long ago. What is said in Plato's dialogue Phaedrus about teaching should be true in the twenty-first century, but now the intimate dialogue between student and tutor will be conducted with a sophisticated computer tutor" (Suppes, 1984, p. 306). Suppes may not have been far off. End of 2022, ChatGPT was made available to the public, and many educational technology companies and educators announced a major upheaval in education, including the use of large language model (LLM)-based chatbots as tutors in higher education. LLM-based chatbots such as ChatGPT, Bard, Claude or LLaMa are applications that simulate conversations with humans, built on AI-trained large language models. In this paper, LLM-based chatbots and AI chatbots are used as synonyms. At the time of the survey, these were text-based apps, and

ChatGPT dominated the market. In a spring 2023 survey at OnlineUni (name changed), students suggested that asking questions was their top use case for LLM-based chatbots in their studies. Students highlighted that they could receive immediate answers at any time, at a level that was appropriate for them, without feeling embarrassed. However, 68% also said they did not trust its output, and a significant concern for the students was the quality of their learning and the value of their diploma. Teachers shared these concerns but also had questions about changing rules and responsibilities in relation to this new tool. The introduction of LLM-trained chatbots has created tensions in higher education, and it appears necessary to understand these contradictions. This research aims to gain a deeper understanding of how LLM-based chatbots are reshaping learning in higher education. How is the human-technological relationship changing? What tensions are emerging within the networked learning system within which our students learn? As a first step towards a deeper and more nuanced understanding, our research question is: what tensions has the emergence of LLM-based chatbots in higher education introduced in the learning activity system?

The context is a distance university which values a networked learning approach, that is, it "involves processes of collaborative, co-operative and collective inquiry, knowledge-creation and knowledgeable action, underpinned by trusting relationships, motivated by a sense of shared challenge and enabled by convivial technologies" (Networked Learning Editorial Collective, 2021). We adopted a socio-material approach, considering the digital as embedded in the social and material (Fawns, 2019), as well as in the political, economic, biological, and environmental (Jandrić et al., 2018) while avoiding an instrumental or deterministic view of technologies (Hamilton & Friesen, 2013). Engeström's cultural-historical activity theory (CHAT) offers a socio-material approach to understanding change and development initiated by the introduction of new technology in the learning activity system (Engeström, 1987/2014). It is particularly well adapted as it does not only focus on the student-technology relationship but considers the whole activity system (subject, object, tools, rules, community, and division of labour) within the wider socio-cultural and historical context. With CHAT's emphasis on collaboration and communication, it also sits well within the social and situated approach of networked learning (Jones, 2015). By identifying the emerging tensions, we can then act on them, opening up the space for possibilities and choices rather than taking the future as given (Dunne & Raby, 2013; Facer, 2016).

The Spring 2023 survey of OnlineUni students (584 respondents, 29% male) and teachers (171 respondents, 60% male) included both open and closed questions regarding demographics, their use of LLM-based chatbots, the risks and opportunities they saw, their trust in the chatbots' output, rules about its use in higher education, what support they may need in relation to the use of these technologies, and their introduction in classwork (for teachers only). The results, especially the open-answer questions, were analysed in the light of Engeström's activity triangle, highlighting the changes in relationships between the different components of the system and tensions that have appeared. We find that the main areas of tension concern the tool mediation, but also the question of division of labour and rules, all these in relation to the student as subject, learning as object, and community.

In the next section, we describe the CHAT framework as it applies to LLM-based chatbots in higher education. We then present our methodology, including the survey. Finally, we discuss our findings and next steps.

The CHAT framework for LLM-based chatbots in higher education

CHAT offers a framework for thinking about the place and role of ChatGPT in education, taking into account the complexity of the whole learning activity system, within its socio-cultural context. This approach is particularly useful as it affirms the possibility of change in the activity system. When a new element, such as a new technology, is introduced into the activity system, it often leads to tensions and contradictions. The model can help question the system and start envisioning new ways. "An expansive transformation is accomplished when the object and motive of the activity are reconceptualized to embrace a radically wider horizon of possibilities than in the previous mode of the activity" (Engeström, 2001). This first research aims at uncovering these tensions and contradictions.

