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Cultural-Historical Activity Theory as a Framework for Exploring Pre-service Teachers' Use of an Intelligent Tutoring System for English Language Proficiency

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Abstract

The purpose of this study was to examine pre-service teachers' perceptions of their use of an intelligent tutoring system (ITS) as an English language proficiency tool. Pre-service teachers' perceptions were analysed using Engeström's second-generation cultural-historical activity theory (CHAT). A qualitative interpretivist paradigm was used. Six pre-service teachers who were learning to be English home language teachers but were not English home language speakers were interviewed. The study's findings indicated that when the ITS was integrated into an activity system for teaching and learning, participants had a favourable opinion of it. The ITS was perceived to aid pre-service teachers in enhancing their language skills and to be instrumental in achieving goals and objectives as a tool for learning.

Keywords: intelligent tutoring system (ITS); English language proficiency; pre-service teachers; cultural-historical activity theory (CHAT); language learning

Introduction

The language proficiency of university students is a contentious issue in South Africa today as many students do not study in their home language but are required to be proficient in a language of instruction that is not their own (Boughey and McKenna 2016; Van der Merwe 2016; Mheta, Lungu, and Govender 2018; Seabi et al. 2014). Keeping this in mind, many students enrolling at universities in South Africa are therefore not fully proficient in English (Coetzee-Van Rooy 2011; Nash 2006; Nel and Müller 2010; Seabi et al. 2014). Not only in South Africa but globally there is a plethora of research available which speaks to the growing number of non-English speakers attending English medium institutions (Calderón, Slavin, and Sánchez 2011; Owu-Ewie 2006; Walqui 2006).

Murray (2013) argues that it can no longer be assumed that students who enter into their university studies have the level of English language proficiency required to participate effectively in their studies, complicated further by institutions needing to produce work-ready graduates who are proficient in English. A potential approach to the issue may be to use technology, such as an intelligent tutoring system (ITS), as a tool to address the problem, and to investigate the use of this tool using cultural-historical activity theory (CHAT) as a theoretical and analytical tool (Allen, Karanasios, and Slavova 2011; Darwin 2011; Lazarou 2011; Nussbaumer 2012).

It is important to identify and appreciate what constitutes an ITS (Kulik and Fletcher 2016; Ma 2014; vanLehn 2011). ITS is synonymous with computer-aided instruction (CAI) and computer-assisted language learning (CALL) which, with the addition of artificial intelligence (the letter “I” stands for “intelligent”) is now commonly referred to as ITS. While there are numerous definitions for what an ITS is, this study identified certain common components of an ITS:

- (a) It is an expert- or knowledge-based AI computer learning programme.
- (b) It is a computer programme that grants the student some control over their own learning.
- (c) It is flexible, interactive, and adaptable to the user’s preferences.
- (d) It provides real-time analysis and feedback.

Previous research has concentrated on the effectiveness of ITSs (Kulik and Kulik 1991; Merrill et al. 1992; vanLehn 2011), especially concerning its comparison with human tutors but what is missing in the study of the effectiveness of ITSs is the voice of the students who have used the system. The research question which guided this study was: What were the perceptions of pre-service teachers of an ITS as viewed through the lens of CHAT? This study hoped to introduce a more nuanced interpretation of how an ITS is viewed, specifically within the context of teacher training at a university in South Africa. With this in mind, the main objective of this study was to examine the perceptions of pre-service teachers regarding the use of an ITS for English language proficiency by collecting data using semi-structured interviews. This study aimed to determine what tensions and contradictions were experienced within the CHAT system,

whether or not the ITS was able to mimic one-on-one human tutoring, and whether it was perceived as effective or ineffective.

Literature Review

Cultural-Historical Activity Theory

The use of second-generation CHAT was motivated by the fact that no activity system exists in isolation, and that sociocultural and historical factors may influence participants' expectations of using a new tool in an activity system, in this case, an ITS (Engeström 2010; Leadbetter 2002; Nussbaumer 2012). Murphy and Rodriguez-Manzanares (2008) describe CHAT as the investigation of human activity in specific social settings such as work and learning. Barahona (2015) defines CHAT as the theory of human development where culture plays a big role in learning and development, based on the works of Vygotsky (1978) (first-generation activity theory), Leont'ev (1981) (second-generation activity theory) and Engeström (1987) (third-generation activity theory), with traditional or first-generation approaches focusing on the individual and what the individual is doing. As Obando (2016) states, all learning systems are influenced by goals that are mediated by cultural and historical influences within the greater constraints of the environment in which they find themselves. With its concept of inconsistencies, CHAT directs researchers to fundamental contradictions between the elements of the system which underpin these difficulties, and thus also to potential sites for further development (Murphy and Rodriguez-Manzanares 2013).

CHAT has evolved over time from a first-generation framework to a third-generation framework. In first-generation CHAT, an activity system consists of a Subject, Tool, and Object that results in an Outcome. Engeström's second-generation CHAT, which was used in this study (Figure 1), includes three additional elements or nodes that have been added to the first-generation CHAT model, allowing for a more realistic interpretation of an activity system in real-life situations, and the interacting forces between the nodes (Engeström 2010). The three additional nodes (rules, community, and divisions of labour) can be seen in the figure below, with the lines connecting the various nodes depicting the interrelationships or forces between the nodes. Rules refer to the rules that govern the activity within this particular system, community refers to the community of people of an activity system (which could be both internal as well as external communities), and division of labour refers to the hierarchy of an activity system.

