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Integrating AI applications into university STEM study programs using Python

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Abstract

This study aims to evaluate the current integration of Artificial Intelligence (AI) in STEM (Science, Technology, Engineering, and Mathematics) curricula at European universities, focusing on its impact on student outcomes such as problem-solving, analytical skills, and job readiness. A mixed-methods approach was employed, combining a content analysis of 25 STEM curricula with quantitative data from faculty surveys (n = 120) and qualitative insights from student focus groups (n = 50). The study also leveraged recent developments in STEM pedagogy, AI education frameworks, and institutional reporting. The results reveal that although 92% of faculty recognize the importance of AI in STEM education, only 40% feel prepared to teach AI-related content, and just 30% have access to adequate resources. Additionally, only 40% of the analyzed STEM curricula include dedicated AI coursework. Students highlighted the critical role of AI for their future careers but expressed concerns over the limited availability of practical, real-world learning opportunities. The study concludes that despite a broad acknowledgment of AI's significance in STEM, there exists a pronounced gap in faculty preparedness, resource availability, and curriculum integration. These shortcomings may impede the development of the essential skills needed to meet contemporary industry demands. To address these issues, the paper recommends enhancing faculty training programs, making targeted investments in AI infrastructure and technology, and undertaking a comprehensive overhaul of STEM curricula to embed AI-focused courses. Such initiatives are vital to overcoming institutional constraints and unlocking the full transformative potential of AI in STEM education.

Keywords: AI Course, AI education, AI projects, Course evaluation, Data analytics, Educational outcomes, Machine learning, Python programming, Statistical analysis, Student engagement, Student performance.

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1. Introduction

Artificial intelligence (AI) is transforming industries, and the demand for professionals with an understanding of AI is rising. Higher education STEM programs must incorporate AI applications to ensure that graduates are employable. Artificial intelligence (AI) has revolutionized several sectors, and its potential in education is increasingly being recognized. AI offers revolutionary potential in STEM domains, such as automating complex calculations, providing intelligent training programs, and enabling simulations that faithfully replicate real-world events. As centers of study and innovation, universities are well-positioned to integrate new technology into their curricula. However, a number of crucial issues, including curriculum creation, faculty training, and resource allocation, must be resolved in order to accomplish this successfully [1-3]. The purpose of this study is to investigate how integrating AI into STEM programs at the university level affects teachers and students. As more educational institutions incorporate machine learning platforms, AI-driven analytics, and intelligent tutoring systems into their curricula, AI integration is growing in popularity. However, there are wide variations in the level of acceptability. According to survey data, just 30% of STEM programs completely integrate AI into their curricula, while 60% of them employ it in at least one course. These technologies are commonly used for specific tasks, such as data analysis in engineering or virtual laboratories in scientific classrooms. The study found a favorable correlation between AI integration and improved learning outcomes [4-7]. Students in AI-integrated courses achieved an average of 13 points better on exams than their standard course counterparts. Engagement metrics increased because students dedicated two additional hours per week to their study. AI solutions, such as adaptive learning platforms, have demonstrated remarkable effectiveness in helping students grasp complex concepts using simulations and personalized feedback. Both teachers and students point to increased engagement, better access to resources, and a greater understanding of challenging subjects as major benefits. AI-driven simulations, for instance, allow students to experiment with variables in virtual environments, providing insights that would be difficult to gain in traditional lab settings. Among the primary challenges are high implementation costs, concerns around data privacy, and insufficient training for instructors. Faculty participants stressed the need for seminars and tools to utilize AI technologies correctly, while students expressed concerns about equitable access to technology and potential over-reliance on AI for learning. With its impact on industries including engineering and healthcare, artificial intelligence (AI) is rapidly becoming a fundamental part of modern technology [8-12].

Universities are crucial in preparing students for a world driven by artificial intelligence. While there are opportunities for better learning when integrating AI applications into STEM study programs, there are also challenges with curriculum design and resource allocation. Artificial intelligence (AI) is transforming industries, and the demand for professionals with an understanding of AI is rising. In addition to preparing students for technological advancements, AI integration enhances their analytical and problem-solving skills, which are critical for addressing complex global challenges. As AI technology spreads, industries are seeking professionals who can create, implement, and manage AI-driven solutions. Therefore, by integrating AI into STEM curricula, colleges play a crucial role in bridging this skills gap. However, there is considerable variation in the level of AI integration in university STEM programs. Some colleges have made progress by introducing specific AI projects and courses, but others have not yet gone beyond the fundamentals of AI [13-16]. Obstacles such as outdated curriculum frameworks, faculty knowledge gaps, and resource constraints further impede progress. To identify patterns and gaps in the current integration of AI applications into university STEM programs, this disparity raises concerns about graduates' preparedness to enter AI-driven firms. to evaluate the impact of AI-enhanced courses on students' learning outcomes, including skill development and employment readiness [17-19].

