

AI Intelligent Tutoring System Tailored to the Students' Personality and Neurodiversity

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Abstract: Over the past few years, several Universities and Educational Institutes have introduced e-learning platforms to support robust alternatives to face-to-face teaching, where students can benefit from them by revisiting topics covered in class without the constraints of time and space. However, despite this considerable flexibility, the role of the instructor as a facilitator is crucial to support learners when they have doubts on their learning or get stuck, by encouraging them to consider suitable strategies to approach the problem, or by providing clarification on some organisational aspects of the module. Providing quality feedback that is tailored to the individual needs of each learner, including personality and neurodiversity, is a challenging task for educators. Developing different methods of learner-specific feedback increases the workload and often fails to fully address learning gaps. The lecturer's empathy, which consists of a deep understanding of students' personal and social situations, care and concern for students' emotions, and compassionate responses, also poses a critical role in student success. Several intelligent tutoring systems have been implemented in e-learning platforms to try to provide immediate feedback to support students, but they focus more on providing feedback on content and often don't tailor feedback with adaptive empathy based on different students' personalities or neurodiversity. In this paper, an AI intelligent tutoring system based on LLM has been implemented within an e-learning platform, fine-tuned to the content and organisational aspects of the final year project module in the IT programme, with the aim of providing immediate feedback based on students' requests. The software can tailor comments to each student's personality and, where appropriate, neurodiversity, for example, showing genuine interest in responses from introverts or paraphrasing content to improve written comprehension for dyslexics. The neurodiversity information was taken from the user's profile, while personality was extracted using the MBTI (Myers-Briggs Type Indicator). Finally, the software was tested using a bespoke algorithm consisting in a matchmaking process able to detect the level of communication strategies (empathy, creativity, sensitivity) by cross matching the responses received with open online dictionaries to evaluate the effectiveness of the tailored responses.

Keywords: Generative AI, LLM, Intelligent Tutoring System, Immediate Feedback, Personality, Neurodiversity.

1. Introduction and Background

The advantages of online education, thanks to the flexibility and interoperability that make it easier access to learning resources, have led several universities and institutions to intensify the use of e-learning for on-line learning (Bigiotti, 2024) or developed as an integration of face-to-face lectures. (Nortvig, 2018). In the e-learning courses, the online tutor plays a crucial role for the success of the e-learning courses, acting as a facilitator able to guide students in the learning process by maintaining their involvement (McPherson, 2004) and providing feedback on their activities (Klimova et al., 2011) to clarify their doubts and allow them to increase their knowledge and skills. However, providing feedback is a challenging task for teachers and often students perceive the feedback provided not always effective because it is unclear, untimely, without a focus on improvement and without strategies for uptake. (Paris, 2022) In particular, if the feedback is not timely in an online environment, it could also be disadvantageous for a student who, despite the flexibility offered by the e-learning course, must interrupt his online study and wait for the 1to1 or face-to-face meetings with the teacher to clarify the doubts. Delayed feedback can indeed have a negative impact on learners' engagement (Boudin et al., 2024), which can affect their motivation and performance. In contrast, evidence confirm that immediate feedback is more effective than delayed feedback (Shute, 2008) and has the advantage of promoting active learning and contributing to improved cognitive outcomes. (Nalli, 2023)

The need to provide immediate support to students following online courses has led several institutions to develop Intelligent Tutoring Systems (ITS). The ITS is a computer-based learning software that can provide individual and adaptive feedback to students and act as an e-tutor able to provide personalised support to meet their needs without the intervention of the instructor (Bouchard, 2008) (Lin, 2023). Recent studies raised concerned about the efficacy of ITS with minimal intervention of the instructor (Son,2024), argued that it can

works properly only with specific topics (Shih, 2023), or because it doesn't always recognise their own mistakes and provided incorrect feedback. (Matsuda, 2013)

The recent development of GenAI with the spread of several LLM tools, accessible to everyone with chatbots (Clark et al., 2025) has contributed to increase the reliability and accuracy of the ITS (Wang, 2025). However, the IT solutions integrated into e-learning platforms do not effectively consider the different needs of students in terms of personality and neurodiversity, as they are often generic and lack the necessary customisation to meet the needs of individual users. (Mukherjee, 2025)

Personalised learning is an educational strategy that consist of a tailored education to the individuals, enabling them to enhance their understanding, abilities, perspectives and knowledge. (Shemshack et al., 2020). Neurodiverse learners can benefit significantly from a personalised learning because, unlike common learners who can organise their learning methods autonomously, they often require individual support to structure their own learning pathways, especially in a self-paced online course usually based on the student-centre approach.(Clouder et al., 2020) For example, students with ADHD prefer active and creative environments (Boot, 2020), introverts feel more comfortable quiet, reflective, and controlled settings (Touvinen, 2020).

