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Integrating an Intelligent Language Tutoring System in Teaching English Grammar

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Abstract
This paper describes a research project using an intelligent language tutoring system model in teaching grammar in English. The study aims to investigate the perceptions of a group of students regarding the effectiveness of this system and its service quality. This investigation is significant since it gives further insights into how Intelligent Language Tutoring Systems can help students learn grammar in a personalized manner based on their levels. Research has revealed that classroom teaching may fall short in providing customized instruction and feedback. Therefore, intelligent language tutoring systems can support adaptivity to individual learner needs. In order to assess the effectiveness of this system, the participants answered a survey questionnaire at the end of this study. The research project involves a class of adult mixed-ability students in a continuing education program at the National School of Applied Sciences in Fes, Morocco. The results demonstrate that these students have a positive attitude toward the merits of such technological tools. These advantages are mainly related to enhancing learner achievement and motivation. Based on these findings, some implications for both teaching and learning grammar can be drawn.
Keywords: individualized instruction, intelligent language tutoring systems, student achievement, student perceptions, teaching grammar

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Introduction

Since English is the primary language of science and technology, the demand for improving the English level of students involved in these fields of study has increased. Concerning this research project, the participants are professionals who work in the field of information technology. They are simultaneously involved in a continuing education program to get a master's degree in computer science for better work prospects. One of the objectives of this specialized master's program is to help learners improve their English language. However, these students make up a class of mixed-ability learners with significant differences in their English levels. The reason for these differences is that these students got their Bachelors from different institutions, some of which devote just some modules to English and others none. Therefore, the teacher researcher in this research project uses an Intelligent Language Tutoring System (ILTS) model to help the participants improve their English grammar in a personalized manner. This system can determine the level of an individual learner or what they know and guide them to learn and improve what they do not know in a personalized manner. There are two reasons behind this focus on enhancing grammar skills. First, any job involves communication, oral or written, with employers, co-workers, and customers. Those who fail to communicate coherently or cannot write grammatically accurate work documents will likely to be marked down. Second, if these students want to continue their Ph.D. studies, they must publish articles with proper grammar in international journals.

Research has asserted that students can achieve better learning outcomes with one-to-one instruction that considers their individual needs and learning styles. In this respect, this study aims to help a group of fourteen students enrolled in a specialized master's degree program for professionals learn English grammar using an Intelligent Language Tutoring System called Cambridge English Grammar in Use. They all have a common need for time and place-independent learning. Therefore, using an ILTS is the most effective learning strategy to help them learn English grammar anytime, anywhere, at their own pace, and get continuous assessment and feedback on their progress.

Accordingly, this investigation seeks to answer the following research questions:

- What are students' perceptions regarding the effectiveness of this Intelligent Language Tutoring System?
- What are students' perceptions regarding this system's service quality?

Review of the Literature

Starting from the 1970s, education has integrated different frameworks of Artificial intelligence like Intelligent Language Tutoring Systems (ILTSs). Shute and Zapata-Rivera (2010) define an ITLS as educational software that uses artificial intelligence to track students' learning and adapt feedback. Van Lehn (2006) explains that ITS use artificial intelligence to personalize instruction and adjust it to the personal needs and characteristics of individual students.

According to Nagao (2019), ILTSs enhance human intelligence through problem-solving. It implements artificial intelligence techniques in four main components. The knowledge base provides the domain knowledge that the system teaches. The student model represents the student's knowledge level. The pedagogical module analyses the student's knowledge state and offers the appropriate instructional measures that improve learning outcomes. The user interface establishes effective communication between an ILTS and learners.

This personalized learning approach of these intelligent systems is supported by the analysis realized by Bloom (1984). It emphasizes the importance of adapting instruction to each student as the most effective way of education.

The term Intelligent Tutoring Systems originates in the publication of Carbonell (1970), which describes a system called Scholar. The technique involves programs that analyze the learners' data. These programs also use a semantic representation of these learners' knowledge and characteristics, and accordingly adapt instruction to their individual needs. Later, Sleeman and Brown (1982) listed the main features that the architecture of a typical ITS should possess. It should respond to the student's individual needs, it should share the control with the student, and provide domain-specific knowledge. The evolution ITSs went on with Wenger (1987), who presented an architecture for an ITS made up of four modules: communication, tutorial, student, and expert.