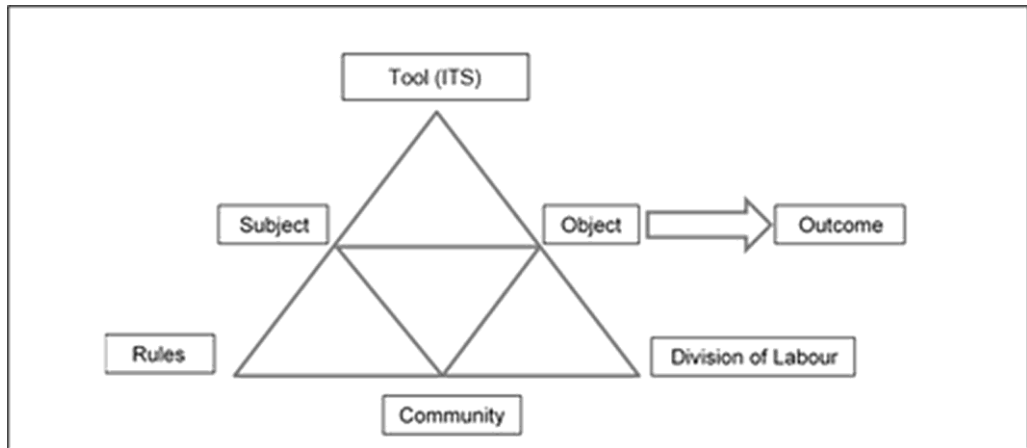


Figure 1: Engeström's second-generation Cultural-Historical Activity Theory model

In this study, the various nodes in the CHAT system are as follows. The Tool/Instrument is the English language proficiency ITS, which is an online adaptive and personalised platform, used by pre-service teachers during the COVID-19 lockdown and accessed by the participants on their digital devices. The subjects are the undergraduate pre-service teachers who used the ITS. The Object is the motivation for the activity system and the Rules refer to any procedures affecting the CHAT system, such as rules related to the classroom, rules related to the use of the platform, rules related to the university, or even rules affecting the participant at home, as the tool was used for supplementary home learning. The Community refers to the specific English class in which the participants found themselves (such as classmates), or the community of the university (such as friends, students at the university), or the larger societal community in which the participants live or find themselves in at home (such as parents, siblings, and community members). The Division of Labour involves the lecturers involved in the course as well as the students/participants interacting with each other during the course and their hierarchical relations. The most obvious hierarchy in this study can be viewed as the hierarchy within the classroom. In this study, the hierarchy involved mostly a top-down approach with the lecturer/researcher at the top and the student/participant at a lower order. (However, Division of Labour could also refer to the hierarchy of the university, or even at a larger scale, the Ministry of Higher Education.) Finally, the Outcome in this system, which will be revealed at the end of the study, is whether the perceptions of the participants were positive, neutral, or negative.

Intelligent Tutoring Systems

Within this CHAT system, this study investigated pre-service teachers' perceptions of their use of an ITS. An ITS can be defined as a teaching and learning system that can adjust to the specific learning needs of students by adapting to and personalising learning for individuals, and that can mimic one-on-one instruction at any place and time (Aleven and Ashley 2006; Merrill et al. 1992; Yang 2010). Phobun and

Vicheanpanya (2010) further add that an ITS as a system assesses each student's actions within an interactive environment, develops a model of their knowledge, skills, and expertise, and then tailors instructional strategies to assist that specific learner.

While there are many different definitions of an ITS, similar components or qualities have been identified. This study adds to the similarities of the ITS definitions offered in ITS research by describing an ITS as follows: It is a knowledge- or expert-based AI computer learning tool that enables pupils to control their learning.

While there may be many computer-aided instruction programmes (CAI: the use of computers or educational technology in learning) or computer-based training systems (CBT: training that is presented primarily on a computer) available for teaching and learning, these are often not able to assist learners individually and on a personalised basis (Chen et al. 2008; Nwana 1990; vanLehn 2011). While CBT and CAI have often used a more standardised form of instruction and testing methods, an ITS uses complex algorithms to adapt to the specific level of the individual student. It is for this reason that ITS is an essential research area, not only in education but also in psychology and computer science.

Intelligent Tutoring Systems Used in Classrooms

Digital technologies such as ITSs have been put forward as a promising mechanism for students to gain abstract knowledge (Carreira 2015; Hsi 2007; Liu and Moeller 2019) and CHAT is a promising framework that can contribute to features that allow for researchers to design and shape tools within an activity system (Fuks, Pimentel, and Pereira De Lucena 2006; Murphy and Rodriguez-Manzanares 2008; Roth, Lee, and Hsu 2009). The ITS used in this study was an online skills programme for general English created by a British university press's English Language and Teaching (ELT) division. While the outcomes of different ITSs can vary depending on the ITS employed, this study was more concerned with the CHAT system and how pre-service teachers perceived the ITS than with the ITS itself. The second-generation Cultural-Historical Activity Theory (Engeström 1987) has been used to examine the perceptions of the use of the ITS by pre-service teachers in an undergraduate English language module. In the context of this study, pre-service teachers are the participants (the Subject) using a Tool/Instrument (the ITS) in a problem-space (the Object) to create an Outcome, as perceived by the pre-service teachers using the ITS.