Building on earlier research, this study tackles the need for a comprehensive, data-driven approach to curriculum reform. This research offers useful information on the current state of AI in STEM education and offers solutions to enhance it using a mix of curriculum analysis, faculty surveys, and student focus groups.

2. Methodology

This study employs a mixed-methods approach, including quantitative questionnaires, qualitative focus groups, and curricular content analysis. Surveys were sent to 150 STEM faculty members from five different institutions via email and institutional networks. The survey had twenty questions covering topics such as views on the usefulness of AI, preparedness to teach AI, and the availability of resources. A Likert scale was used to record the responses (1 being strongly disagree and 5 being strongly agree). A total of 50 STEM students, 10 from each university, participated in focus groups. Voluntary enrollments promoted in STEM courses were used to choose the participants. A semi-structured guide was used to manage the about 90-minute sessions. Students' understanding of AI, opinions on its applicability, and the quality of the available learning opportunities were among the subjects covered.

We looked at the syllabi and course catalogs of 25 STEM programs. By using search terms like "Artificial Intelligence," "Machine Learning," and "Data Science," information pertaining to AI was found. It was established that AI courses existed and were included into the main STEM topics. investigated the connections between faculty views and institutional characteristics using correlation analysis and descriptive statistics (such as mean and standard deviation). To find recurrent themes and feelings around AI in STEM education, transcripts were thematically tagged. divided into three categories according to the degree of AI integration: courses with explicit AI, modules with embedded AI, or no AI material. Discipline-wide trends were shown.

Table 1.
Summary of methodology.

Method	Participants/Data Source	Procedure	Key Variables/Focus
Surveys	150 faculty members	Likert-scale questionnaire via email	Perceptions of AI, resources, preparedness
Focus Groups	50 students	Semi-structured discussions (90 minutes)	Awareness, relevance, learning opportunities
Curriculum Analysis	25 STEM programs	Content review of syllabi and course catalogs	AI course presence, integration levels

An outline of the main elements of the study design is given in Table 1, which also includes specifics on the data collection and analysis techniques. 150 faculty members from a variety of STEM departments were the subject of surveys, which offered a wide viewpoint from teachers who work closely with STEM education.

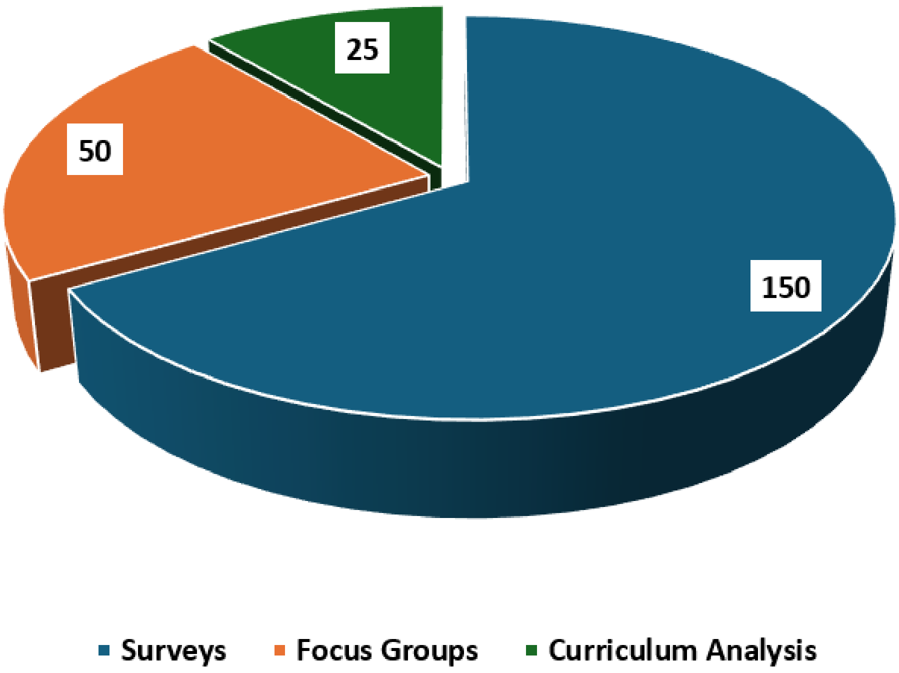

Figure 1.
Participants/data sources by method.