CHAT is rooted in Vygotsky's work on mediated action within a cultural-historical context and Leontiev's addition of an activity system, emphasizing the collective. Engeström developed CHAT as a holistic and dynamic lens to examine the complex interplay between students, educators, technology, and the institutional environment to explain collective activity (as differentiated from the individuals' actions). It has often been used to describe learning (Tight, 2012). In this project, we consider the basic activity triangle (see Figure 1), to focus on the learning activity, leaving aside for now the interaction of multiple systems.

The basic activity triangle includes the subject, the object, the community, tools and signs, rules and the division of labour (Engeström, 1987/2014). In the case of a university setting and a focus on student learning, the different components can be described as follows:
- The subject: students in a distance university setting.

- The object: the learning objectives or the module and programme.
- The community: other learners, teachers, the institution (including policymakers and the data protection officer)
- Tools and signs: the focus is on LLM-based chatbots, but there are many other material tools (computer, for example), technologies and software (Internet access, learning management systems, prompts, etc), and signs (texts, videos) that are used in the process of learning.
- Rules: guidelines, norms and expectations governing the activity, including, for example, guidelines on the use of LLM-based chatbots, ethical standards, or assessment regulations.
- Division of labour: distribution of tasks and responsibilities between learners, teachers, and LLM-based chatbots.

These all participate in shaping the learning experience in higher education. With the advent of ChatGPT, the roles of the different components are changing, leading to tensions and possible contradictions.

In the research, we propose to analyse how the tool and social mediations are changing with the introduction of ChatGPT. We then look at the tensions and contradictions appearing at the different intersections.
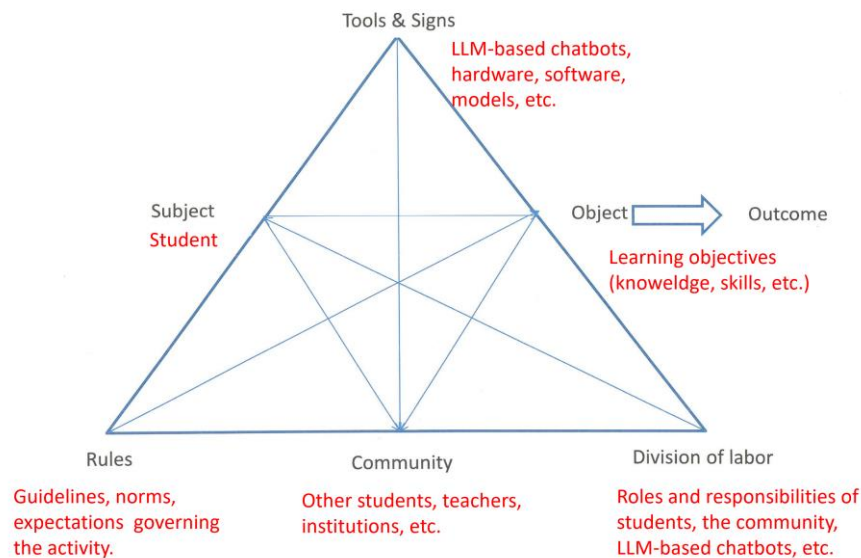

Figure 1: Basic activity triangle (Engeström, 2001, p. 135)

Methodology

To uncover the emerging tensions in the activity triangle, we carried out a survey of both students and teachers on their use, concerns and expectations of LLM-based chatbots and analysed them based on the CHAT framework.

Student and teacher surveys

There were two parallel surveys, one for the teachers, which included professors and assistants, and one for the students. The survey structure was identical, and the questions were the same whenever possible, just adapted when needed (e.g., the context of use "in my private life, for work, for my studies, other" for students and "in my private life, for teaching, for my research, for administrative tasks, other" for teachers). The survey had three sections: demographic data, use of ChatGPT, risks and opportunities, and future developments.

The primary demographic data was the same for both surveys: age group, gender, teaching field or study. For the teacher survey, we added a question on their role (teacher or assistant). For the student survey, we added a question about the programme (Bachelor, Master, Further education or 25+) and the semester of study (1-2, 3-4, 5 or more). The second section was concerned with the use of ChatGPT or other AI chatbots:

- How often do you use ChatGPT or another AI chatbot? Choose one option: "Never, a few times to try it out, a few times a month, a few times a week, daily."
- In which context(s) have you used ChatGPT or another AI chatbot? Choose multiple options: "In my private life, for work, for my studies, other (open answer)" for the students and "In my private life, for teaching, for my research, for administrative tasks, other (open answer)."