A growing challenge for lecturers is to find ways to support the ever-increasing language needs of students in their classrooms (Mohamedbhai 2014). Even though students know that they are entering English medium of instruction (EMI) universities, and the universities try to assist them with academic reading and writing skills, many still struggle with language proficiency. This naturally leads to frustration, demotivation, and anxiety in many (Liu and Huang 2011; Murray 2013; Woodrow 2006). This issue takes on another dimension when pre-service teachers who are studying to become English home language teachers are not English mother-tongue

speakers themselves (Nel and Müller 2010). Even though these pre-service teachers will eventually go on to teach English as a home language, it has been noticed that they still battle with a variety of language issues. The implementation of ITSs has been suggested not only to address the increasing number of students enrolling at university level, but also to develop their language skills.

Human Tutoring vs ITSs

There is still a lack of consensus in the research community when it comes to the effectiveness of ITSs. Historically, Anderson et al. (1995) found that ITSs show only an average improvement in learning, with recent reviews showing ITSs to have only moderate effects (Ma, Nesbit, and Liu 2014). Kulik and Fletcher (2016) examined 50 ITSs to evaluate their effectiveness in comparison with human tutors. Their analysis showed that students who used ITSs outperformed students who attended only traditional classes. They found the ITS to be an effective instructional tool that performed better than other forms of tutoring. In fact, in some instances, they found that ITSs outperformed human tutors, and that overall, ITSs showed a moderately strong effect across the board (Kulik and Fletcher 2016). Their findings tie in with VanLehn (2011) who found that ITSs could potentially be as good as human tutors, if not better, and that further research is therefore needed to prove their effectiveness in the classroom.

When educators refer to tutoring, the thought is often that one-on-one human tutoring is the gold standard (Mathews 2012; vanLehn 2011). In fact, studies have shown that this form of instruction can lead to a student learning four times faster than through traditional classroom methods (Merrill et al. 1992). Since the early 1970s, researchers have been interested in seeing how computers could be used to aid instruction and learning in the classroom and potentially act in the same way as human tutors. The thought of a computer being able to act as or even replace a human tutor has therefore existed for many decades (vanLehn 2011; Yang 2010).

How ITSs Have Evolved Over Time

With the advancement of technology, how the computer has been used in the classroom has evolved into what we now refer to as ITSs. The earlier use of computers in classrooms was primarily as digital aids; instructors taught with the assistance of a computer in the classroom. Historically, learners could be asked questions via a computer programme, and they could get immediate answers or feedback (Atkinson 1968). A shortcoming with these earlier-generation computer tutors was that they were not specific enough to an individual learner; in addition, the testing done was more standardised and not adaptive enough. Learning was therefore not individualised enough to mimic human tutoring. With the advancement of computer technology and the use of artificially intelligent software, newer generations of computer tutors have evolved. An ITS is now able to deliver content and give the learner immediate feedback to questions (Alkhatlan and Kalita 2019; Ma, Nesbit, and Liu 2014; Mahmoud and Abo El-Hamayed 2016; Marouf 2019). These ITSs are now successfully able to adapt to the

individuals' learning needs by acting as a human tutor (Alkhatlan and Kalita 2019; Phobun and Vicheanpanya 2010; Shuib et al. 2015). This adaptation, in turn, makes the content delivery and testing more specific and customised to the individual's needs (vanLehn 2011), thereby improving cognition.

ITSs that adapt to the individual needs of a student are grounded in the thought that each student has an individual aptitude to learn (Clifford 2013; Heilman et al. 2013; Ma, Nisbet, and Liu 2014). Even though ITSs can adapt according to the individual's aptitude, this study will not be looking at aptitude, but rather at participants' perceptions of using the ITS. This study examined pre-service teachers' perceptions of an ITS when introduced into an activity system, what their overall perceptions of the ITS were, what tensions and contradictions existed in the activity system, and whether or not the ITS was perceived to mimic a human tutor.

Methods

This study employed a qualitative research design embedded in a CHAT framework. Qualitative data collection methods allow the researcher to study participants in their natural settings and to make sense of or interpret a phenomenon (Westberry 2009) while also trying to explore social contexts (Almalki 2016). This is the essence of this study whose primary purpose was to examine pre-service teachers' perceptions of an ITS using CHAT as a comprehensive lens to view the participants' interactions with the ITS.

Participants

The participants in this study were undergraduate students at an education faculty in the Western Cape, South Africa, who were enrolled in the bachelor of education degree. Using non-probability sampling, six participants who displayed high levels of contradictions or tensions within the CHAT system while using the ITS were selected by the researcher to interview to uncover a deeper understanding of these perceptions. Contradictions or tensions can be defined as not just competing complications or issues within an activity system, but as historically accumulated structural tensions within an activity system that not only agitate but ultimately can be drivers to innovate change (Engeström 2010).

The participants in this study were chosen because they were pre-service teachers studying to become English home language teachers but did not have English as their mother tongue. Furthermore, the participants had to have fully completed the ITS programme. The researcher that conducted this study obtained ethical clearance (EFEC 2-11/2019) from the university where this research was conducted. The researcher ensured that all university ethics policies and procedures were followed, as well as that all participants supplied written consent to participate in the research. The study was conducted on a voluntary basis, and participants were given the option of withdrawing at any moment. Participants were advised that the study would be conducted in an anonymous manner, that all data would be anonymised, and that they would be given

pseudonyms to ensure their privacy. The researcher ensured that all ethical requirements of the institution were followed, as well as best practices, to protect the university's and participants' integrity. Additionally, the researcher acknowledged any bias in the research and signed a declaration revealing any potential conflict of interest.