The paper proposes a novel approach of an e-learning Intelligent tutoring system based on LLM, fine-tuned to the students' characteristics to maximise their learning experience by providing immediate feedback and recommendations (Polatidis et al., 2022) tailored to their personality and neurodiversity. This should contribute to bridge the gaps of the students and help them to enhance their motivation in the study and improve their academic performance.

2. Design Based Research

This work considers the characteristics of the individual learner as its primary and most important input.

The characteristics of the learners are characterised by the personality and neurodiversity that have a crucial impact for the effectiveness of the intelligent tutoring system. Indeed the intelligent tutoring system need to tailor the responses to meet the needs of the learners by providing the answer with the correct style and tone based on the different characteristics able to maximise the learning experience.

While neurodiversity information was taken from the user's profile, the personality was extracted by using Myers-Briggs Type Indicator (MBTI) by providing the related questionnaire which returns one of the 16 personalities. The MBTI is a psychometric questionnaire that measures users' preferences in terms of perception and decision-making, considering the following dimensions: Extroversion/Introversion, Sensing/Intuition, Thinking/Feeling. Feeling and Judging/Perceiving. (Ahmad, 2020) Recent studies have highlighted the effectiveness of the MBTI test in the educational field such as helping teachers to understand the needs of students and design instruction properly (Rodriguez, 2013) or as framework for categorising personality preferences and providing valuable insights (Vaughans, 2024)

Feedback should be prioritising these characteristics to be effective and as such the followed methodology is divided into 4 distinct phases:

- Phase 1: Capture the individual learner characteristics
- Phase 2: Create an individual Learning Diagnosis Profile (LDP)
- Phase 3: Interact with the learner to determine the context and motivation behind a learning request
- Phase 4: Fulfill the request and enhance it based on the LDP
- Phase 5: Evaluate the learner's interaction based on the learner's satisfaction as measured by the provided results as well as correlate satisfaction with the LLM's tuning against the individual LDP.

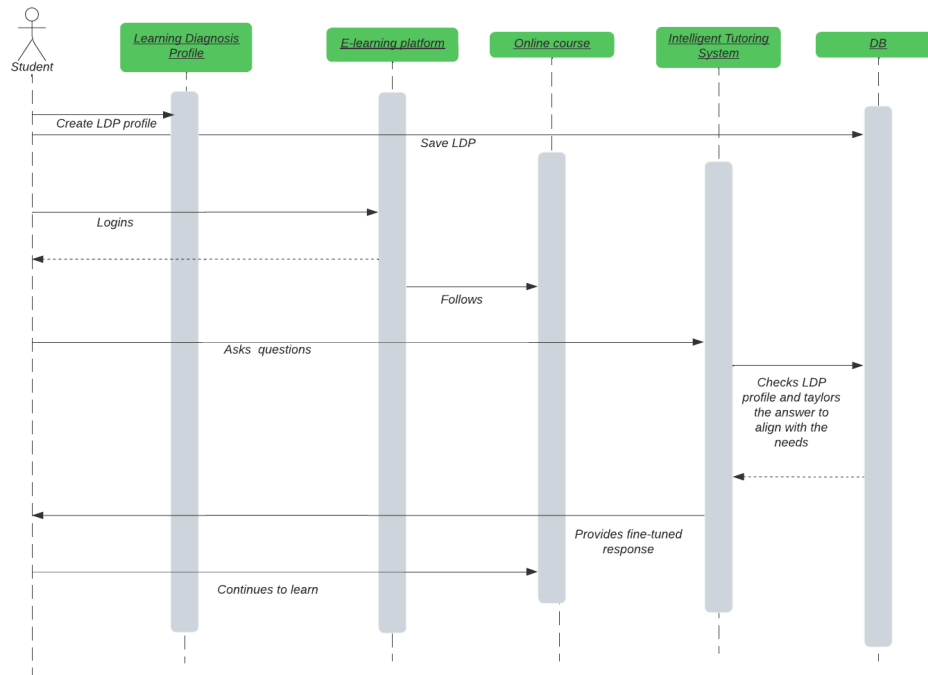


Figure 1: Sequence diagram which describes the flow of a student's interactions with the Intelligent Tutoring System when following an online course.