- For what purpose(s) do you use ChatGPT? Choose multiple options: "create content, get answers to questions I have, improve my writing style, generate feedback on a production, create an outline, write code, for entertainment, other (open answer)".

The third section covered risks and opportunities with two open questions:
- What concerns do you have regarding the use of ChatGPT (or other AI chatbots) in higher education?
- What opportunities do you see in the use of ChatGPT (or other AI chatbots) in higher education?
- And one closed question: How much do you trust the content generated by ChatGPT? With one answer from: "totally trust, somewhat trust, somewhat don't trust, don't trust at all."

The last section was concerned with the future:
- Should students be allowed to use ChatGPT or other AI chatbots in their studies? Choose one option: "yes, no, it depends" followed by an open question: Could you briefly explain your position?
- Regarding ChatGPT and other AI chatbots, would you like support to better: choose multiple options: "understand how it works, understand how to use it in your studies, understand how to use it in your work, none, other (open question)" for students and "understand how it works, understand how to use it in your teaching, understand how to use it research, help students develop AI literacy skills, none, other (open question)"
- What would be the best format for such support? Choose one option: "Written guidelines, one-hour seminar, workshop (online workshop in the student survey, just workshop in the teacher survey), other (open question)."

Two more questions were added to the teacher survey, with a choice of one option for each: "Yes, I have, planned to, no"
- Have you discussed ChatGPT (or other AI chatbots) in your module?
- Have you introduced an activity that requires using ChatGPT (or another AI chatbot) in your module?

The initial survey was written in English. Once the structure and questions were agreed upon, the survey was translated into French and German by one person, and then tested by native speakers in each language. This allowed for a validation of the questions through multiple iterations between the three versions. LimeSurvey was used for the administration of the survey. We applied the UniDistance Suisse Ethics Commission rules, including the anonymisation of all the data.

Method of analysis
In our quantitative analysis, we employed descriptive statistics to evaluate the closed-ended survey responses. To ensure the representativeness of our sample, we conducted a demographic comparison between our respondents and the target population. This allowed us to confirm that our sample broadly mirrors the population in gender, faculty, degree, semester or academic position (lecturers or assistants). We then computed the response frequencies and percentages for each closed-ended question, providing a foundational understanding of the distribution of responses.

For the qualitative component, we implemented a thematic analysis of the responses to the open-ended questions. This process was facilitated by the use of Dedoose, a qualitative analysis software. Our methodology involved several systematic steps: data familiarization, coding, capturing diversity and major themes around emerging tensions. We developed a coding framework based on the six components of the Activity Theory triangle—subject, tools, object, rules, community, and division of labour. This framework also included provisions for identifying types of tensions or areas for improvement within the learning activity system.

We have currently analysed the open-answer questions for around 100 students and 100 teachers. The next step is to have a second person participate in the coding to first ensure consistency and then complete the entire coding process. We expect to finish the entire coding and analysis during the first trimester 2024. Themes will then be reviewed and refined to ensure consistency and coherence.

Perceptions and Use of LLMs

We received 584 responses from the students, a response rate of 27%, 70% of females, 29% of males, and 1% didn't answer. A total of 171 teachers responded, a response rate of 36% (60% of males, 39% of females, and 0,6% of other and no answers). Forty-five percent of the respondents were lecturers, and 55% were assistants. All fields of study and research were represented, with a slight overrepresentation of psychology for both teachers

and students. Students of all semesters responded, 82% were engaged in a bachelor programme, 15% in a masters and 2% in further education. In both surveys, respondents were spread across the age groups represented in the institution.

At the time of the survey, beginning of April 2023, 80% of students and 73% of teachers had never used ChatGPT or tried it out just a few times. Six per cent of students were using it a few times a month, 7% a few times a week, and just 2% were using it most days. The figures are higher for teachers at 12%, 10% and 4%, respectively. The use rate has certainly increased over the past year, but we do not (yet) have new data.

ChatGPT or other AI chatbots were mainly used in private life (29% for students, 50% for teachers). For students, chatbots were used for their studies for 21% of them and work for 18%. For teachers, it was used in teaching for 26% of respondents, in research for 22% and 14% for administrative purposes.