Procedure

The ITS was introduced to an undergraduate cohort of 82 Senior Phase (SP) and Intermediate Phase (IP) pre-service teaching students pursuing a first-year English language module at a university in the Western Cape. The ITS was administered for three months in 2020. The researcher chose these participants because they were among the population who were best suited to answer the research questions. Furthermore, the participants belonged to a target population that satisfied several other convenient and practical criteria for the researcher. These criteria included (a) ease of access since they were located in a geographically suitable place for the researcher, (b) availability at the time of the research, and (c) willingness to participate openly in the research.

The participants were required to complete a standardised English test to determine their proficiency benchmarked against the Common European Framework of Reference (CEFR). The participants were then placed on the correct language level on the ITS and were expected to complete the course as part of an English curriculum module. The ITS was added to the course as a supplement to face-to-face tutoring as there were an insufficient number of tutors for students to access, lecturers did not have enough capacity for additional tutoring, and this research took place during South Africa's COVID-19 lockdown when students were not allowed on campus and needed to learn from home. Once the ITS module had been completed, the researcher then interviewed the participants to determine their perceptions of the ITS. A semi-structured interview schedule focussing on the CHAT nodes was created to probe and cross-check participants' responses to the questions posed and the researcher was not limited to the schedule and asked additional probing questions when required to do so.

Data Analysis

The data were then analysed according to the CHAT nodes (Subject, Tool, Object, Rules, Community, Division of Labour, and Outcome). Data related to the CHAT nodes were grouped together into themes making use of thematic categorisation, a popular method used in qualitative analysis to understand certain phenomena (Saldana 2015). The thematic analysis was based on a version of Saldana's thematic analysis of coding used to form data clusters for analysis (Figure 2). Data were coded using predetermined or a priori codes, according to second-generation CHAT nodes. The transcribed interview data were then grouped into themes according to these codes, and according to the perceptions of the participants. From the categorisation of the coded data, specific themes and patterns emerged, which then resulted in a theory or hypothesis being developed.

Results

The results are discussed in relation to the CHAT nodes that showed the greatest tensions: the Tool, the Community, the Subject and Division of Labour, and the subject. Six participants (10% of the participants that completed the programme) were chosen to participate in the interview process to justify the quantitative findings.

The six participants (referred to with the pseudonyms AB32, AB28, AB66, AB25, AB14, and AB63) were all English second- or third-language speakers (for AB66 English was a third language). All six participants were first-year students and were Afrikaans home-language speakers, with five of the participants choosing to speak Afrikaans to their friends, and one participant choosing to speak Xhosa to their friends. From a socioeconomic and political account, all six participants were from previously disadvantaged backgrounds. The six participants all had access to the ITS but had limited access to devices (such as laptops or computers). They all did, however, have access to the internet, having received data to access the internet from the university.

While CHAT can be used to examine both positive and negative aspects of activity systems, this study was primarily interested in the tensions perceived by the participants. Semi-structured interviews (Appendix A) were used to ask the six participants questions linked to the high-tension questions identified by the researcher in order to ascertain their perceptions.

The CHAT nodes were used to code the words or phrases, with each node representing a category. The categories then evolved into themes or concepts, which culminated in a theory or hypothesis. The following sections outline the categories and the supporting data that contribute to the formation of themes or concepts (Figure 2).