Phase 1 is designed to interact with the learner providing some sample questions to quantify the background, potential disability and learning method preference of each individual learner. This phase comprised 17 short questions that could be answered via multiple choice and some concise free response questions. Phase 1 is a prerequisite to mitigate the cold start problem and the only way of identifying the learner's background.

In the phase 2 an LDP is created based on the prerequisites of Phase 1. For this design 22 different profiles of MBTI personality and neurodiversity were considered, as seen in Table 3. LDPs are also considered in the tuning and pre-programming of any text requests to the LLM ITS to account for accurate responses against each individual learning case.

Regarding the phase 3 the learners are called to interact with the system while following on-line courses, providing relevant learning requests without disclosing any learning bias - requests were funnelled to ITS as genuine learning requests and the ITS did not identify any individual learning characteristics at this phase.

In the phase 4 the ITS provides answers to any learning request using a combination of the user input from Phase 3 as well as knowledge from Phase 2. The ITS considers each individual case base and attempts to tailor the output to the learner's needs that allow them to obtain an early clarification about the doubts they can encounter.

Finally, the phase 5 evaluates the effectiveness and quality of the learner's interaction with the system. For this phase a custom research component evaluates the ITS by matchmaking the fine-tuned responses against its LDP, accounting for unique personality traits or neurodiversity with different word categories. Phase 5 is designed to identify features such as empathy, Creativity and Tone Sensitivity.

3. Implementation

The Intelligent Tutoring System has been implemented using the Flask web framework and a database and is run in a virtual machine based on Ubuntu 20.04.

The screenshot shows a web browser window with the address bar displaying '127.0.0.1:5000' and a 90% zoom level. The main heading is 'Intelligent Tutoring System'. Below it, there is a 'Your Question' section with a text input field containing 'How can I write a literature review'. Underneath the question field are two dropdown menus: 'Choose Personality' set to 'INTJ - The Architect' and 'Choose Neurodiversity' set to 'ADHD'. A blue 'Ask' button is positioned below these menus. The 'Chat Output:' section shows a response: 'Writing a literature review can be a daunting task, but with proper planning and organization, you can tackle it effectively. Here are some steps to help you get started: 1. **Define your topic**: Clearly define the scope of your literature review. What

Figure 2: Example of responses tailored based different MBTI personality

The ITS currently operates as standalone software within an online environment, enabling users to easily access it for testing purposes. Although the design includes integration with the database, the software interface currently comprises a text box in which users can write questions and select their personality or neurodiversity from two drop-down menus. The software has been written in Python and developed by integrating the OpenAI API using the GPT-3.5 Turbo model. The model has been fine-tuned by mapping the personality and neurodiversity options selected by the student, offering tailored prompts to guide the ITS's responses.

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'Autism': "You are an assistant that is precise, logical, and
focused. Your responses may be very detail-oriented and structured, with
a preference for clear, direct communication and no ambiguity.",

'Dyslexia': "You are an assistant that provides clear, simple, and
straightforward responses. You may sometimes use concise language,
making sure the information is easy to follow and not overwhelming.",
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Figure 3: Example of fine-tuned prompt related to neurodiversity.

The responses are shown in the chat output and are also collected in a CSV log file on the server. This includes the user ID, personality, neurodiversity, user input and assistance response. This helps evaluate the responses provided and understand the reliability of the LLM. To evaluate the ITS, new software has been developed that can match the fine-tuned responses generated for each personality or neurodiversity with different word categories extracted using online lexicons, which identify features such as empathy (Empathy Lexicon, n.d.), creativity (Creative Writing Vocabulary, n.d.) and tone sensitivity (NRC Emotion Lexicon, n.d.). The software then returns the percentage of features in each ITS response based on the occurrences found. The software, which was developed using Python, utilises an input tokenization process to break the text into shorter tokens, making it ready to be processed by software that can analyse word frequency using the Python “collections” library. The software counts trait-relevant keywords and checks their occurrence in the provided dictionaries, returning the percentage for each feature. Finally, the software generates a CSV file that creates a table containing the question asked of the ITS, the personality type, the response and the percentage achieved for each specific trait.