AI chatbots are being used for a variety of reasons. The highest uses for students were getting answers to questions (27%). Creating content was slightly lower than for teachers at 13%, and similar for generating feedback on a production (5%) and creating outlines (6%). They also used LLM-based chatbots for entertainment purposes (18%), coding (just 5%) or improving their writing style (9%). Teachers had a slightly different profile: 31% used LLM-based chatbots for entertainment, closely followed by 30% for getting answers to questions, 19% used it to improve their writing, 17% to write code, and 15% to create content. At 6% and 7%, generating feedback on a production and creating an outline were less popular uses.

When asked whether students should be allowed to use ChatGPT or other AI chatbots in their studies, unsurprisingly, most students (45%) and teachers (44%) answered that it depended on the situation. More teachers (37%) responded that students should be allowed to use ChatGPT than the students themselves (31%). Participants were asked to explain their position, which is discussed below.

Although students and teachers do not fully trust the content generated by AI chatbots, 32% of students and 29% of teachers somewhat trust the content. Just 21% and 15%, respectively, don't trust the content at all.

Unsurprisingly, 70% of teachers had not yet discussed ChatGPT with their students; just 1 teacher had introduced an activity that required the use of ChatGPT. Nineteen per cent of teachers had planned to take up the topic in class, and 11% intended to introduce an activity that requires ChatGPT in their module. ChatGPT was made public as the modules were being revised for the semester, so it was not integrated into the pedagogical activities. Moreover, the large majority of teachers still had little experience and understanding of the technology.

When asked about the support they would like to receive in relation to AI chatbots, 54,7% of students wanted to understand how to use them in their studies, 35.6% for using them at work, and 25.6% said they didn't need any support. Amongst the teachers, 54.8% wanted to understand how to use them in their teaching, 35.7% how to use them in research, 38.6% on how to help students develop AI literacy skills, 31.7% would like to understand better how it works, and 28.6% did not want any support.

To summarize, students and teachers believe that AI chatbots should be (or are already) part of the learning system, but a majority needed support to learn how to use it to learn, for their work, or research purposes. In the following section, we analyse the emerging tensions within higher education due to the introduction of AI chatbots.

Identifying emerging tensions

The analysis of the open-answer questions allowed us to highlight the areas of tension that have emerged with the introduction of AI chatbots, based on the CHAT framework. We describe our findings centring on the central tensions that emerged from the analysis around the four of the six components of the activity triangle, the tool (LLM-based chatbots) mediation, division of labour, and rules, in relation to each other and with regard to the three central components of learning activities: the subject, the object and the community.

1. **Tensions around tool (LLM-based chatbots) mediation**
Tool-subject tensions: The main use-case students mentioned was answering questions:

> Accessibility: most of the time, ChatGPT explains things better than teachers, using simple, clear terms that are accessible to aspiring students. The fact that chatGPT is in private mode is a great help to introverted or shy students, who can ask questions separately, away from the crowd. ChatGPT offers a one-to-one tutor service that is accessible to everyone, with no restrictions on financial resources, especially when you want to drop out of school.
> Speed: responses are immediate, as if you were asking a teacher directly for an answer without having to write to the forums and wait for a reply. What's more, if the answer given isn't clear, you can ask other questions over and over again.
> (Stu 401, translated from French)

However, the trustworthiness of the answers was questioned by a majority of students, which casts doubt on the value of LLM-based chatbots in some instances. Accessibility, equity, and inclusion were not taken as given, as not everyone had equal access or understanding of the new tool. Other ethical issues were also highlighted, such as the ecological impact of such large models and the question of data privacy.

A few students were not concerned or interested in AI chatbots: "I prefer not to pay attention to this kind of thing" (Stu338, translated from French).

Tool-object tensions: With the advent of LLM-based chatbots, should learning objectives evolve? As mentioned above, students asked to learn how to use them for learning, and for their future work. This also implies an understanding of how they were built and work, a critical approach to what they can and cannot do, what could be shared with them or not.

> It's a very powerful tool. Once you teach students to use it (just as you teach younger students to use a computer or the Internet), you increase their competence. It's a step for the faculty to take, but it's an option. (Stu428, translated from French).

