Towards a Digital Assessment: Artificial Intelligence Assisted Error Analysis in ESL

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ABSTRACT

The study we present here aims to explore the possibilities that new Artificial Intelligence tools offer teachers to design assessments to improve the written proficiency of students of English as a Foreign Language (the participants in this study have predominantly Spanish as their L1) in a University English Language Course with CEFR B2 objective. The group we are going to monitor is, as far as the Spanish university system is concerned, on average: more than sixty students, with diverse backgrounds and unequal proficiency in English. In such conditions, the teacher must be very attentive to meet the needs of all students/learners and, at the same time, keep track of successes and failures in the designed study plans. One of the most notable reasons for subject/class failure and dropout, in a scenario such as the one described, is the performance and time dedication to written competence (Cabrera, 2014 & López Urdaneta, 2011). Consequently, we will explore whether the union of all the theoretical baggage that underpins the linguistic and pedagogical tradition of Error Analysis, one of the most notable tools for enhancing the writing competence of English as a Foreign Language, and new intelligent technologies can provide new perspectives and strategies to effectively help learners of English as a Foreign Language to produce more appropriate written texts (more natural outputs) and, at the same time, to check whether an AI-assisted Error Analysis-based assessment produces better results in error avoidance and rule application in the collected writing samples.

Keywords- Artificial Intelligence, English Didactics, English Teaching, Writing Assessment.

I. INTRODUCTION

Natural Intelligence (N.I.) is usually understood as the kind of intelligent behaviour displayed by humans, whereas Artificial Intelligence (A.I.) is normally defined as the capacities and abilities shown by machines to replicate human behaviours and to communicate with humans (Grewal, 2014). In recent years we have seen many advances in the world of Artificial Intelligence and its applicability to human learning (Shin, Kim & Minkyung, 2021; Markauskaite et al, 2022 & Viber, 2022). The direction of the advances in the discipline seems to indicate that the desired objective of theoreticians and practitioners is the total integration of the capacities shown by machines in the different teaching-learning processes that humans undergo in their lives (Silva, 2018).

Nowadays, devices that show the ability to undergo complex tasks with success are considered to have some degree of Artificial Intelligence, more so when the device shows the ability to adapt to different possibilities and answer patterns without much margin of error (Lemos, 2022). In other words, the newest Artificial Intelligent devices, and the underlying intelligence show capacities to initiate cognitive-like functions usually attributed to human thinking such as

communication, problem-solving skills and, more frequently these days, learning and responding.

Different areas of Artificial Intelligence Studies focus on different aspects of the discipline. One preeminent area inside this new discipline is Natural Language Processing (NLP) (Zhang, 2020). This broad research area is especially interested in machine translation and machine-human-machine communication. Another broad research is Object Recognition Studies (ORS) (Daniel, 2018 & Kumar, 2020), which nowadays focuses on the recognition of physical objects (such as parked cars or moving objects) and is usually linked to human-machine-human communication on a very simple basis: beeping and signalling alert sounds (Viberg, 2022). Although both areas show an interest in human-machine-human communication, different areas of A.I are being employed to cater to different aspects of human everyday life.

Another broad (and very recent) research area inside the Artificial Intelligence discipline is that of A. I theories and concepts applied to human education. One of the most significative approaches of A. I applied inside the Educational Studies that of viewing A. I as a tool to simplify the process of managing, directing, planning, and conducting a class (Göçen, 2020), as well as a tool aimed at increasing teaching effectiveness and syllabi success (Yunus & Rajendran, 2021). This research area is linked to Error Analysis, one notable area in Applied Linguistics, L2 Studies, and SLA Studies (Livingstone, 2012 & Kuma, 2021). The link between Educational A.I Studies and E. A can be found in error identification tools and devices designed to recognise and treat errors in learners (such as Trinka.ai or Grammarly.com) (Torben, 2022).

