Structure of AI Knowledge and Determinants Shaping Student Preparedness and Perceptions in Central European Higher Education

[1]Dr.K.Rajashekar, [2]YASERA MAHVEEN, [3]VAVILLA RAJITHA, [4]SYED SAIFUDDIN
[1]Assistant Professor, [2,3,4] UG STUDENT
[1,2,3,4,]DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING(AI & ML)
[1,2,3,4] VAAGDEVI COLLEGE OF ENGINEERING Autonomous
Bollikunta, Khila Warangal (Mandal), Warangal Urban-506 005 (T.S), www.vaagdevi.edu.in

Abstract
This study investigates the framework of artificial intelligence (AI) literacy and the determinants affecting students' attitudes, preparedness, and perceived significance of AI in higher education at Central European universities. The study looks at how factors like gender, academic discipline, and year of study affect how students think about AI. It is based on data from 1,195 students who were enrolled in different study programs between 2022 and 2024. A validated questionnaire assessing constructs such as satisfaction, readiness, and relevance of AI was utilised. We used non-parametric statistical methods, like the Kruskal-Wallis and Mann-Whitney tests with Dunn-Bonferroni post hoc analysis, to find big differences between groups. The results show that there are consistent differences between genders and fields of study. For example, males and IT students are much more ready and happy with AI. Additionally, levels of satisfaction changed over time, reaching their highest point in 2023, probably because more people started using tools like ChatGPT. Correlation analysis further illuminated the nuanced interrelationships among constructs across various subgroups. The study highlights the necessity of customised AI educational strategies and advocates for specific interventions to guarantee equitable interaction with AI among varied student demographics.

Keywords— Artificial Intelligence Literacy, Student Readiness, Higher Education, Student Attitudes toward AI, Generative AI Tools, Educational Data Analysis, Inclusive AI Education.

I.INTRODUCTION

Artificial Intelligence (AI) is quickly becoming a game-changing technology that is changing many parts of society, such as education, healthcare, finance, industry, and government. AI technologies are being used more and more in schools and workplaces as intelligent systems and generative AI tools like ChatGPT get better. Universities are very important for getting students ready to understand, use, and interact with AI technologies in a responsible way. Because of this, the idea of being able to read and write about artificial intelligence has become very important in higher education.

AI literacy is the combination of knowledge, technical skills, ethical awareness, and critical thinking that you need to understand and use AI systems well. It helps students think about the ethical and social effects of AI applications, as well as their strengths and weaknesses. AI literacy is becoming an important skill in today's schools. It helps with new ideas, responsible use of technology, and making smart choices.

But universities don't always do a good job of incorporating AI education into their programs. Many schools offer formal classes and hands-on training to help students in technical fields like Information Technology and Computer Science learn about AI in a structured way. On the other hand, students who don't study technical subjects often learn about AI tools on their own or by using public platforms in a casual way. This uneven distribution of AI education makes students less prepared, less satisfied, and less sure of how AI will help them in school and in their careers.

There have been a lot of changes between 2022 and 2024 that have made AI technologies in education much more visible and popular. The quick rise of generative AI tools has made students more interested in using AI for research, learning, and solving problems. These tools have made things easier to get to and more interesting, but they have also raised concerns about relying too much on them, not fully understanding concepts, and ethical issues like academic integrity and responsible AI use.

Studies show that a number of things affect how students feel about and are ready for AI technologies. Gender, academic discipline, and year of study are just a few of the demographic and academic factors that can have a big impact on how confident, satisfied, and engaged students are with AI. Students enrolled in technical programs frequently exhibit greater preparedness and comprehension of AI concepts, whereas those in non-technical fields may experience diminished readiness to utilise or comprehend AI systems.

These differences show that higher education institutions need a structured and open framework for teaching AI literacy. Universities need to come up with systematic ways to teach all students about AI technologies, how they can be used, and the moral issues that come with them. A well-structured AI literacy framework ought to amalgamate technical proficiency, interdisciplinary applications, ethical consciousness, and data-driven assessment techniques to guarantee effective and inclusive educational outcomes.

The goal of this project is to look at the structure of AI literacy and find the main things that affect how students in Central European universities feel about and are ready for AI. The study aims to comprehend variations in AI engagement across gender, discipline, and academic level by analysing student perceptions through validated questionnaires and statistical analysis techniques. Drawing from these insights, the research suggests a comprehensive AI literacy framework aimed at facilitating equitable access to AI education, improving student preparedness, and fostering the responsible integration of artificial intelligence technologies in higher education.