Students highlighted the broader issue of what should humans continue to learn and what can be left to chatbots. Stu346 (translated from German) wrote:

> The boundary between personal performance and AI performance is becoming more and more blurred as the performance of the AI improves. This is not only the case in higher education, but in almost all areas of life: I am a passionate musician, but there are already AI forms that generate finished songs based on parameters. The songs are not top, but they are not bad either... At some point, you will ask yourself why you are still educating yourself. Everything can be asked for or generated by the AI. Designs, news, books, film scripts, maybe even judgements at some point...

The emergence of LLM-based chatbots in higher education is thus forcing institutions, teachers, and students to reconsider the knowledge and skills that need to be taught.

Tool-community tensions: If students are asking their questions to chatbots, what will happen to the interactions with the community? Some students reacted forcefully, defending human-to-human interactions. Answering the question regarding the possible benefits of LLM-based chatbots, one student wrote:

> None! Human exchange should remain central. Top managers are often former students. The disastrous consequences of universities only imparting knowledge without also always imparting the human dimension in which this knowledge is later to be applied are seen time and again when amoral behaviour by top executives endangers entire economies. Therefore, higher education must under no circumstances become more detached from human beings. Not everything that can be done must be done. (Stu348, translated from German)

A teacher also worried "[t]hat ChatGPT will gradually replace teachers..." (T85, translated from French).

To conclude this section, the emergence of this new tool has created tensions in relation to the students, what they need to learn, and the place of the community in this newly emerging system. We now look more specifically at how LLM-based chatbots are affecting the division of labour and then the rules within higher ed.

2. **Tensions around the division of labour and objects**

When using LLM-based chatbots, students need to make choices as to what to do themselves and what to outsource. The tension here came from the hope that AI chatbots could facilitate learning but also the worry this may simultaneously lower the quality of learning. One student suggested it could "Supplement for teaching; helpful for summaries for exams; stimulus for discussions (solve the question yourself, then compare with the answer of the AI chatbot -> discussion)" (Stu425, translated from German). Some also noted that AI chatbots could help with research: "Efficiency and speed in research. Saves time reviewing existing literature on a particular subject" (Stu404, translated from French), as well as summarising. Students thought they could save time, "taking over unnecessary time-consuming activities" (Stu351, translated from German). Help with repetitive tasks was also considered: "The possibility to execute in a fast way tasks which do not require intelligence but time" (Stu386). LLM-based chatbots were mentioned twice (as the analysis currently stands) as a help for writing.

On the other hand, when asked about concerns they may have regarding the use of AI chatbots, the students' main issue was a negative effect on learning, followed by the question of cheating and authorship. As Stu425 wrote: "No more own thought processes; no independent thinking/dealing with a question, as one can simply ask an AI chatbot for help; possible misuse of AI chatbots regarding papers/exams" (translated from German). Some did mention the risk of losing or not developing one's creativity or writing skills. Others were concerned about the risk of changes in teaching and assessment practices, such as making assessments more difficult. The question of unfair advantage was also mentioned by a number of students, such as Stu365 (translated from French):

> Apparently, teachers are becoming suspicious that students are using it to answer for them, especially during exams. Because of this, they want to increase the difficulty of exams, which is unfair and stressful for people like me who don't know how to use it.
> Personally, if I take the trouble to study in addition to my work and family life, it's because I'm interested in the subject, not so that an artificial intelligence can do the work for me. Especially as, in my future professional situation, this tool won't be able to take my place when dealing with clients/patients, etc.

LLM-based chatbots offer new affordances to support learners, but their effective use to foster learning is still unclear. How activities should be divided amongst the human and non-human actors of higher education is still to be determined, and there is undoubtedly the need for a plurality of solutions.