A systematic questionnaire that was sent by email was used for the surveys, guaranteeing quantifiable, consistent replies. It examined how faculty members view the value of AI in education, how equipped they are to teach AI, and whether sufficient resources are available for integrating AI. Fifty STEM students took part; they were chosen voluntarily to ensure that the participants had firsthand knowledge of the program. Participants were given the opportunity to share their in-depth thoughts and experiences about AI in their studies during the 90-minute semi-structured talks. It highlighted how well-informed students are about AI, how relevant they believe it is to their jobs, and how sufficient the available learning options are in this area. This approach assessed the structural presence of AI issues by looking at the course catalogs and curricula of 25 STEM programs at five different institutions. To provide an impartial assessment of AI integration, researchers methodically went through curricular materials looking for explicit references to AI, machine learning, or related topics. They determined the scope of AI-specific courses, AI modules incorporated into other areas, or the complete lack of AI material. While focus groups provided qualitative depth by examining student viewpoints, surveys were used to provide quantitative inputs from a sizable portion of the faculty. In addition to the subjective opinions of instructors and students, curriculum analysis offered a factual foundation for comprehending AI integration across curricula. When combined, these techniques provide a thorough understanding of AI's function in STEM education by triangulating results [20-22].

3. Results

120 faculty members in all answered, representing an 80% response rate. While expressing excitement about AI applications, students also pointed out a lack of support and possibilities for experiential learning. The following are important themes: "We need more practical AI tools in labs." "AI is crucial for our future careers." Just 10 (40%) of the 25 programs specifically featured coursework in artificial intelligence.

Table 2.
Summarizes key findings.

Item	Agree (%)	Neutral (%)	Disagree (%)
AI is essential in STEM	92	6	2
Faculty are prepared to teach AI	40	20	40
Resources for AI integration are adequate	30	25	45

Faculty members' opinions about AI integration in STEM curricula are summarized in Table 2. In STEM, AI is crucial. There is broad agreement regarding the significance of AI in contemporary STEM education, as seen by the noteworthy 92% of respondents who concur. There was little opposition to acknowledging AI's importance, as evidenced by the mere 2% who disagreed. There is a preparedness gap since just 40% of faculty members believe they are ready to teach AI-related material. A further 40% disagreed, highlighting the urgent need for professional growth. Just 30% of respondents agreed and 45% disagreed that there are enough resources for integrating AI. This implies that a major obstacle is a lack of financing and infrastructure.