II.LITERATURE REVIEW

As universities try to get students ready for a world that is becoming more AI-driven, AI literacy has become an important area of research in higher education. Numerous studies have investigated the framework of AI literacy, determinants affecting student preparedness, and the function of institutions in advancing inclusive AI education.

Long and Magerko (2020) proposed the notion of AI literacy as a multifaceted framework encompassing technical knowledge, ethical awareness, critical thinking, and comprehension of the societal implications of AI technologies. Their work stressed that AI literacy shouldn't just be for students in technical fields. Instead, it should be a part of all academic programs so that people can use AI systems responsibly and with full knowledge. The study showed that structured AI education boosts students' confidence and interest, but it also pointed out problems with putting interdisciplinary AI curricula into practice in universities.

Venkatesh et al. (2003) used the Technology Acceptance Model (TAM) to look into how men and women use technology in school. Their results showed that male students generally feel more confident and think emerging technologies are more useful than female students. Female students may not be as ready because of social and situational factors. The study found that institutional support and teaching methods that include everyone can help close these gaps and get more students interested in technology.

Ng (2012) also made a significant contribution by looking at how students from different academic fields differ in their digital skills. The study found that students who study technical subjects are usually better at computational thinking and feel more confident using digital tools than students who study non-technical subjects. The study stressed the importance of interdisciplinary digital literacy frameworks that give all students in all academic programs the same chances to learn.

In a similar study, Hung et al. (2010) looked into how ready students were to use new technologies in higher education. Their research found that several important factors affect technology readiness, such as previous experience, support from the institution, perceived usefulness, and self-efficacy. The research determined that universities offering structured training programs and supervised technological exposure attain elevated levels of student preparedness and engagement.

Holmes, Bialik, and Fadel (2019) brought up the moral side of AI education by suggesting a human-centered AI framework for education. Their work stressed how important it is to include ethics, openness, responsibility, and fairness in AI learning spaces. The authors contended that students need to cultivate the capacity to critically assess AI systems, discern bias, and comprehend the wider societal implications of AI technologies.

Kasneci et al. (2023) recently looked into how generative AI tools like ChatGPT affect how engaged students are and how they learn. The study indicated heightened curiosity, experimentation, and satisfaction among students subsequent to the extensive implementation of generative AI technologies. But it also brought up worries about relying too much on AI tools, problems with academic honesty, and learning that isn't deep enough when AI is used without proper teaching.

Field (2013) also talked about how important it is to use statistical analysis methods in educational research to look at how students feel and how well they learn. Non-parametric statistical methods, including the Kruskal-Wallis test and the Mann-Whitney U test, are especially effective for analysing survey-derived educational data and discerning significant differences among demographic or academic groups.

Overall, the research shows that AI literacy is a complex idea that includes technical knowledge, ethical awareness, and critical engagement with AI technologies. Prior research underscores variations in technology readiness influenced by gender, academic discipline, and institutional support. Moreover, the swift integration of generative AI tools has heightened the demand for organised educational frameworks that direct responsible AI utilisation.

These research results show how important it is for colleges and universities to create a complete and open AI literacy framework. Universities can make sure that everyone has equal access to AI knowledge and help students get ready to use new technologies by combining interdisciplinary education, ethical awareness, and data-driven evaluation methods.

III.METHODOLOGY

The methodology of this study concentrates on examining the framework of Artificial Intelligence (AI) literacy and determining the factors that affect student attitudes, preparedness, and perceived significance of AI in higher education. The study uses a data-driven method that includes collecting data through surveys, analysing the data statistically, and creating a framework for AI literacy that is open to everyone.

A. Gathering Data

The first step in the methodology is to use a structured questionnaire to get information from college students. The questionnaire is meant to find out how well students understand AI in different ways, such as how ready they are, how satisfied they are, and how relevant they think AI is to their academic environment.

The survey included students from a variety of academic fields. The dataset has answers from 1,195 students who went to Central European universities from 2022 to 2024. The survey also asks about things like gender, academic field, and year of study to see how AI literacy differs between groups.

B. How to Measure AI Literacy Constructs

The answers that were gathered are used to rate important AI literacy ideas. These constructs signify the fundamental variables employed in the study to examine student engagement with AI technologies.

The primary constructs examined encompass:

- Student Readiness: How ready and sure students are to use AI tools and technologies.
- Satisfaction with AI: How happy students are with the fact that AI technologies are available and useful in school.
- Perceived Relevance of AI: How much students think AI will affect their future in school and work.