According to Butz, Hua, and Maguire (2006), a typical architecture for ITSs consists of four basic modules: knowledge base/domain module, student module, pedagogical/tutoring module, and user interface module. The system functions through an interaction between these four modules. In this interaction, the domain, student, and tutoring modules communicate through the user interface module as the central module. The following figure describes this architecture:

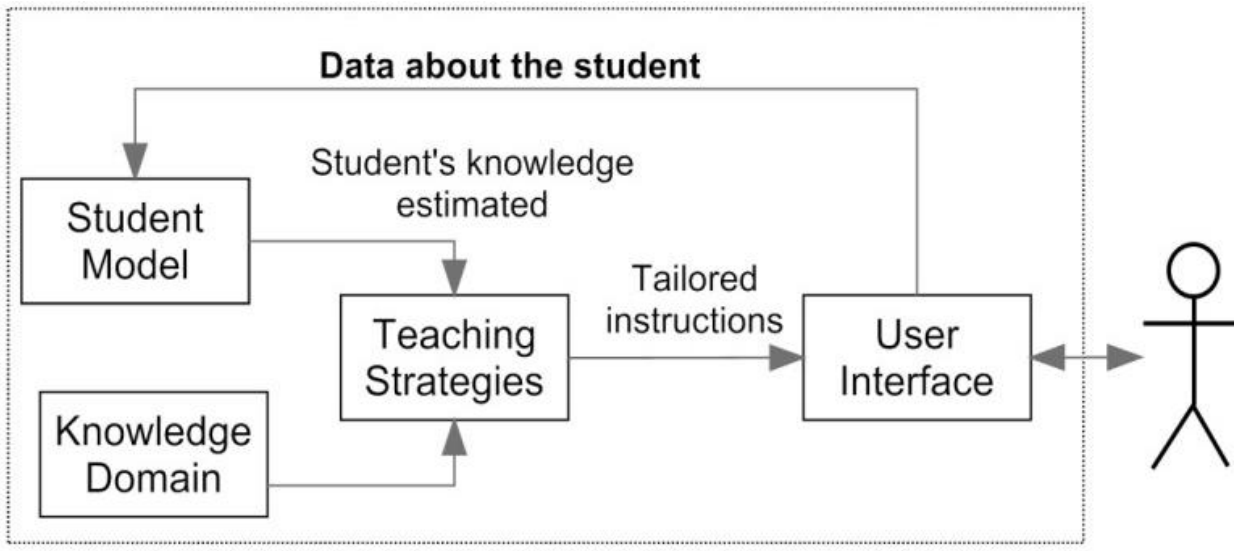


Figure 1. A typical architecture of an ITS (Adopted from Butz et al. 2006, p.3)

The domain model contains the lessons/ knowledge to be acquired by the learner and related practice exercises that the system provides. It also includes the images, videos, and sounds that help deliver knowledge to students. When a learner provides an answer, this model determines whether the answer is correct.

The student model is the frame that provides information on the knowledge that students get from the domain model. Cataldi and Lage (2009) add that this module also gives insights into students' learning levels and styles based on the answers to different questions.

The tutoring, also called, the pedagogical model, uses information from the student module to generate feedback. Polson and Richardson (2013) explain that when a student gives a wrong answer, the tutor interferes in giving error-specific feedback. The tutor, then, guides the correct

answer. This module may also select the most appropriate learning material and exercises for its users.

The user interface is the communication interface between the student and the ILTS. It receives the learners' content requests and provides feedback and support to the students' activities. Millan (2000) emphasizes that the interface should be user-friendly so that the students quickly learn how to use it.

Methods

The teacher-researcher in this study implemented an ILTS for online English grammar learning as an off-class option for the English module. Fourteen students from a continuing education master's program at the National School of Applied Sciences of Fes used a web-based ILTS called Cambridge English Grammar in Use. The participants could use the system to study at any time and any place they wanted for twelve weeks. This system allowed them to have access to a variety of grammar content. At the end of each grammar lesson, the students take assessment tests and receive feedback on their progress.

Participants

The participants are male and female professionals who work for different companies in information technology. Their age ranges from 23 to 26 years old.

Research instruments

After twelve weeks, the students answered a survey questionnaire about their perceptions of the ILTS used in this research project. The questions are related to the ILTS 's usefulness, its service quality, and the challenges that the students experienced using it. The study uses both quantitative and qualitative methods to interpret the findings.

Findings

The Intelligent Language Tutoring System implemented in this research project is a web-based education system designed for learners of English who want help with grammar. It employs illustrations with text to deliver the target content. The learning content contains units with sub-sections. Each unit revolves around a particular grammar point and provides explanations and examples. At the end of each sub-section of a unit, the learner has to take a progress test. If students get the predetermined score for a particular area, they can move to the next one. Learners can get feedback on their work; they can check the correct answer for the wrong ones, and they get hints on the content section they have to review. They can also get additional practice exercises. The system updates the student module after every test and movement between units. The learners can check the "My record" option in the menu to see which units they have covered, and the tests they have taken, as well as their grades.

After using this ITLS for twelve weeks, the participants answered a survey questionnaire to evaluate the success of this instruction system concerning its effectiveness and service quality.