The study presented here aims at exploring the possibility that these new Artificial Intelligent tools can offer to enhance the writing competence of students of English as a Second Language (predominantly Spanish L1) at a University Course in the English Language with a targeted objective of CERFL B2. The group that we will monitor is, as far as the Spanish university system is concerned, the average: more than sixty students, with various backgrounds and uneven command of English. In such conditions, the teacher/professor needs to be very attentive to meet the needs of all the students/learners, and simultaneously keep records of success and failure in the designed syllabi (Brown, 1994).

One of the most notable reasons for failure and subject/class abandonment, in a scenario like the one described, is writing competence (Cabrera, 2014 & López Urdaneta, 2011). This is the reason that motivates the study presented here. Consequently, we will explore whether the union of all the theoretical background behind Error Analysis, one of the most notable tools to enhance EFL writing competence, and the new intelligent technologies can provide new perspectives

and strategies to effectively help EFL learners produce more adequate writings (more natural outputs) and, at the same time, test if the if an A. I assisted in Error Analysis and Correction Feedback to produce better results in error avoidance and rule application in writing samples collected.

II. LITERATURE REVIEW

In contemporary Linguistics Theory, the error is no longer a synonym for the mistake (Corder, 1967, Selinker 1972, Corder 1993, Gass & Selinker, 2008). Nowadays errors are regarded as linguistic features that can indicate the efficiency and efficacy of the language teaching-learning process (Johansson & Hofland, 1994). The Error Analysis approach focuses on the exploration and explanation of why a certain error is committed at a precise moment of the teaching-learning process (Richard, 2002), which links Error Analysis to the practice of teaching EFL and makes the discipline paramount to the successful design of EFL syllabi. Hence, being able to understand and treat the errors can be beneficial to the teaching-learning process at various levels: assessing student performance, observing success and failures in the teaching-learning process, and exploring ways to implement more efficient syllabi that enable learners to get rid of the errors and produce better language outputs (Clerk & Rutherford, 2000).

One of the most notable contributions of the Error Analysis perspective as a research discipline is the fixation and theorisation of the Interlanguage Hypothesis. Although Interlanguage was effectively introduced in the Linguistics L2 Studies by Selinker in 1969 when he spoke of «the interim grammar structure constructed by second language learners on their way to the target language» (cited in McLaughlin 1987, p.69), it was William Nemser in 1971 who offered the most accepted definition of the concept: «Learner speech at a given time is the patterned product of a linguistic system distinct from Native Language and Target Language and internally structured» (1971, p.116).

McLaughlin (1987) following Corder (1967) and Selinker (1972) describes the cognitive central processes of Second Language Learning and Interlanguage – which are essential to Error Analysis: Language Transfer and Interferences of the learners' Native Language (L1), Overgeneralisations of rules in the Target Language and Misconceptions of rules and uses in the Target Language.

Artificial Intelligence in Error Analysis

What we know today as CALL (Computer-Assisted Language Learning) was introduced in Linguistics and Engineering Studies in the 1950s, although it took quite some time to develop into an effective teaching-learning tool (Chapelle, 2001 & 2003). The basis of the CALL approach to second language learning is simple yet compelling: computers and computing devices can help in learning a

second/third language if designed correctly (Levy, 1997).

CALL remained a research area for some time before it was effectively used by teachers, instructors, and learners. Experts in this field claim that it was during the 1990s when CALL started to be put into practice (Chapelle, 2003). The reason underlying the late use of CALL perspectives in teaching-learning may be the obvious lack of technology around the final addresses of the process; schools, universities, students, and families may not have had access to the necessary technology at the early stages of the discipline development 1960s and 1970s (Schulze, 2003). It is widely claimed that it was the 1990s the decade that brought about the technological revolution that we are living in nowadays (Chauhan; Parida & Dhir, 2022).

CALL and Artificial Intelligence applied to L2 Studies have benefitted from the theoretical background and academic discussions, not only around Computing Sciences (Popovic & Ney, 2011) but also around Error Analysis, Error Treatment, and Interlanguage Hypotheses (Jodai, 2012). Much has been debated about the effective integration of Computer-assisted Feedback in the Error Analysis discipline (Ferreira, 2007). However, theoreticians and experts in this discipline have not reached an agreement on this aspect and the question remains open to further discussion: is Artificial Intelligence Feedback a real example of Computing Error Analysis?