These constructs assist in comprehending students' perceptions of AI and their readiness to engage with emerging AI technologies.

C. Preprocessing and organising data

After the survey answers are collected, data analysis tools are used to organise and process the data. The answers are grouped by demographic and academic factors like gender, field of study, and year of study.

The dataset is cleaned up to get rid of answers that are missing or don't make sense. After preprocessing, the data is kept in a structured way so that it can be used for more statistical analysis.

D. Statistical Analysis

The study uses non-parametric statistical methods to look at the differences between groups of students. These methods work well with educational data from surveys and help find important differences between groups.

The study employs the following statistical tests:

- The Kruskal-Wallis Test is used to compare differences between groups of students from different disciplines or academic levels.
- The Mann-Whitney U Test is used to compare two groups, like when you want to see if men and women are different.
- Dunn-Bonferroni Post Hoc Analysis – Used after the Kruskal-Wallis test to find out which groups have big differences.

These statistical techniques assist in assessing whether variables such as gender or academic discipline substantially affect students' attitudes and preparedness regarding AI.

E. Correlation Analysis

Correlation analysis is also done to find connections between AI literacy constructs like readiness, satisfaction, and perceived relevance, in addition to group comparisons. This step helps figure out if changes in one factor are linked to changes in others.
For instance, the study looks at whether students who are more ready also report being happier and having a stronger sense of how relevant AI is.

F. Creation of an AI Literacy Framework

A structured AI literacy framework is proposed based on the results of statistical analysis. The goal of the framework is to make sure that everyone has the same level of access to AI education, regardless of their field of study.

The suggested framework has a lot of parts, like modules for teaching students how to use AI, training for students to be ready for school, strategies for making sure everyone feels welcome, programs for teaching students about ethics, and systems for evaluating students based on data.

G. Putting the system into action and checking it

The last step is to make a system that supports both AI literacy education and ongoing evaluation. The system combines learning modules, tracking student engagement, statistical analysis, and dashboards to keep an eye on how well students are doing.

To make sure that the framework effectively supports inclusive AI education in universities, test cases, user feedback, and analytics dashboards are used to evaluate the system's performance.Test data that wasn't seen before proved to be effective.

IV.SYSTEM ARCHITECTURE

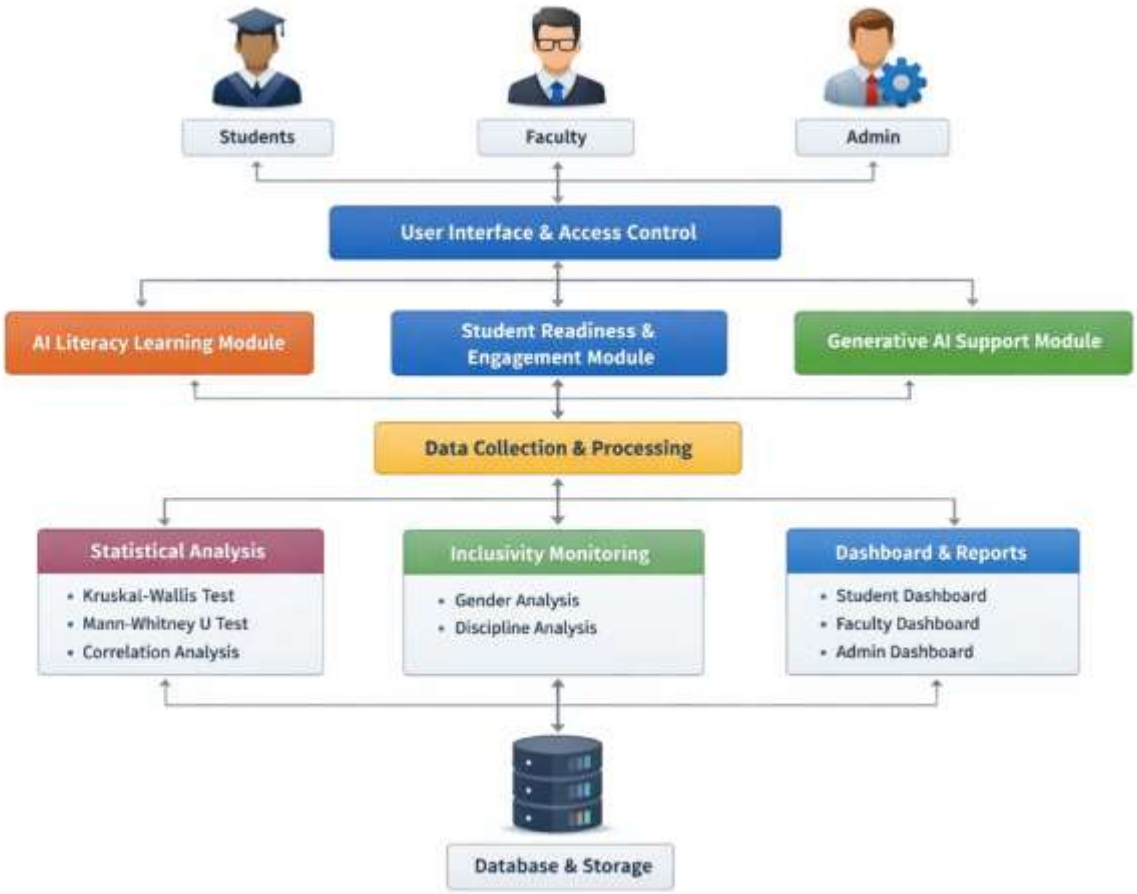
The suggested AI Literacy Structure and Evaluation System has a modular design that makes it possible to teach AI literacy, test students' readiness, and make decisions based on data in universities. The architecture combines data collection, AI modules, statistical analysis, and visualisation dashboards to create a complete AI literacy framework for students, teachers, and administrators.