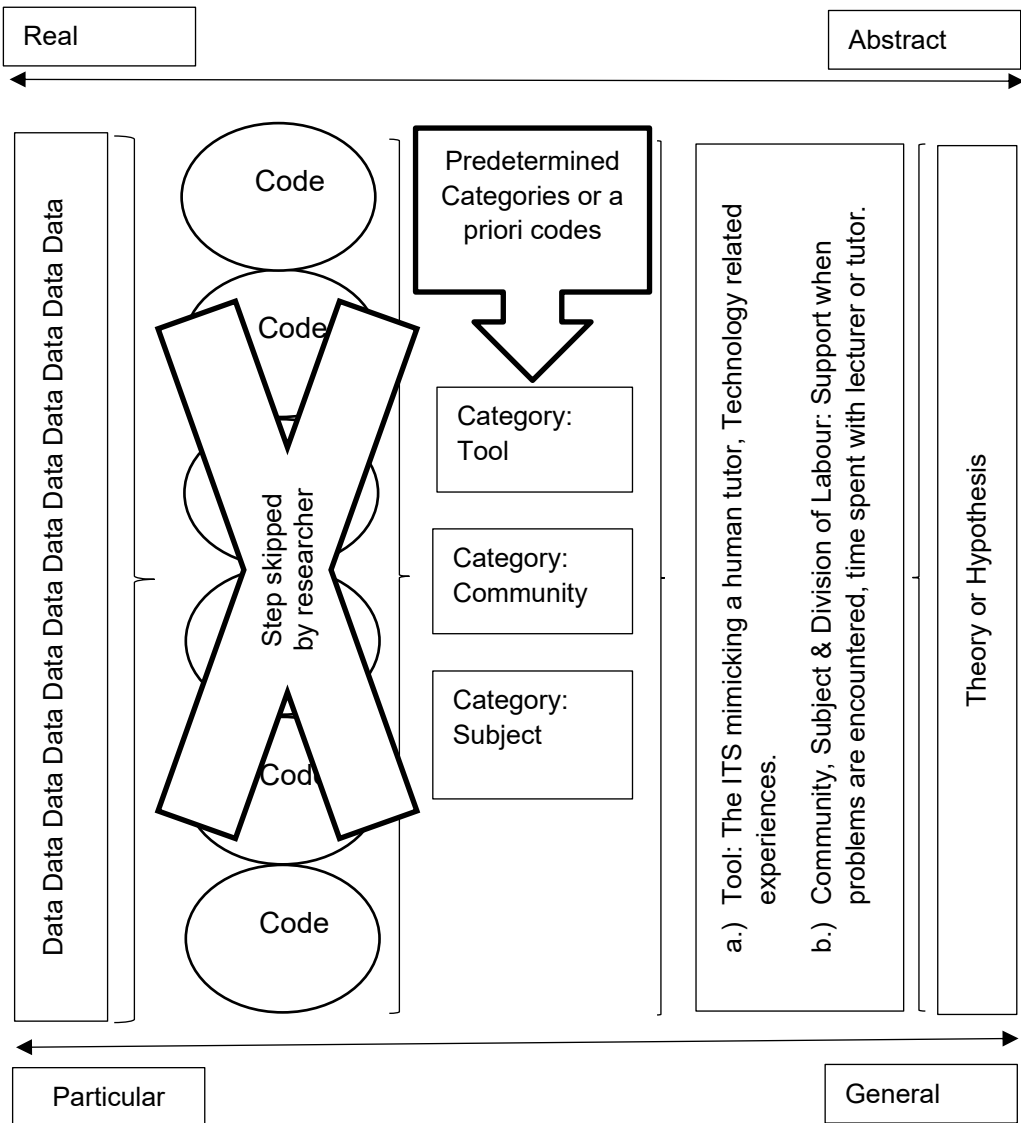


Figure 2: An updated representation of Saldana's (2015) streamlined codes-to-theory model for qualitative inquiry

Tool

The data highlighted two themes regarding the use of the ITS (the Tool). These are related to the ITS as a tutor and how technology affected the user experience.

The ITS Mimicking a Human Tutor

Participants indicated that the ITS was dissimilar to a human tutor as they could not interact with it as one would with a tutor, with one participant stating, “I think an actual human tutor could assist better than the online tutor” (AB32). They missed seeing the lecturer’s face and missed the “presence” of a tutor and, finally, participants indicated that they preferred the verbal and physical interactions with human tutors. This was clearly indicated by participant AB32, who stated, “You can’t interact with the system as with a human being.”

Although the ITS did not authentically mimic a human tutor according to the participants, they did feel that the ITS offered help and guidance and that it was precise. It was always available which enabled them to interact with it and go back to correct their mistakes. One participant particularly stated, “Like I said, it gave me the opportunity to go back and see where I didn’t do as well and I could always better myself and more or less I do consider the platform as a tutor, just for me to go and put myself out there to fix that” (AB28).

Technology-related Experiences

The second Tool-related theme emerged when participants were asked about the differences between their technology-related experiences on campus compared with their technology-related experiences at home. The interviews showed that there were more challenges related to technology than satisfying experiences. Many of the participants indicated that working in an online environment was not pleasant: “I haven’t had a pleasant experience with technology” (AB66). This was related to the fact that they preferred to access resources on campus: “On campus you can do everything. You literally have all the resources ... there are literally no barriers that restrict you from doing your best.” Some of the participants had to share laptops—“I had to share with a cousin” (AB32)—which was problematic for them. Furthermore, some participants indicated that “I’m not very tech-savvy” (AB25) which proved to be problematic for them.

Participants also indicated that although there were challenges, they still preferred to work at home. One participant indicated that they preferred working at home as “about a month ago we had fibre installed so when my data is up, I still have the fibre, whereas at the campus the wi-fi often breaks up” (AB28). AB28 indicated that working online at home was better because access to equipment could be problematic: “For me, it’s better. On campus you often have to wait for the computer or something but at home, I have my own.”

Community, Subject, and Division of Labour

Within the CHAT node of the community, subject, and the division of labour, two specific themes came to the fore. These related to whom the participants turned to for support and specific time spent with lecturers.

Support when Problems were Encountered

The most obvious theme to emerge about support when encountering challenges was whom the participants turned to. Overwhelmingly, all participants confirmed that they would first turn to friends or classmates for help, as AB32 stated: “The advantage I had on campus was there was a lot of students and my mentor and everyone could help me.” AB14 mentioned turning to former schoolteachers for support as they explained concepts more clearly: “I can go to my teachers’ from my school and ask them for help if I struggle with something.” Interestingly, lecturers and tutors were last to be approached for assistance, because they took too long to respond to questions, as seen in this comment by AB14, “Sometimes the lecturers or the tutors they take very long to respond maybe and sometimes they don’t explain in detail.” This leads directly to the next theme that was identified from the interview data, the time spent with lecturers.

Time Spent with Lecturer or Tutor

The participants revealed a strong preference for face-to-face classes versus online classes using the ITS. Reasons for this preference were alluded to by the participants who indicated several tensions related to not seeing their lecturer or tutor often enough. One participant, AB63, indicated that they “almost never” saw the lecturer outside of class time and that “I would want to spend more time with my lecturer face-to-face.” The same issue was identified concerning the tutors, with AB28 indicating that “I have a mentor and she tries to ... as far as possible as she can but there’s no tutor that I can go to when I’m stuck or when I have a problem.”

Subject

Three specific themes regarding the subjects (the participants) emerged from the data. These themes relate to learning preferences, their perceptions of the ITS, and their motivations to complete work on the ITS.