An obvious answer to that question can be found in recent studies (Cabrera; Elejalde & Vine, 2014; Kraut, 2018; Wobst &Lueg, 2022; Magid et al. 2022) which claim that modern technology enables students to practise and to get feedback on their written and oral competences. This shows that modern devices have incorporated effective evaluative technology, necessary for the assessing process. Hence, CALL proves to be an effective tool to analyse errors as it helps identify trends that ultimately lead to committing errors (or to avoid them).

Artificial Intelligence in Education Studies

It was in the 1950s when one of the most notable personalities in the field of Applied Artificial Intelligence, Alan Turing, offered a definition or solution to what can be understood as an intelligent system or device (French, 2000). Turing came up with what is now known as the 'Turing Imitation Game': if a human listener cannot distinguish if his/her interlocutor is a machine or a human, then, we can talk about an artificially intelligent device/system/tool (Stefan & Sharon, 2017).

However, as far as the contemporary situation in Education Studies is concerned, Artificial Intelligence is not an unknown concept or tool. One of the most notable recent contributions to the integration of AI and Educational Studies (linked to Error Analysis) can be found in Luckin's studies (2011 & 2016). The expert claims that AI can support the development of

technologies that enhance learning by minimising errors in the process and maximising the possibilities of positive results. According to Luckin, A. I assisted models enable the learners to work at their own paces and rhythms and, at the same time, offer teachers and instructors the possibility of witnessing the process their learners are undergoing from an external and objective perspective. It is also noted that the model helps teachers and instructors to intervene whenever necessary and in various modes, not only face-to-face but also through distance tutoring (Underwood & Luckin, 2011).

In more recent research (Kessler 2018 & 2021) it is claimed and argued that modern technologies (especially those capable of processing and analysing texts and oral output) and experiences with the latest technological and communicational improvements (social media and virtual reality) enable teachers and instructors to effectively understand the new dimensions of the reality and challenges of their learners. Hence, Kessler states that all the knowledge acquired from these experiences helps teachers produce a more individualized teaching-learning process by considering the specific knowledge and specific needs of a specific student. This has an evident impact on the feedback process: the more information the teacher can collect, the better knowledge he/she has of the specific situation; this should result in better feedback which may have a double nature, computer-assisted and teacher-based (Chaudhry & Kazim, 2022). Thus, we could argue that A. I-powered tools and data collection should help elaborate better and more personalise teacher-student support and success in the learning process.

Nowadays it is clear that Artificial Education affects and has effects on several educational processes and contributes to bettering and boosting the educational system and the educational processes (Al-Fequi, 2012). Artificial Intelligent applications, machines and devices contribute to a change in the roles played by the different educational actors and actants (schools, teachers, directives, administrative personnel, learners, …). According to Dickenson (2017), these new technologies will change completely and drastically the interactional patterns between teachers /instructors and learners /students as machines will offer an interactive educational solution to traditional problems. Dickenson also states that these new technologies and artificially intelligent tools can provide solutions to the problem of interaction in big groups – this is especially important when giving feedback, improving student achievement and positivising attitudes towards the teaching-learning process (Dickenson, 2017, 105- 115).

Teaching English as a Second and Foreign Language is currently benefitting immensely from the introduction of Artificial Intelligence in particular, and ICTs in general. As it has been previously argued (Haupinn, 2016) language classrooms are highly artificial spaces to learn a language and communication and interaction are usually difficult when those situations

are granted learners do not have the possibility of practising real-life skills. Hence, the introduction of technologies that can simulate reality and force learners to communicate – imposing real-life difficulty – can be extremely beneficial for the process as a whole (Barnes, 2016). These new applications, programs and devices implement and boost communicational skills; through communication programs, conversational skills can be stimulated by introducing accurate, realistic, virtually interactive, and practical training in the language (Rabah, 2020).