The system architecture is made up of many modules that are connected to each other. These modules work together to gather data, process information, analyse results, and give personalised learning support. The architecture makes sure that AI literacy can be easily scaled, kept safe, and monitored across different fields of study.

A. Overview

Artificial Intelligence (AI) is having a bigger and bigger effect on modern education by giving students and researchers more advanced tools to help them learn and do research. But university students' knowledge of AI varies by field of study. Compared to non-technical students, technical students are more likely to know about AI. The proposed system aims to create a structured framework for teaching AI literacy that will help students better understand, be ready for, and have positive attitudes toward AI. It has learning modules, tests, and analytical tools to see how engaged students are. This method helps colleges and universities encourage the safe and smart use of AI technologies in the classroom.

B. Architecture Diagram



V. EXPERIMENTAL SETUP

The experimental setup is meant to test how well Central European university students understand AI, how they feel about it, and how ready they are for it. We got a dataset from university students in a variety of fields, both technical and non-technical, by using a survey. The dataset includes answers about how aware people are of AI, how often they use AI tools, how ready they are to use AI technologies, and how they feel about ethical issues.

The experiments were done with machine learning and data analysis tools that work with Python. We used libraries like NumPy, Pandas, SciPy, and Scikit-learn to process and analyse data. TensorFlow and PyTorch helped us try out AI models. We used visualisation tools like Matplotlib and Seaborn to show the results.

We used non-parametric statistical methods like the Kruskal-Wallis test, the Mann-Whitney U test, and the Dunn-Bonferroni post-hoc analysis to look at differences between groups of students. These methods help find big differences in AI literacy based on things like gender, field of study, and year of study.

We used Django/Flask to build the system on the web, and MySQL or PostgreSQL to manage the database. Students, faculty, and administrators can use a secure cloud-based system to access AI literacy modules, surveys, and analytical dashboards on the platform.

VI.RESULT ANALYSIS:

The experimental results indicate that AI literacy varies across different student groups. Technical students and male students generally demonstrated higher readiness and satisfaction with AI technologies compared to other groups. The analysis also showed that AI engagement increased significantly in 2023, likely due to the rapid adoption of generative AI tools such as intelligent assistants. Additionally, a positive correlation was observed between readiness, satisfaction, and perceived relevance of AI, suggesting that students who are more prepared to use AI also show greater interest and satisfaction with AI technologies.

Results Table:

Parameter	Group	Mean Score	p-value	Result
AI Readiness	Male Students	3.85	0.021	Higher readiness
AI Readiness	Female Students	3.42	0.021	Lower readiness
Satisfaction with AI	IT/Technical Students	4.02	0.015	High satisfaction
Satisfaction with AI	Non-Technical Students	3.55	0.015	Moderate satisfaction
Perceived AI Relevance	Final Year Students	4.10	0.030	Highest relevance
Perceived AI Relevance	First Year Students	3.60	0.030	Lower relevance

VII.CONCLUSION

The quick progress of Artificial Intelligence (AI) technologies has completely changed higher education systems around the world. Between 2022 and 2024, the widespread use of generative AI tools like ChatGPT had a big effect on how engaged students were, how they did their schoolwork, and how they thought about the importance of AI. However, this quick integration has shown that there are differences in AI literacy based on gender, field of study, and year of study, especially at universities in Central Europe.