Learning Preferences

When the participants were asked whether they preferred face-to-face learning or online learning using the ITS, their general preference was for face-to-face learning. Their reasons related to not being “tech savvy” with AB32 stating, “I’m not a big internet guy.” Participants also stated that they just generally preferred the face-to-face interaction, with AB63 categorically stating:

I would prefer it anyway because this distance learning is not for me and I think I’m speaking on behalf of many other children and learners because at home there are—there’s a lot of things that’s going on around you and you don’t have that study environment about and you don’t have the assistance to—how you need to do a specific thing. So, it’s a bit difficult, I would prefer face-to-face learning.

This notion was reiterated by AB32: “Definitely face to face because I feel it is easier to interact with the lecturer.” AB32 further felt that the lecturers gave clearer

instructions: “There is always something that the lecturer actually explains to you in-depth” and “I really do prefer face to face because face to face ... it is like I understand it better and the lecturer is explaining everything, so I get it but at home, it is like I do not get it, I just don’t get it.”

There was definitely a fear amongst the participants that there could be a possible misinterpretation of explanations in a digital environment.

Perceptions of the ITS

The participants’ perceptions of the ITS were generally positive. AB28 stated: “Overall, I think it is a good platform, it is excellent.” Although the online ITS was a new experience for most of the participants, they were able to cope. This can be clearly seen in AB32’s comment, “I was scared that I might not cope but overall, I think I found my feet very quickly and it was a great learning curve for me.” Most of the participants indicated that using the ITS was definitely a growth experience: “For me, it was amazing because it helped me grow and it taught me to work more on my own and do my own research” (AB41). Many of the participants, like AB63, were able to see the value in this experience for the future of their teaching careers: “I’ve learnt a lot because I know that maybe in the future—in the near future—if there is anything again like this I would know how to work with my students or my learners or so on.”

One of the issues that was raised by the participants was that although working on the ITS was an interesting and positive experience, it was time-consuming. “It was nice, interesting. It was, as I said, time-consuming, lot of reading but it was a very nice experience and I actually learnt a lot” (AB25). The fact that the ITS was perceived as positive is summed up in the following statement:

My overall perception, it helped me further ... the first term I did that with confidence and by the end of the term my marks were ... wasn’t what I expected this was the practice that I did on my own at home with the English platform that did it for us. So, I do, I definitely ... and it was nice to find myself and find my feet throughout this platform. (AB28)

Motivation

Although many of the participants indicated that they preferred working face-to-face with lecturers and tutors, there was an overriding need to complete the work that was presented on the ITS. One participant indicated: “So that was my motivation, I want to pass my first year, I want to finish my studies” (AB28). Some indicated a fear of failing: “I’m very scared of failing” (AB28). Another had to “to prove to myself that I that I can actually work on a computer because it’s literally not my strong [point]” (AB32). There was a strong motivation to actually improve their English proficiency: “I personally want to be better in English and I want to achieve my goals” (AB63). The participants in the activity system were motivated to complete the work on the ITS. Even though some of the participants felt that they were not “tech-savvy” or good with technology,

they still wanted to do well and improve their skills with technology and offered a general perception of wanting to do well despite any perceived tensions experienced.

Discussion

In this study, we investigated the students' perceptions of an ITS, specifically within a CHAT system. Our results are discussed below, with reference to our adapted second-generation CHAT model for ITS (Figure 3) based on the model designed by Sannino and Engeström (2018).

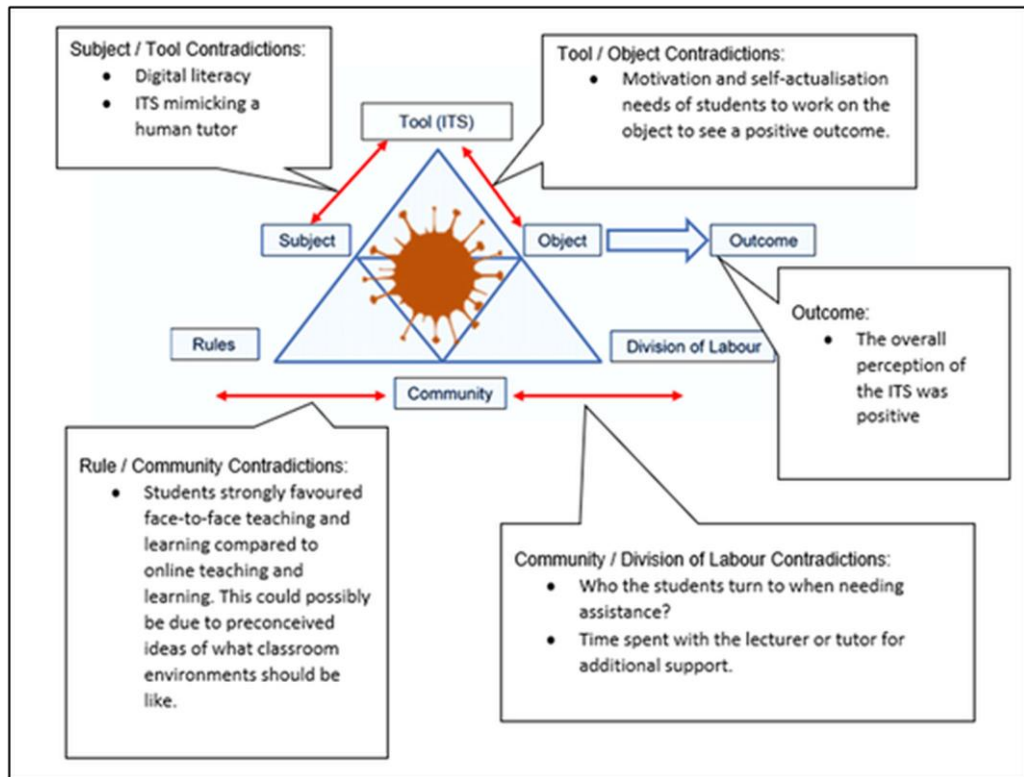


Figure 3: Adapted third-generation CHAT model for ITS

What Were the Perceptions of Pre-Service Teachers Of An ITS as Viewed through the Lens of CHAT?