Recent research (Radwan, 2017) has identified and described the various uses of Artificial Intelligence in order to overcome difficult situations in the classroom and to enhance the teaching-learning process. According to Radwan, the combination of educational and artificial intelligence tools can:

• be used to build and better the ability to comprehend reading passages.

• develop and enhance students' translation skills by using machine-assisted translation.

• help learners to improve pronunciation by using Automatic Speech Recognition Tools.

• help demolished barriers for visually and hearing-impaired students by using text-to-speech tools.

• Improve writing competence by using writing evaluation techniques, records and automatised writing correcting tools.

III. METHODOLOGY

The primary objective of this study is to assess and to determine how useful, if at all, is employing Artificial Intelligence tools in the practice of teaching English and what is the impact of using those tools to teaching / instructing writing competence in the CRFL B1 and B2. We also set out to determine the perceived effectiveness of these tools and their viability of application.

This study also aims to determine how related, if at all, are Artificial Intelligence tools applied to Second Language Learning and Second Language Acquisition studies (SLL and SLA) to Error Analysis and Error Corrective Treatment. Hence, theory must be explored in search of potential connections between both disciplines.

This study is motivated by the problem identified and that it intends to explore. Writing competence is usually disconnected in EFL (also in ESL sessions) classes with a considerable amount of usual delay in the feedback given and presented to the learners. Since AI tools offer almost immediate and interactive feedback and the possibility of automating feedback records, we need to explore the connection between those and the improvements in the written competence of learners, as opposed to traditional methods (teacher-based correction). With the intention to address these problems and fulfil the objectives

mentioned, this study attempts to answer the following questions:

• What are suitable strategies and methods for employing AI for teaching/learning English from the learners' perspective?

• How effective is the employment of AI for developing the processes and outcomes (the syllabi) of teaching/learning English?

• To what extent is viable to use AI tools to enhance writing competence?

• To what extent is using AI tools perceived as a viable and useful alternative to traditional feedback by learners?

The corpus study presented here, as already stated, has two main objectives. Firstly, our aim is to understand and examine the integration of Artificial Intelligence in Error Analysis and in Educational Studies. This preliminary objective is addressed by an exhaustive theoretical and academic literature review conducted in the first part of this project.

On the other hand, in a much more practical approach to the discipline we intend to explore the possibilities that the newest Artificial Intelligence tools, capable of processing texts and spoken outputs, can offer in the feedback and assessment process of learners of EFL. Particularly, the possibilities that A. I - based writing correction and text processing offer in comparison to a more traditional teacher-based correction system. The latter objective is linked to the final goal of this study: to comprehend if Artificial Intelligence helps learners of EFL produce better writings (more adequate to the objective desired) and, hence, if A.I can enhance EFL teaching-learning competencies.

In order to reach the aforementioned objectives, we have designed a methodology based on a five-step practical method, based on the corpus studies methodology. In these studies, the collection and analysis of samples if essential and so it is in this case. The following steps are essential to understand how this study has been conducted – and if desired to replicate it:

Step 1: Creation of the first corpus of the study or Corpus 1. For this study, we have collected a total amount of 70 writing sample collection of university students of EFL CERFL level B2. It is notable to mention that the complete class population is 70 students and for each of the class members one sample was collected. The members of the class possess various degrees of EFL competence and proficiency (mastery) but approximately 65/70 have produced language output that meets the descriptors and criteria at the targeted level.

Step 2: Division of Corpus 1 into study units. Once the samples are collected, they are, first, anonymised, to avoid any kind of affective or memorial interference (Stanton & Nosofky, 2007; Kaiser et al., 2021) in the study conducted, and, secondly, divided randomly into

two groups (35 writing samples on each group). These two groups are the main study units.

Step 3: Analysis of the study units. For each of the study units, one type of analysis is applied. One of the groups (unit 1) is analysed using Artificial technology capable of processing and analysing texts on a grammatical and lexical level (Trinka.ai was used in this particular study). The second group was analysed in a more traditional way: a teacher-based correction with pen and paper but with the same degree of analysis and detail. This enabled us to present the students/learners with two different outputs: an electronically corrected version of their samples and a paper-based version of the feedback process. Once their writing outputs are given back, the learners are required to examine their own errors.