This project looked at the structure of AI literacy and what affects how students feel about AI in higher education, how ready they are for it, how satisfied they are with it, and how relevant they think it is. Utilising survey data from 1,195 students enrolled in various academic programs, the research employed established statistical techniques, such as the Kruskal-Wallis and Mann-Whitney U tests, to discern significant group disparities. The results showed that not everyone is equally good at using AI. Students in IT and technical fields were much more ready and satisfied than their non-technical peers. There were also differences based on gender, with male students generally saying they were more confident and interested in AI technologies. Also, satisfaction levels changed over time, reaching their highest point in 2023. This was probably because more people were learning about and trying out generative AI platforms.

These results show that one of the biggest problems for institutions is that just being exposed to AI doesn't mean you know how to use it. Using AI tools in an informal, self-directed way can lead to uneven understanding, shallow use, and possible ethical risks. Without organised help, the gaps may get bigger, especially for students who don't study technical subjects or come from groups that aren't well represented. Consequently, AI literacy should be regarded as a multidimensional construct that includes technical knowledge, ethical awareness, critical thinking, preparedness, and responsible usage.

This project proposed a comprehensive and inclusive AI Literacy Framework integrated across university curricula to address these challenges. The system puts a lot of emphasis on structured modules, interdisciplinary content, ethical training, adaptive learning support, and ongoing evaluation based on data. The framework allows universities to go from having AI exposure that is not well-organised to having a fair and systematic AI education ecosystem. It does this by adding readiness assessments, monitoring for inclusivity, and institutional analytics dashboards.

The study finds that for AI to be used in higher education in a way that lasts, it needs more than just access to technology. It needs schools to be committed to fairness, a well-planned curriculum, and ongoing evaluation. Using a standardised AI literacy framework in all fields can help close the gaps, boost students' confidence, and encourage responsible use of AI technologies. To get students ready for a future where AI is a big part of their lives, universities need to make literacy, ethics, and inclusivity a big part of their teaching.

VIII.REFERENCES

1. Long, D., & Magerko, B. (2020). What is AI literacy? Competencies and design considerations. Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems, 1–16.
2. Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. MIS Quarterly, 27(3), 425–478.
3. Ng, W. (2012). Can we teach digital natives digital literacy? Computers & Education, 59(3), 1065–1078.
4. Hung, M. L., Chou, C., Chen, C. H., & Own, Z. Y. (2010). Learner readiness for online learning: Scale development and student perceptions. Computers & Education, 55(3), 1080–1090.
5. Holmes, W., Bialik, M., & Fadel, C. (2019). Artificial Intelligence in Education: Promises and Implications for Teaching and Learning. Center for Curriculum Redesign.
6. Kasneci, E., Sessler, K., Küchemann, S., et al. (2023). ChatGPT for good? On opportunities and challenges of large language models for education. Learning and Individual Differences, 103, 102274.
7. Field, A. (2013). Discovering Statistics Using IBM SPSS Statistics (4th ed.). Sage Publications.
8. Russell, S., & Norvig, P. (2021). Artificial Intelligence: A Modern Approach (4th ed.). Pearson.
9. Luckin, R., Holmes, W., Griffiths, M., & Forcier, L. (2016). Intelligence Unleashed: An Argument for AI in Education. Pearson Education.
10. OECD. (2021). OECD Digital Education Outlook 2021: Pushing the Frontiers with AI, Blockchain and Robots. OECD Publishing.
11. European Commission. (2022). Ethical Guidelines on the Use of Artificial Intelligence and Data in Teaching and Learning for Educators. Publications Office of the European Union.
12. UNESCO. (2021). AI and Education: Guidance for Policy-makers. UNESCO Publishing.
13. Brynjolfsson, E., & McAfee, A. (2017). Machine, Platform, Crowd: Harnessing Our Digital Future. W. W. Norton & Company.
14. Goodfellow, I., Bengio, Y., & Courville, A. (2016). Deep Learning. MIT Press.
15. Creswell, J. W., & Creswell, J. D. (2018). Research Design: Qualitative, Quantitative, and Mixed Methods Approaches (5th ed.). Sage Publications.