Perceived effectiveness of the system

Table 1. *Participants' perceptions of the effectiveness of the ILTS*

Questionnaire item	Yes	%	No	%
1. The ILTS provides the useful grammar information you need	12	85.7	2	14.2
2. The ILTS provides clear explanations with sufficient examples	13	92.8	1	7.1

3. The colorful on-screen visual aids used in illustrations help me like and further understand the grammar content	10	71.4	4	28.7
4. The ILTS provides engaging, relevant, and challenging content that motivates me to learn new things	11	78.5	3	21.4
5. The ILTS provides enough practice exercises and instant feedback	12	85.7	2	14.2
6. I feel my grammar has improved thanks to this ILTS	11	78.5	2	14.2

Analysis of the participants' answers on the effectiveness of the ILTS used in this study shows that 85.7% of the students perceive that it provides the useful grammar information they need. Intelligent Language Tutoring Systems (ILTS) are well-known for delivering personalized instruction (Ma, Adesope, Nesbit, & Liu, 2014). These programs are responsive to individual student needs to enhance their understanding and learning further. Human tutoring may fall short here as teachers cannot attend to their students' different needs due to time and class size limitations (Bloom, 1984).

Also, 92.8 % of the participants think that the system gives clear explanations with sufficient examples of the grammar components. 71.4 % of the students further justify that the colorful on-screen visual aids used in illustrations help them like and better understand the grammar content. McLaren et al. (2010) discovered, based on the findings from their study, that learners prefer on-screen agents and find them much more motivating. These findings demonstrate also that such animated pedagogical agents have a positive effect on their learning outcomes.

Motivation is a crucial criterion that influences the outcome of an instructional technology design. Rashid and Asghar (2016) maintain that there is a strong relationship between technologies-enabled relevant learning activities and student motivation. Concerning this study, 78.5% of the learners perceive that the system provides, challenging enough contact that motivates them to learn new things.

Concerning practice, 85.7% of the respondents think that this system provides enough exercises and instant feedback. Amaral, Meurers, and Ziai (2011) stress the advantage of ILTSs in providing instant feedback for learners. These systems create a supportive learning environment in which students receive customized assistance when they need help. This instant feedback helps these students overcome any frustration that they may experience if they feel they are left alone in the shadows.

An important question when considering the integration of Intelligent Tutoring Systems in classrooms is whether they have a positive impact on student achievement. According to 78.5 % of the participants, their grammar has improved thanks to this ILTS. Many studies in the literature have reported that the implementation of Intelligent Tutoring Systems has improved learners' performance. For instance, in their studies, Taylor et al. (2013), Cooper and Steenbergen-Hu (2014), and Kulik and Fletcher (2016) report that intelligent tutoring systems have improved students' performance because they are adaptative and interactive.

Perceived System Service Quality

Table 2. *Participants' perceptions of the system service quality*

Questionnaire item	Yes	%	No	%
1. The ILTS is user - friendly	13	92.8	2	14.2
2. During these twelve weeks using this ILTS, I had to contact the help service for usability problems	0	0	14	100
3. This ILTS is motivating because it offers time and place learning flexibility	13	92.8	1	7.1

4. While using the ILTS, I don't feel distracted as I have the choice of the length of my learning sessions	12	85.7	2	14.2

Service quality is another aspect that has a significant impact on learning achievement. In this respect, Gorla et al. (2010) emphasize that a well-prepared and flexible system helps fulfill the desired learning outcomes.

According to Delone and McLean (2003), an intelligent tutoring system must be easy to use in order to achieve the desired learning goals. However, if the tool is difficult to use, it may be perceived as an obstacle to learning and good performance. Concerning the system in this study, 92.8 % of the participants found this ILTS user-friendly. Also, the participants didn't have to contact the help service for any usability problems.

Another advantage of this ILTS is that 92.8 % of the participants in this study find learning using it much more motivating because it offers time and place flexibility. Besides, 85. 7% of the respondents appreciated the freedom that this ILTS gives to students to choose the length of their learning sessions. As such, they can keep focused and avoid being distracted compared to the long periods in classes. According to Calkins and Vogt (2013), learning research is best informed by a deepened understanding of how, where, and why students learn most effectively. Given this requirement, the anytime/anywhere mantra and the Intelligent Language Tutoring Systems have successfully attended to learners' needs for choice and flexibility.

Conclusion

The primary purpose of this study is to measure the impact of integrating an intelligent language tutoring system on the learning experience of a mixed-ability class of students enrolled in a specialized master's program for information technology professionals. The findings reflect a positive attitude of the participants towards this web-based instructional system in terms of its learning effectiveness and service quality.

Implications

As a result of this research and other similar research in the literature, one can conclude that we should measure the overall impact of technology on learner achievement based on some essential criteria. These criteria relate mainly to its perceived effectiveness, relevant content, sufficient practice, instant feedback, motivating on-screen visual aids, system ease of use, and flexibility.

The findings also imply that ILTS can be an excellent tool to supplement teacher-directed instruction in classrooms. These systems provide one-on-one instruction and feedback to students in an impossible way for teachers to achieve.

We can also deduce from the participants' perceptions in this research project that the ILTS should be of good service quality. It can encourage students who are yet to try a new learning environment to be more motivated and engaged.

Finally, ILTSs can be an excellent way to enhance autonomous learning. When students learn on their own at their own pace, they gain the confidence they need for academic achievement and personal development.

About the Author

Dr. Dahbi Manar is an assistant professor of ESP at the National School of Applied sciences of Fez. She holds a PhD in applied linguistics. She is the author of a book, a chapter in an international

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