When this research was viewed through the lens of CHAT, three main categories became clear, the Subject, the Tool, and the Community, which could affect the participants' perceptions of the ITS. Tensions and contradictions perceived were evident between Community and Division of Labour, Rules and Community, the Subject and the Tool, and the Tool and the Object (Figure 3).

Within the CHAT system, the findings indicate that the ITS tool is *not* good at mimicking a human tutor and that the tool cannot work well within the challenges related to technology experienced by the participants, therefore adding to the lack of consensus that ITS are as good as human tutors (Merrill, Nibet, and Liu 1992; Aleven and Ashley 2006; Yang 2010). Within the community, there was support within the peer group, but participants indicated that there was an issue with the physical time they were about to spend with their tutors or lecturers. The findings further indicate that within the subject of the CHAT system, participants preferred face-to-face learning. Even though they indicated this preference, there were still positive experiences indicated and the overall perception of the ITS was positive and could be a way to support lecturers (Mohamedbhai 2014). The participants indicated that the reasons for this perception were related to their motivations for interacting with the ITS. This included fear of failure, achieving personal goals, and personal growth, leading to a strong sense of self-actualisation.

The greatest assumed tensions or contradictions perceived by the participants when introduced to the ITS for online learning was the lack of access to devices or the internet. However, this study showed that this was not the case with these participants. Despite this, contradictions or tensions were perceived in all three categories of Tool, Community, and Subject. The two main themes of contradictions or tensions experienced concerning the use of the Tool were the ITS unsuccessfully mimicking a human tutor, and technology challenges related to getting to know the device and the participants' own digital literacy. This, therefore, pointed to specific contradictions related to the Tool node, between the ITS tool itself and the knowledge and skills needed by the subjects (so also a subject-tool contradiction). While the participants recognised that aspects of the ITS did successfully mimic some of the elements of human tutors, they were clear that the human "presence" for them was missing, with examples given such as being able to read body language and seeing in the participants' faces when they did not understand a concept being explained to them. When it came to technology challenges, participants mentioned extremely specific words or phrases, such as not being "tech-savvy" and battling with storage and getting to know their phones or laptops, with one participant referring to it as "just the technological side." The challenges with the tool however did not affect the students' motivation to continue using the tool and complete the module.

Interestingly, the contradictions or tensions that were perceived when it came to the community were to do with whom the participants turned to for help when faced with challenges, and the amount of time they were able to spend with their lecturer or tutors. In both themes, there was consensus among all the participants interviewed. All the participants, when faced with challenges, would first turn to their classmates or friends for help. Lecturers and tutors would be turned to last. The participants also all agreed that they did not spend enough time with their lecturers and, if given the choice, would want to spend more time with them, linking with the theme of missing a human presence on the ITS. Even though participants clearly favoured face-to-face learning compared

with online learning with the ITS, they still experienced the ITS positively. There was thus again a contradiction between the subjects, their preferences, and the ITS tool they were expected to use. It might be suggested that this relates to participants' more commonplace understanding of how education should be conducted, perhaps indicating their understanding of "rules" which may be in conflict with a more online environment. The participants also admitted that they considered the ITS to be a form of digital tutor, but that it fell short when compared to human tutors. The ITS was described by the participants as precise, concise, it offered timeous feedback, was interactive, and was able to offer assistance in many similar ways to those which a human tutor could offer; however, it still wasn't successful in mimicking a human tutor, possibly indicating a contradiction between the make-up of the ITS tool and its purpose to help subjects work on the object of the system.

The consensus among the participants was that the ITS was an effective tool for improving language proficiency and could therefore be a promising mechanism for students in the future (Carreira 2015; Hsi 2007; Liu and Moeller 2019). This was an interesting finding, particularly because the participants all preferred face-to-face learning compared with online learning. Part of what made the ITS effective was how it mimicked a human tutor, such as offering help and guidance, by being concise and precise, by being "always there" (referring to its being available anywhere, at any time), by being interactive, and by allowing the participants to go back and fix their mistakes.

Practical Implications

Based on our findings we advise that the institution ensure that students have access to devices and the internet if they want the implementation of an ITS to be successful. The institution should also invest in the user experience of this ITS as the missing element of human interaction was problematic for most of the participants. Finally, the importance of community in the activity system was highlighted in this study. What became clear was that the participants preferred to ask friends or classmates for help first, before turning to a lecturer or tutor. The students felt that they did not get to see their lecturer or tutor often enough, and the time taken to get back to them was too long. What the institution and further research should do is consider ways in which to improve communication when using the ITS, perhaps by relying more on the messages, discussions, and chat functions of the ITS. In this way, questions posed to the lecturers could potentially be answered by more knowledgeable students in the class, and corroborated by others, if the lecturer is unable to get back to the student fast enough. This community engagement within the ITS could assist in allowing it to mimic a human tutor more successfully.