Step 4: Creation of the confirmation corpus or Corpus 2. This confirmation corpus mirrors corpus 1: 70 written output samples produced by the same population under study. The main objective of this confirmation corpus is to assess the effective possibilities that A.I-based writing correction and text processing offer in comparison to a more traditional teacher-based correction system is essential to create a confirmation corpus that enables us to understand if or when the errors are repeated. To confirm our findings, we create a second corpus that will be analysed in detail looking for: error repetition and error nature (Gass & Selinker, 2008; Rutherford, 2022).

Step 5: Contrast analysis of both corpora (Corpus 1 and Corpus 2). Once Corpus 2 is analysed in detail, it needs to be contrasted with Corpus 1. The contrastive analysis of both corpora helps understand the process of error analysis, error treatment and error elimination or fossilisation of the error (McLaughlin, 1987). This

contrastive analysis, also, enables us to inspect if A.I minimise the errors produced as suggested by Kessler (2018 & 2021).

IV. RESULTS

This corpora-based study has shed some light on how Artificial Intelligence linked to Error Analysis can be an effective tool to consider within Artificial Intelligence Educational Studies (AIEd). It has also answered some questions about the effectiveness of the A.I-based tools themselves when assessing and feedbacking EFL students. In this section, we summarise the most significant results and findings of the study, which will be presented statistically organised in this section and discussed and analysed in the next.

On the one hand, Artificial Intelligence has proven to be an effective tool in the writing correction process EFL students. When we look closely at the results of both study units, we can see that the error repetition percentage is lower in the A.I-based correction system. Only 25% of the learners received and A.I-based feedback repeated in their second writing output the errors found in the first writing produced as opposed to the 30% in teacher-based feedback. Error elimination, and consequently preventing error fossilisation a better adequation of the production to the rules of the target language, in other words, to progress and success (Alderson, 2005).

The relationship between participation modality and error repetition and error success s can be seen in graph 2:
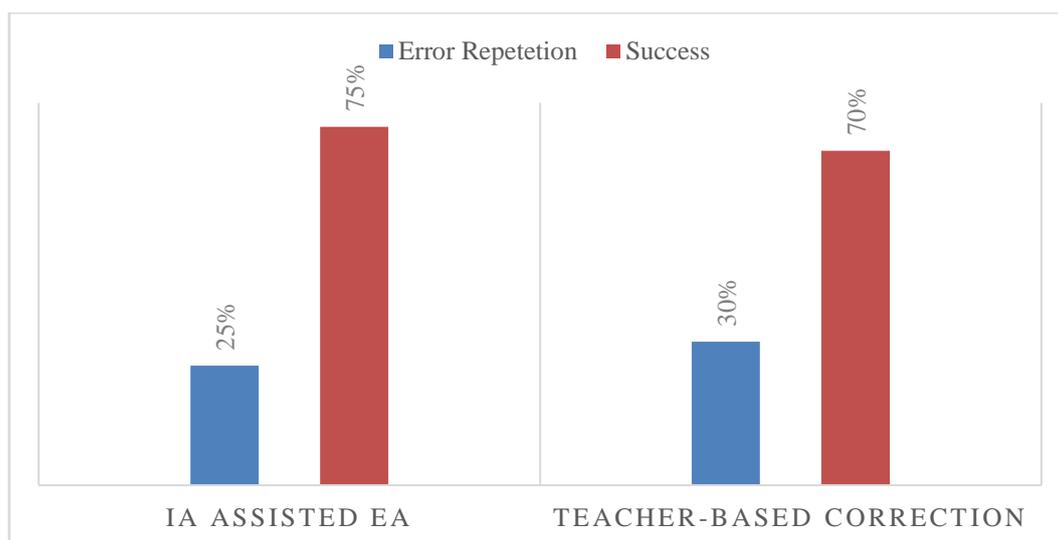
Graph 1: Error repetition and success per modality.