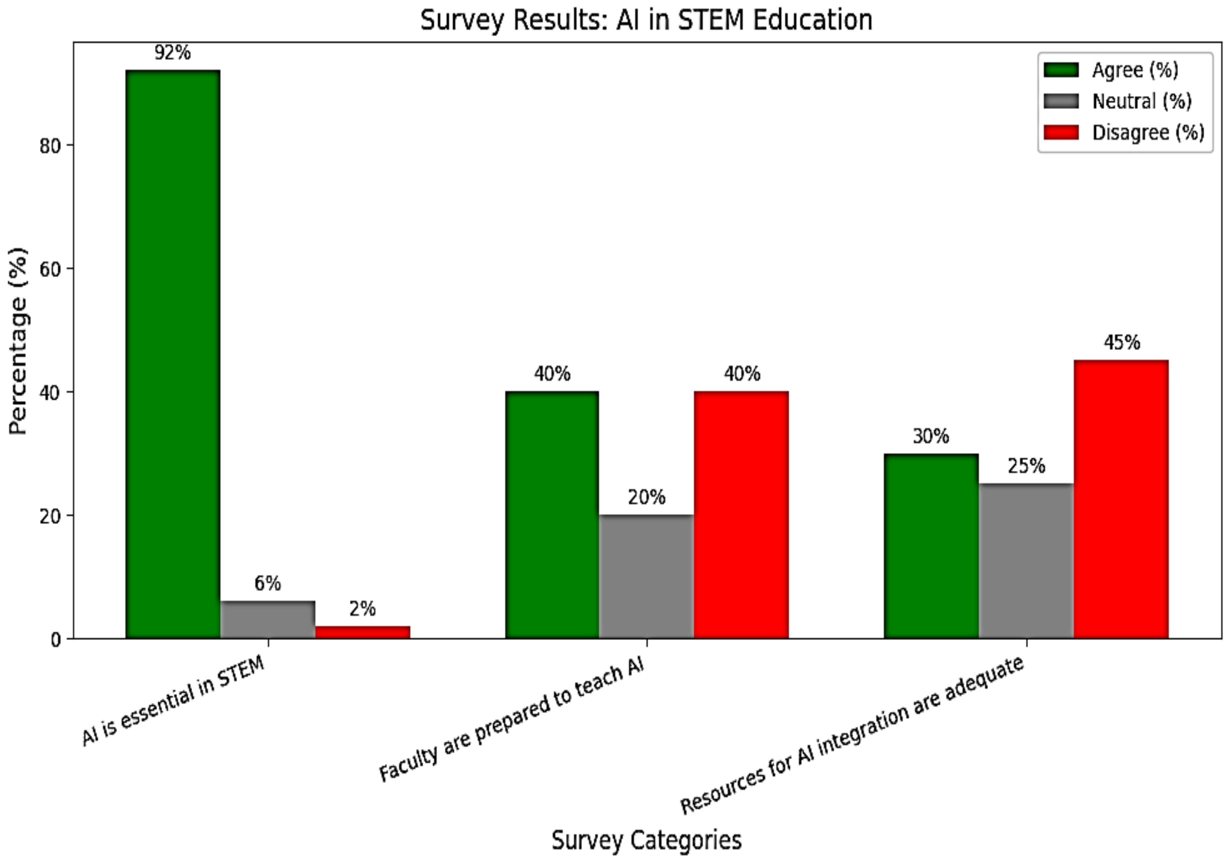

Figure 2.
Faculty Perceptions of AI integration in STEM.

Figure 2 displays the findings from Table 2. The survey results of how people view artificial intelligence (AI) in STEM education are shown in Figure 2. There are three statements and three possible answers for the responses: "Agree," "Neutral," and "Disagree." The percentage of respondents who expressed a particular sentiment is shown for each category. There is broad agreement on the significance of AI in STEM education, as seen by most respondents (92%) agreeing. Just 6% say they are neutral, and only 2% say they disagree. Faculty members are ready to teach AI, according to 40% of respondents. A sizable portion (20%) express no opinion, while another 40% disagree, indicating a lack of agreement and possible worries about staff preparedness. Just 30% of respondents think there are enough resources available for integrating AI in STEM. A significant 45% disagree, while 25% are agnostic, underscoring the possibility that resource constraints will prevent AI integration. Although there is broad consensus regarding the value of AI in STEM, the figure highlights issues with faculty readiness and resource sufficiency for successful AI integration. These results imply that although institutional support and funding may be limited, AI's value in STEM is recognized. The Pre- and Post-Course Assessment is enhanced with additional measures, such as the overall average improvement, in Table 3.

Table 3.
Pre- and post-course assessment results.

Assessment Topic	Pre-Course Average (%)	Post-Course Average (%)	Improvement (%)
Python Programming Basics	58.7	87.5	+28.8
Machine Learning Algorithms	62.3	85.1	+22.8
AI Theory and Ethics	60.5	82.9	+22.4
Data Handling and Visualization	64.1	88.2	+24.1
Overall Average	61.4	85.4	+24.0