3. **Tensions around the question of rules:**
Rules-community: The need for clear rules was mentioned several times, both by students and teachers. A student expressed their concern "that there are or will be no clear regulations on the use of the tools. That the universities have no control over whether the tools are used despite a possible ban" (Stu317, translated from German). The current rules do not explicitly cover the use of AI chatbots; however, developing new rules needs to be community work as there is no single correct approach. Tensions appeared around different values within the community. Fairness was a concern if students' use was not regulated and equal access and training were not offered. Some students are waiting for guidelines to start using these tools: "As I am not a big fan of AI being used as a replacement for our networked thinking. If it should be used officially, then I will be happy to try this out." (Stu374 translated from German).
Rules-object: Depending on the field and specific work a student wants to do, different skills are expected and require practice. Forbidding LLM-based chatbots was not an option for most students and teachers because of its public availability and possible widespread use in future jobs. Stu429 was against "Prohibitions that are too restrictive, so that students do not learn how to use them meaningfully (the use of search engines and internet resources must also be learned, the same applies to AI chatbots)" (translated from German). Learning objectives, using AI chatbots, and means of evaluation need to be aligned. Otherwise, as one student wrote, there is a "danger of losing the ability to write and think for oneself" (Stu267, translated from French).
The students highlighted a number of areas in which tensions are emerging due to the introduction of LLM-based chatbots. In direct relation to the mediation role of such chatbots, students put forward the question of accessibility, both as a positive aspect and as potentially leading to inequalities, their value for answering questions, but also the need to adapt learning objectives in some instances, and the threat of reducing human-to-human interactions. A second area of tension related to the division of labour between students and AI. What work should be outsourced to machines? What work should be done by humans? Finally, there was a strong demand for rules in this unchartered space.

Discussion

Although ChatGPT was just six months old when we surveyed our students and teachers, and a majority were not using the technology, areas of tension were already emerging around the object (learning), rules, and interactions. Learning was obviously at the centre of the emerging tensions. What should be taught and learned needs to be adapted to a world with AI, including both critical AI literacy and the use of AI for learning, and the use of AI in society and at work. The division of labour between students, LLM-based chatbots, and the community in learning activities is already happening. Still, this research shows that the affordances and risks are not yet fully understood by students. This is also true for teachers and pedagogical experts. Mollick and Mollick (2022) suggested teachers ask students to generate drafts using AI chatbots and then critically evaluate them to write an improved version. This has the advantage of showing students the limitations of chatbots but may not always be optimal for learning. For example, Hill (2023) showed that students did better when writing their own answers rather than starting from

an AI output. More research is needed to understand how this assemblage of students and AI chatbots within a wider sociomaterial environment can foster new and different forms of collaboration and learning, as with Bayne's (2015) teacherbot experiment. This emerging new division of labour also leads to changing responsibilities between the different actors of the system. All these affect the professional identity of the different members of the learning community.

The need for new rules emerged as a complex area of tension in the learning activity triangle. For example, the old rules regarding plagiarism and citations no longer seem to work; the American Psychology Association Publication Manual (American Psychological Association, 2020) does not (yet) mention LLM-based- chatbots or AI, and some academic journals initially accepted ChatGPT as an author but then decided to refuse it as it cannot be held responsible for its output (Stokel-Walker, 2023). Moreover, in higher education, the question of accessibility of AI chatbots is essential to avoid deepening the digital divide even further. With the many unknowns about the role and place of LLM-based chatbots in learning, as well as the diversity and changing learning objectives, writing rules or guidelines must be a collaborative and ongoing effort. How can institutions offer a reassuring but agile framework?

The question of interactions mainly focused on student-AI chatbot interactions, with a few strongly worded statements dismissing AI chatbots and forefronting the importance of human-to-human interactions. If students are asking their questions to ChatGPT and receiving feedback from it on their work, where does that leave the human and inter-personal relationships that are central to networked learning (Networked Learning Editorial Collective, 2021)? What effect will it have on learning, but also more widely on knowledge creation in the long run? At the time of the survey, 10.3% of teachers " had planned to introduce an activity that requires the use of chatGPT ". Taking a networked learning approach, these teaching and learning situations are an interesting place to gather information on and discuss the dynamics of human and non-human interactions (teacher-students, student-students, student(s)-LLM-based chatbots) as they foster learning. Such research would help us characterise these developing relationships, in particular the subject-tool relationship, as proposed by Rabardel (1995) in his instrumental genesis approach.

To conclude, this study has helped reveal the complex dynamics set in motion with the public release of LLM-based chatbots and their use in higher education, and highlighted the emerging tensions around what and how students should learn, accessibility and rules around this accessibility, as well as the place and role of LLM-based chatbots in academic interactions. Taking a networked learning approach, we can reimagine, in a collaborative process that includes all the stakeholders, of all different levels, human and non-human, how to learn in this new and ever-changing environment.

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