4. Testing and Evaluation

The ITS has been tested by asking the question 'How can I write a literature review?' with different settings in terms of personality and neurodiversity. Specifically, 23 responses were collected by the ITS and then grouped in a CSV file generated directly by the platform and uploaded to a dedicated repository (Github repository, n.d.).

Table 1: Example of responses tailored based different MBTI personality

Question	Personality	Example of Response
How can I write a Literature Review?	ISFP - Adventurer	Writing a literature review can be a wonderful experience of exploration and synthesis. Here are some gentle steps to guide you through the process: 1. Define Your Purpose: Clarify the focus and scope of your literature review. What are you trying to achieve? What specific research question are you addressing? 2. Gather Sources: Begin by collecting a wide range of relevant sources such as academic articles, books, and other materials. Make sure to keep detailed notes as you read through them. 3. Organize Your Thoughts: Create an outline to structure your literature review. Think about different ways to categorize and group the sources based on themes, methodologies, or other relevant factors. 4. Start Writing: Begin by introducing the topic and providing context for your literature review. Then, summarize and analyze the key findings and arguments from your sources. Remember to connect the information in a coherent and logical way. 5. Create a Narrative: Weave together the different sources to create a narrative that flows smoothly and engages the reader. Highlight connections, disagreements, and gaps in the existing literature. 6. Critical Analysis: Be sure to critically evaluate the strengths and weaknesses of each source. Consider the methodology used, the credibility of the authors, and the relevance of the findings to your research question. 7. Synthesize and Conclude: Finally, synthesize the information you have gathered and conclude by summarizing the main findings, discussing the implications of the research, and suggesting potential avenues for future study. Remember, writing a literature review is a creative process that allows you to engage with the existing scholarship in a meaningful way. Embrace the opportunity to contribute your unique perspective and insights to the conversation.
How can I write a Literature Review?	ESTP - Persuader	To write a literature review: 1. Define your topic: Clearly define the scope and focus of your literature review. 2. Gather sources: Collect relevant academic papers, articles, books, and other sources related to your topic. 3. Organize your sources: Create a system to keep track of the sources you find, such as using citation management tools. 4. Read and take notes: Summarize the key points, methodologies, findings, and arguments of each source as you read. 5. Identify themes and gaps: Look for common themes, patterns, and gaps in the existing literature. 6. Outline your review: Create an outline that organizes your sources and key points in a logical order. 7. Write your review: Start writing your literature review, making sure to include an introduction, body paragraphs, and a conclusion. 8. Cite your sources: Properly cite all the sources you use in your review using the appropriate citation style (e.g., APA, MLA). 9. Edit and revise: Proofread your review for clarity, coherence, and accuracy. Make sure it flows well and addresses your research question. 10. Seek feedback: Consider sharing your draft with peers or professors for feedback and suggestions for improvement. Remember, a literature review should not just summarize existing research but also analyze, evaluate, and synthesize the information to contribute new insights to the field. Good luck!

As can be seen, the ITS offers different responses depending on a student's personality or neurodiversity. The aim is to suggest the most suitable option to empower learning and fill in skill gaps. Table 1 shows an example of different outputs. First, for the ISFP (Adventurer), the ITS provided a response that used decorative language, such as “wonderful experience”, and engaging sentences that reflect the student's personality and enjoyment of socialising. In contrast, the response for the ESTP (Persuader) is shorter, encouraging the student to view it as a challenge. It provides clear, brief instructions and uses the phrase 'good luck', which is more suited to students who are practical, skilled at problem solving, and drawn to challenging experiences.