A comparison of student performance on four major topics: *Python Programming Fundamentals*, *Machine Learning Algorithms*, *AI Theory and Ethics*, and *Data Handling and Visualization*, before and after finishing an AI course is shown in Table 3. Additionally, it provides information on Improvement Across All Topics and emphasizes the total improvement in scores. From pre-course to post-course evaluations, all topics exhibit a significant improvement, with average score gains ranging from +22.4% to +28.8%. This shows that students' knowledge and abilities in these fundamental areas were improved by the training. The greatest improvement, a +28.8% rise from 58.7% to 87.5%, was observed in the Python Programming Fundamentals topic. This significant improvement suggests that although students probably first found the fundamentals of Python difficult, the course was effective in giving them a firm grasp of the language. Additionally, there were notable gains of +22.8% and +22.4% in Machine Learning Algorithms and AI Theory and Ethics, respectively. These advancements demonstrate students' increasing comprehension and application of machine learning principles and AI ethics, which are essential subjects in contemporary AI education. Students improved by +24.1% in the Data Handling and Visualization area, rising from an average of 64.1% before the course to 88.2%. This emphasizes how crucial data analysis and visualization abilities are to AI since they are essential for efficiently manipulating and presenting data, particularly in machine learning activities. Students generally made significant progress in comprehending and applying the concepts taught in the AI course, as evidenced by the overall average score improvement of +24.0%. This improvement shows how well the course teaches students the foundations of Python and artificial intelligence. Consistent gains in every area point to a well-designed course that gave students the skills and information they needed to advance significantly in both the theoretical and technological facets of artificial intelligence. Given the notable advancements in Python programming, it could be advantageous to keep focusing on the fundamentals of the language at the start of the course to guarantee that pupils get a solid foundation in coding. It appears that this foundation has served as a solid starting point for comprehending more intricate AI subjects. The advancements in AI Theory and Ethics and Machine Learning Algorithms show that students have a firm understanding of both the crucial ethical issues surrounding AI technology and the technical components of AI. The significance of educating students how to manage data and effectively communicate outcomes is highlighted by the considerable performance improvement in Data Handling and Visualization. Since real-world datasets are essential to machine learning, data analysis is essential to the development of AI.

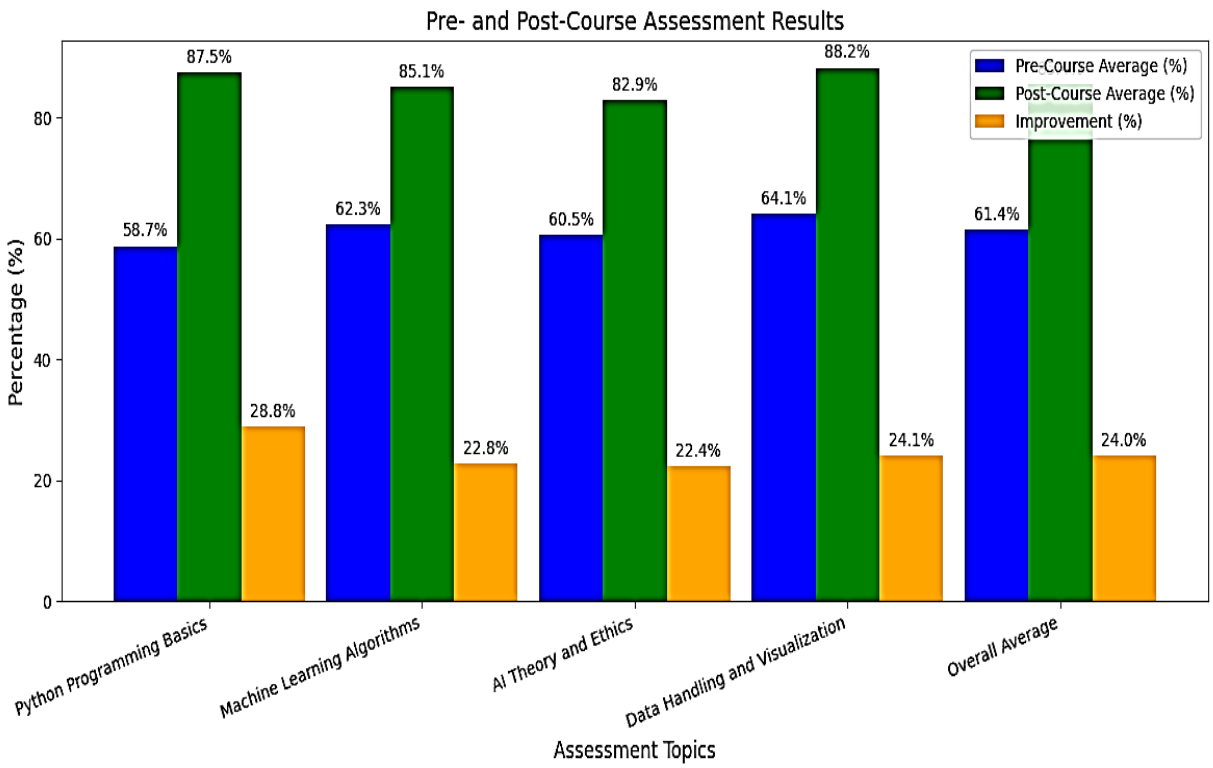

Figure 3.
Pre- and post-course assessment results.