Secondly, this study has helped us understand the nature of the most frequent errors in the group studied and their distribution. The various natures of the different errors committed by the learners always indicate that something did not go according to plan

within the teaching-learning process, even when linguists and teachers have not yet agreed on a clear definition of the error itself (Gadd, 2016). This has some curricular essential implications. Knowing the nature and distribution of the errors of learners enables the

teachers/instructors to (i) be aware of them, (ii) find ways to help learners overcome them, (iii) assess the curriculum and syllabus to ensure error elimination and avoid error repetition and fossilisation (Murad, 2018; Rao, 2018). Is widely sustained that one of the many natures of the most frequent errors in EFL could be attributed to negative language transfer (NT) or interferences of students' and learners' native language in their EFL production/outputs (Gass & Selinker, 2008; Goker, 2021).

In the case of the study presented here, it is essential that ways to overcome the impact of Negative Transfer need to be considered and included in the syllabus of subject. This is evident as the results indicate that it is a common hindrance in all the members (students and learners) of the class studied: 72% of the errors in the A. I assisted modality and 77% in the teacher-based system can be attributed to NT; these results are in line with other recent research that suggests that NT continues to be the greatest source of error fossilisation EFL and ESL learners (Gass & Selinker, 1993; Arabski, 2006; Yunus, 2021).

The findings related to the Negative Transfer impact can be seen in the following graph (graph 3):
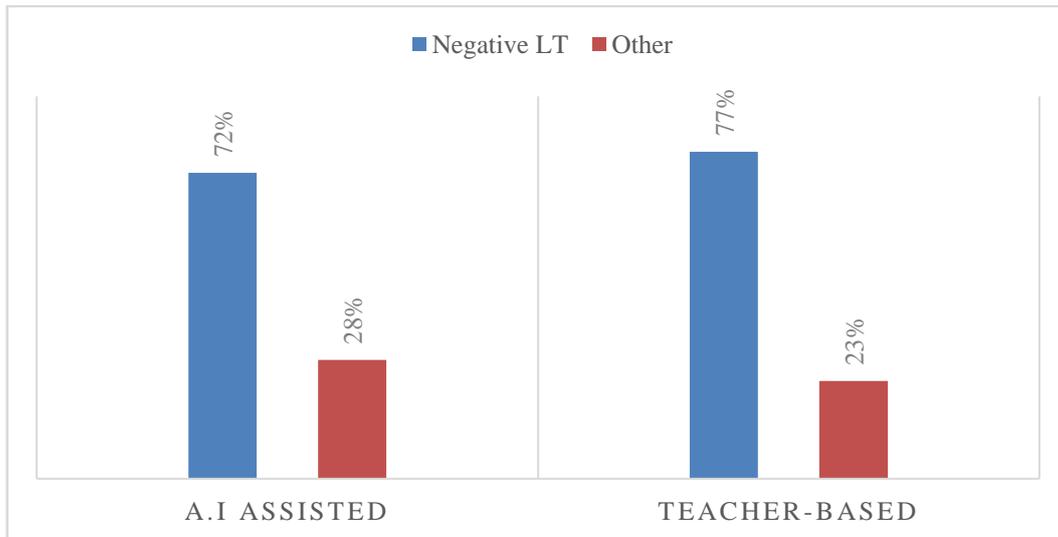

Graph 2: Negative language transfer impact vs other error natures.

Another conclusive finding in this study is the great level of satisfaction of the participants and the outstanding degree of inferred and perceived effectivity of the study. All the participants in the study were interrogated (via an anonymous survey) about three key questions: (i) how satisfied they were with the correction process and their results; (ii) how effective they thought it could be to be assessed in the way they were (whether A.I assisted or Teacher-based) and (iii) if they would have preferred to have been selected for the opposite group.