Table 2: Example of responses tailored based different neurodiversity

Question	Neurodiversity	Example of response
How can I write a Literature Review?	Autism	Writing a literature review involves the following steps: 1. **Define your topic**: Clearly define the research question or area of focus for your literature review. 2. **Search for relevant sources**: Use academic databases, libraries, and other resources to find scholarly articles, books, and other sources related to your topic. 3. **Evaluate the sources**: Assess the credibility, relevance, and quality of the sources you find. Consider the date of publication, the author's credentials, and the methodology used in the research. 4. **Organize your sources**: Create an outline or a concept map to organize the sources you've gathered. Group them based on themes, theories, or key concepts. 5. **Summarize the key findings**: Write a brief summary of each source, focusing on the main arguments, methodologies, and results. 6. **Identify gaps in the research**: Highlight any areas where there is a lack of research or conflicting findings. This can help you identify the contribution your literature review will make. 7. **Synthesize the sources**: Analyze the similarities and differences between the sources you've reviewed. Look for patterns, trends, and contradictions. 8. **Write the literature review**: Start with an introduction that provides an overview of the topic and explains the purpose of the review. Then, organize the body of the review based on your outline or concept map. Make sure to include in-text citations for all sources. 9. **Conclusion**: Summarize the key findings of your literature review and discuss their implications. You can also suggest areas for future research. 10. **Edit and revise**: Review your literature review for clarity, coherence, and accuracy. Make sure your writing is well-structured and free of errors. By following these steps, you can create a comprehensive and well-organized literature review.
How can I write a Literature Review?	Dyslexia	Writing a literature review involves: 1. Selecting a topic 2. Searching for relevant sources 3. Reading and analyzing the sources 4. Organizing your review (e.g., by themes, chronologically) 5. Writing the review (introduction, body, conclusion) 6. Citing sources properly (APA, MLA, etc.) You should aim to summarize, analyze, and synthesize existing research on your topic. Be sure to include critical evaluation of the sources and discuss their relevance to your own research or argument.

Table 2 shows the responses generated for neurodiversity profiles, particularly those relating to autism and dyslexia. The response for the autism spectrum uses simple, direct language, such as 'define the research question' or 'write a brief summary of each source', avoiding metaphors or ambiguity that could limit comprehension of the profile. In contrast, the dyslexic profile yields a shorter answer characterised by structured sentences to improve readability and understanding by reducing the cognitive load that longer texts can cause.

Table 3: Evaluation of the ITS responses in terms of empathy, creativity and tone sensitivity.

Personality/Neurodiversity	Description	Empathy	Creativity	Tone Sensitivity
INTJ	Architect	4.4%	0.4%	4.4%
INTP	Logician	13.7%	3.4%	6.8%
ENTJ	Commander	0.0%	5.4%	0.0%
ENTP	Debater	14.8%	3.7%	3.7%
INFJ	Counselor	7.4%	7.4%	3.7%

Personality/Neurodiversity	Description	Empathy	Creativity	Tone Sensitivity
INFP	Mediator	3.4%	13.6%	3.4%
ENFJ	Giver	8.8%	0.0%	8.8%
ENFP	Champion	19.0%	3.2%	6.3%
ISTJ	Inspector	9.5%	0.0%	3.2%
ISFJ	Protector	25.2%	3.2%	9.5%
ESTJ	Director	4.2%	4.2%	4.2%
ESFJ	Caregiver	9.5%	6.3%	9.5%
ISTP	Crafter	4.0%	4.0%	0.0%
ISFP	Artist	14.0%	18.0%	7.2%
ESTP	Persuader	0.0%	13.8%	4.6%
ESFP	Performer	10.6%	3.5%	3.5%
ADHD	Attention Deficit	7.1%	10.7%	0.0%
Autism	Social communication difficulty	3.5%	14.0%	3.5%
Dyslexia	learning difficulty	5.0%	12.0%	0.0%
Dysgraphia	difficulty to write legibly	6.8%	3.4%	6.8%
Dyspraxia	coordination difficulties	5.0%	4.3%	0.0%
Dyscalculia	process numbering difficulty	6.5%	3.3%	6.5%

Table 3 illustrates the results obtained by performing the matchmaking software achieved for each selected personality type or neurodiversity. Despite the percentages not being particularly high, there are some interesting results which demonstrate how the LLM tailors its responses to meet students' needs. Empathy achieves the highest scores, demonstrating its importance in formative feedback. It creates a safe place where students don't feel judged and are open to learning from mistakes, which increases their motivation and engagement (Johnson, 2020). In individuals with certain personality types, such as ISFJ (Protector), ENFP (Champion) and ENTP (Debater), empathy scores exceed 14%. In contrast, scores for neurodiverse individuals decreased significantly. This is because neurodiverse individuals usually struggle to understand social awareness, which limits their ability to develop empathic understanding (Chapman, 2022). Instead, creativity seems to achieve higher scores in neurodiversity than in different personality profiles (except for the Artist, Mediator and Persuader, for whom creativity is one of the main features). This is because creative interventions in neurodiverse individuals generate ruptures and new forms of understanding and action that differ from traditional ones (Elisondo, 2025).

Tone sensitivity is lower in neurodiverse individuals due to their impaired understanding of emotions (Dawson, 2025), so the LLM responses seem to reduce this feature to avoid misinterpretation of concepts. However, it is interesting that higher scores are returned for personalities such as ENFJ (Giver), ESFJ (Caregiver) and ISFJ (Protector) due to their ability to be highly emotionally attuned to others, understanding their needs and concerns.