Conclusion

Our objective in this study was to determine pre-service teachers' perceptions of their use of an ITS for English language proficiency, viewed through the CHAT as the

analytical framework. Our findings show that the participants' perceptions of the ITS were mostly positive, even though there was a strong preference for contact learning with many of them struggling to learn online and not always having technical know-how. Our findings also indicate that although the participants initially struggled with the ITS, they quickly adapted and were motivated to reach their personal goals and to complete the course. They agreed that the ITS did help them with their language and digital proficiency. Since the effectiveness of an ITS in ill-defined domains such as language is still up for further debate (Chinnery 2006; Heilman and Eskenazi 2006; Tai 2012), it should be noted that these findings should be interpreted cautiously. While there is undeniable potential for ITSs, there is still a need for additional research and development in terms of supporting the tensions or contradictions noted in this study, for example, on what affordances interpersonal communication and support can offer which ITSs cannot.

Limitations

CHAT, like any other research framework, has limits. CHAT has two specific limitations: 1) a limited perspective of an activity system's environment, and 2) a lack of uniform approaches employed in CHAT. A restricted perspective that considers the individuals' immediate environment rather than their greater sociocultural environment could be troublesome. Second-generation CHAT uses a single activity system as its unit of study. However, one system is often part of a broader network of interrelated activity systems, for example, the systems of the university and students' home life. In future work it may be useful to analyse such interactions in what Engeström (2010) refers to as third generation activity research.

Initially, 82 participants participated in the study, but only 48 were surveyed. As a result of the COVID-19 pandemic, the university required participants to work online from home on their own devices with limited data. All 82 participants were contacted via email and WhatsApp. Nevertheless, only 48 of the 82 responded. This could be because participants did not have access to a computer or the internet.

Although the researcher attempted to communicate with the participants regularly via email, it was difficult to tell whether the emails were received or read. Furthermore, suppose the ITS had been offered to the participants in a face-to-face classroom setting. It may have been better positioned, with training provided to any participants who may have required some digital training.

This study focused on a single English language proficiency ITS and did not conduct a meta-analysis of all available English proficiency ITSs. The ITS that was employed was developed in 2014. With technology constantly developing and evolving, it is possible that a more advanced ITS, which is more flexible and better customised to the needs of the participants, could have resulted in different perceptions and outcomes.

Finally, the original assumption was that the participants would use the ITS on campus, where they would have adequate access to devices and the internet. Many of the conflicts or inconsistencies reported by the participants might have been avoided if the study had proceeded as planned. If the study had been conducted on campus, the participants would have had better access to devices and the internet and access to a lecturer or tutor. They would have received assistance with technical challenges connected to digital literacy. As a result, one limitation of this study was that different contradictions or tensions would have been noticed had it been conducted on campus.

Recommendation for Future Research

To improve on this research in the future, the researcher advises doing a digital literacy pre-test with its own baseline. The overall impression of the ITS was quite positive. This was despite the activity system's numerous paradoxes and conflicts. Institutions and lecturers frequently think that access to devices and the internet will be the most difficult barrier for students. While this may still be true in some cases, this study found that the greatest need was for students to be digitally literate regarding devices and the internet.

More time and research will be needed to determine whether an ITS can successfully emulate a human tutor. Future research should concentrate on improving the user experience to the point where the loss of human presence is undetected. Instead, ITS users should be supported to the point that the "presence" mentioned by the participants is not defined as human. The pupils that used the ITS thought they were highly motivated to use it. Could the driving forces behind students' motivation be tied to this enhanced user experience and improved feedback and communication from lecturers and tutors, resulting in the ITS successfully replicating a human tutor (or improving performance)?

Finally, the significance of community in the activity system was emphasised in this study. What became evident was that students preferred to seek assistance from friends or classmates before resorting to a lecturer or tutor. The students thought that they did not see their lecturer or tutor frequently enough and that the time it took to respond to them was excessive. Future studies could investigate strategies to increase communication when utilising the ITS, such as depending more on the ITS's message, discussion, and chat functionalities. In this manner, queries presented to lecturers may be answered by more knowledgeable students in the class and corroborated by others if the lecturer cannot respond quickly enough. This community involvement inside the ITS may also help it simulate a human tutor more successfully.

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Appendix A: Interview Questions

Interview Questions	Relevant CHAT Node
Interview Question 1: Describe your technology experience at home compared to your technology experience on campus? (Technology being a device that you can work on). How is it different to your experience on campus?	Tool
Interview Question 2: What is your internet access like at home compared to on campus? How do you describe internet access? How is it different?	Tool
Interview Question 3: Why do you prefer face to face learning? Does the ITS mimic human tutoring? What was your overall perception of the online platform?	Subject, Rules, and Community
Interview Question 4: What did you prefer about face-to-face teaching? Why? How did the ITS affect your learning experience.	Subject, Rules, and Community
Interview Question 5: What were your biggest challenges when completing the online work?	Subject, Tool, Rules, and Community
Interview Question 6: How often do you get to spend one-on-one time with your lecturer? What are some of the reasons why you would want to spend more time with your lecturer?	Division of labour, Subject, Rules
Question 7: How often do you get to spend one-on-one time with a tutor on campus? Would you consider the online platform to be a type of digital tutor or lecturer?	Division of Labour, Subject, Rules