The following graph (graph 4) illustrates these results:
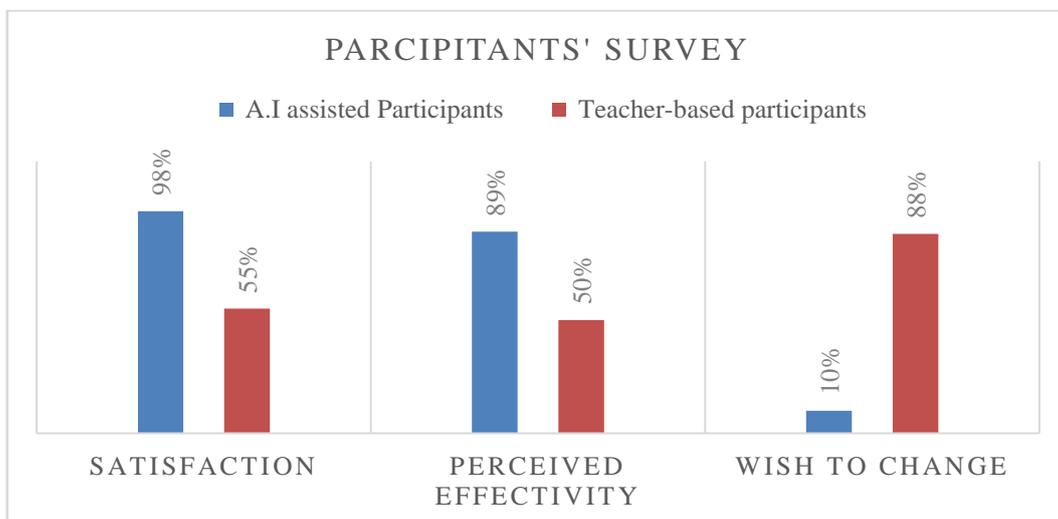
Graph 3: Participants survery.

V. CONCLUSION

This study attempts to explore the opportunities that Artificial Intelligence tools and Error Analysis can offer in the process of teaching-learning English as a second and foreign language to Spanish L1 university students. With the results and findings obtained from the corpora study proposed, we can infer that the combination of both disciplines, Artificial Intelligence and Error Analysis, can offer a personalised teaching-learning method that can be perceived as satisfactory by learners and students and, at the same time, introduce in the everyday practice of ESL / EFL teaching the theoretical background of both disciplines.

By introducing AIEd models capable of processing texts and spoken outputs, teachers and learners can easily keep developmental records which analyse and observe patterns of errors repetition, error fossilisation and/or error elimination. Hence, AIEd approaches to EFL, ESL and L2 Studies can constitute active, interesting, and satisfactory models and lessons which overcome language difficulties, such as Negative Transfer (which constitutes the greatest source of error in the population studied).

However, we need also to be aware that new technologies have their limitations and are most capable to assess and correcting language output from a grammatical and lexical point of view, whereas semantics and pragmatics of the language output still require a human-base correction (Tschichold, 2003; Silva, 2018). Hence, the higher the EFL level the student or learner possesses, the higher degree of teacher-based feedback will be required, even if technology permits to allocate part of the teaching-learning process in AIEd systems and devices, which is linked to Manns reflection about the so-called Fourth Industrial Revolution:

The rapid expansion of technology and digital applications that characterizes the "4th Industrial Revolution" is changing the way we live, work – and learn. It's a revolution driven by the fusion and amplification of emerging breakthroughs in artificial intelligence, automation, and robotics, and multiplied by the far-reaching connectivity between billions of people with mobile devices that offer unprecedented access to data and knowledge (Manns, 2017, p.4).

AIEd and CALL approach benefit from the advances in new technologies and Applied Linguistics theories, such as Error Analysis, but nowadays cannot be completely in charge of the teaching-learning process as, nowadays it is agreed that Artificial Intelligence cannot develop either a sense of semantics or pragmatics and, as a result, cannot interpret correctly the written and spoken outputs of human beings (Rapaport, 2005; Lolli, 2013; Mahmood, 2021; Kasirzadeh & Gabriel, 2021; Steels, 2022). They help develop learning methods and strategies and should be taken into consideration when designing EFL and EFL (but also other languages) syllabi because they enable them to bring the reality of the students and learners into the classroom and enhance their motivation and perceived satisfaction with their learning process.

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