5. Conclusion

The paper demonstrated preliminary results on formative feedback tailored to students' personalities, as well as offering neurodiverse students suitable responses to help bridge their skill gaps. This work can be expanded substantially to provide students with alternative learning strategies and thus having an effective assistive tool to support their continued learning in the future.

The results demonstrate the effectiveness of the implementation of the Intelligent Tutoring System developed using the OpenAI API, specifically the ChatGPT 3.5 model. The ITS provides clear and accurate responses that can guide students on how to write a literature review by offering the formative feedback necessary for

structuring a strong review. This offering has to be expanded and quantified further but so far the results seem promising.

The ITS also demonstrated its effectiveness in tailoring answers based on personality type and neurodiversity, achieving scores of 25% empathy, 18% creativity, and 9.5% tone sensitivity, increasing or decreasing features to meet learners' needs. However, concerns may arise when requests need online searches or deeper information and this could be provided by new models, such as ChatGPT 4.0. In addition, as this work only evaluated the feasibility of creating the ITS platform, a thorough investigation is required to adequately evaluate its performance. A future extension of this work could involve conducting a case study where the students can access the ITS during their self-paced online courses and collect their feedback about the responses provided. This would evaluate the effectiveness by considering the user perception and the reliability as an assistive tool for neurodiverse students during the learning.

Ethics Declaration

This is not applicable as the study only consists of a stand-alone software implementation, and doesn't involve human participants, personal data or interaction with users.

AI Declaration

The AI hasn't been adopted for the content development. A translator tool was used to refine some sentences in the paper. The OpenAI API has been linked to the software developed in the paper.

References

- Ahmad, H., Asghar, M. Z., Khan, A. S., and Habib, A. (2020). "A systematic literature review of personality trait classification from textual content", *Open Computer Science*, Vol 10, No 1, pp 175-193.
- Bigiotti, A., Bottoni, M.P.F. and Nalli, G. (2024). "Blockchain in e-learning platform to enhance trustworthy and sharing of micro-credentials", *International Conference on Advanced Information Systems Engineering*, Springer, pp. 5-17.
- Boot, N., Nevicka, B., and Baas, M. (2020). "Creativity in ADHD: goal-directed motivation and domain specificity", *Journal of attention disorders*, Vol 24, No. 13, pp. 1857-1866.
- Bouchard, J. (2008). "Intelligent tutoring systems", *Research Starters Education*, Vol 1, pp. 1-12.
- Boudin, A., Rauzy, S., Bertrand, R., Ochs, M., and Blache, P. (2024). "How is your feedback perceived? An experimental study of anticipated and delayed conversational feedback", *JASA Express Letters*, Vol 4, No7.
- Chapman, R., and Carel, H. (2022). "Neurodiversity, epistemic injustice, and the good human life", *Journal of Social Philosophy*.
- Clark, J., Barton, B., Albarqouni, L., Byambasuren, O., Jowsey, T., Keogh, J., Liang, T., Moro, C., O'Neill, H. and Jones, M. (2025). "Generative artificial intelligence use in evidence synthesis: A systematic review", *Research Synthesis Methods*, pp.1-19.
- Clouder, L., Karakus, M., Cinotti, A., Ferreyra, M. V., Fierros, G. A., and Rojo, P. (2020). "Neurodiversity in higher education: a narrative synthesis", *Higher Education*, Vol 80, No 4, pp. 757-778.
- Creativity Writing Vocabulary List (n.d.). Available at: <https://www.scribd.com/document/376474173/Creative-Writing-Vocabulary-Lists1>
- Dawson, G., Webb, S., McPartland, J. (2005). "Understanding the nature of face processing impairment in autism: insights from behavioural and electrophysiological studies", *Developmental Neuropsychology* Vol. 27, No 3, pp. 403-424
- Elisondo, R. C., and de la Barrera, M. L. (2025). "Creativity and Autism: A Systematic Review of Interventions", *The Journal of Creative Behavior*, Vol 59, No 1.
- Empathy lexicon (n.d.). Available at: <https://www.kaggle.com/datasets/georgiwhiteley/empathy-lexicon>
- Github repository (n.d.). Available at: <https://github.com/giacomonalli/its>.
- Hoogman, M., Stolte, M., Baas, M., and Kroesbergen, E. (2020). "Creativity and ADHD: A review of behavioral studies, the effect of psychostimulants and neural underpinnings", *Neuroscience and Biobehavioral Reviews*, Vol 119, pp. 66-85.
- Johnson, C. E., Keating, J. L., and Molloy, E. K. (2020). "Psychological safety in feedback: what does it look like and how can educators work with learners to foster it?", *Medical Education*, Vol.54, No 6, pp. 559-570.
- Kebritchi, M., Lipschuetz, A. and Santiago, L. (2017). "Issues and challenges for teaching successful online courses in higher education: A literature review", *Journal of Educational Technology Systems*, Vol 46, No 1, pp. 4-29.
- Lin, C. C., Huang, A. Y., and Lu, O. H. (2023). "Artificial intelligence in intelligent tutoring systems toward sustainable education: a systematic review", *Smart Learning Environments*, Vol 10, No 1, pp. 1-22.
- Matsuda, N., Yarzebinski, E., Keiser, V., Raizada, R., Cohen, W. W., Stylianides, G. J., and Koedinger, K. R. (2013). "Cognitive anatomy of tutor learning: Lessons learned with SimStudent", *Journal of Educational Psychology*, Vol 105, No 4, pp. 1152.
- McPherson, M. A., and Nunes, J. M. B. (2004). "The role of tutors as an integral part of online learning support", *European Journal of Open and Distance Learning*.

- Mukherjee, U. (2025). "Neurodiverse education and chatbots as personalized learning tools: Opening the research agenda", *Journal of Informatics Education and Research*, Vol 5, No 1.
- Nalli, G., Culmone, R., Perali, A., and Amendola, D. (2023). "Online tutoring system for programming courses to improve exam pass rate", *Journal of e-Learning and Knowledge Society*, Vol 19, No 1, pp. 27-35.
- Nortvig, A.M., Petersen, A.K. and Balle, S.H. (2018). "A literature review of the factors influencing e-learning and blended learning in relation to learning outcome, student satisfaction and engagement", *Electronic Journal of E-learning*, Vol 16, No 1, pp. 46-55.
- NRC emotion lexicon (n.d.) Available at: <https://saifmohammad.com/WebPages/NRC-Emotion-Lexicon.htm>
- Paris, B. (2022). "Instructors' perspectives of challenges and barriers to providing effective feedback", *Teaching and Learning Inquiry*, Vol 10.
- Polatidis, N., Kapetanakis, S., Pimenidis, E. & Manolopoulos, Y. (2022). "Fast and Accurate Evaluation of Collaborative Filtering Recommendation Algorithms", *ACIIDS 2022: Intelligent Information and Database Systems*, pp. 623 – 624.
- Rodríguez Montequín, V., Mesa Fernández, J.M., Balsera, J.V. and García Nieto, A. (2013). "Using MBTI for the success assessment of engineering teams in project-based learning", *International journal of technology and design education*, Vol 23, pp.1127-1146.
- Shemshack, A., and Spector, J. M. (2020). "A systematic literature review of personalized learning terms", *Smart Learning Environments*, Vol 7, No 1, pp. 1–20.
- Shih, S. C., Chang, C. C., Kuo, B. C., and Huang, Y. H. (2023). "Mathematics intelligent tutoring system for learning multiplication and division of fractions based on diagnostic teaching", *Education and Information Technologies*, Vol 28, No 7, pp. 9189-9210.
- Son, T. (2024). "Intelligent Tutoring Systems in Mathematics Education: A Systematic Literature Review Using the Substitution, Augmentation, Modification, Redefinition Model", *Computers*, Vol 13, No 10, pp/ 1-24.
- Tuovinen, S., Tang, X., and Salmela-Aro, K. (2020). "Introversion and social engagement: Scale validation, their interaction, and positive association with self-esteem", *Frontiers in Psychology*, Vol 11, pp. 1-11.
- Vaughans, A., (2024). "Enhancing learning through mbti: customizing educational strategies to student personality types", In *EDULEARN24 Proceedings*, IATED, pp. 4960-4963.
- Wang, T., Zhan, Y., Lian, J., Hu, Z., Yuan, N. J., Zhang, Q. and Xiong, H. (2025). "LLM-powered Multi-agent Framework for Goal-oriented Learning in Intelligent Tutoring System", *Companion Proceedings of the ACM on Web Conference 2025*, pp. 510-519.