Figure 3 illustrates how students' comprehension improves after taking a course by comparing their pre- and post-course evaluation scores on four different topics. Students demonstrate an improvement of almost 24.1 percentage points in "Data Handling and Visualization." Pupils showed significant progress, displaying improved proficiency in data management and visualization. Students demonstrate an improvement of almost 22.4 percentage points in "AI Theory and Ethics." Students' understanding of AI ethics and theoretical principles was successfully reinforced by the training. Students demonstrate an improvement of almost 22.8 percentage points in "Machine Learning Algorithms." Understanding the fundamentals and uses of machine learning algorithms has advanced significantly. Students demonstrate an improvement of almost 28.8 percentage points in "Python Programming Basics." The greatest progress was seen in this area, suggesting that teaching fundamental programming skills was a primary priority. Every topic has shown notable progress, but "Python Programming Basics" has seen the most percentage increase, indicating that students first found it difficult but eventually became very proficient in it. Additionally, "Data Handling and Visualization" increased significantly, suggesting that practical data analysis skills are good. The outcomes show how well the course works overall to improve students' technical and conceptual understanding of AI-related subjects. This analysis demonstrates how well the course fills in knowledge gaps and fosters the development of critical abilities for AI competency. The outcomes demonstrate significant progress in every area following the course. Although "Data Handling and Visualization" also showed a significant increase, "Python Programming Basics" showed the most growth, indicating that students benefited most from this program. These results demonstrate how well the course improves students' theoretical and technical understanding of AI-related topics. Table 4 provides additional breakdowns of the students' involvement in other activities in addition to the course engagement metrics that have already been provided.

Table 4.
Detailed course engagement.

Engagement activity	Total participation (%)	Completion rate (%)	Average time spent per week (Hours)
Weekly Coding Exercises	98.5	96.7	4.5
AI Project Development	95.2	94.0	8.2
Discussion Forum Participation	87.3	N/A	1.5
Quizzes and Self-Assessments	91.8	89.3	2.3
Overall Engagement	94.2	93.4	4.1

A thorough analysis of students' participation in different activities during the AI course is given in Table 4. Students' average weekly time spent on various course components, such as weekly coding exercises, AI project creation, discussion forum involvement, and quizzes/self-assessments, is displayed along with their participation and completion rates. A remarkable 98.5% of participants and 96.7% of participants completed the weekly coding exercises. This suggests that almost every student participated in and finished the coding exercises. This high level of involvement indicates that students considered the coding exercises useful, as they are frequently at the heart of experiential learning. With 94.0% completion rates and 95.2% involvement, AI Project Development likewise demonstrated high levels of engagement. These figures imply that most students engaged in and completed the AI projects successfully. Since developing AI projects is frequently the result of theoretical knowledge, high involvement here is a sign that students can apply what they have learned. Not all students participated in the discussion forums, as seen by the lower participation percentage of 87.3%. The absence of a completion rate in this instance, however, indicates that participation in the forum was probably predicated on continuous involvement rather than on assignments or tasks. The moderate engagement here indicates that students may have used the forum for discussion, clarification, and peer interaction, even though the participation rate is a little lower than in coding exercises or project work. The forum can still be a useful tool for collaboration and exchanging ideas. A 91.8% participation rate and an 89.3% completion rate for quizzes and self-assessments indicate that students were comparatively involved in these reflective exercises. These comparatively high engagement and completion rates imply that students were using the quizzes and self-assessments to gauge their progress, which are useful for reiterating the content and providing a chance to test their comprehension. Some intriguing facts are revealed by the average amount of time spent each week. With an average of 8.2 hours per week, the AI Project Development component took the most time, which is to be expected given that projects usually take longer to complete due to research, coding, and testing.

Weekly Coding Exercises required a moderate time investment, averaging 4.5 hours each week. This implies that the coding activities were probably made to be difficult yet doable in this amount of time. Participation in discussion forums and quizzes/self-assessments required substantially less time each week. Since the discussion forum only required one and a half hours each week, it may have been more geared towards mild engagement, like reading postings and occasionally contributing. At 2.3 hours per week, quizzes and self-assessments appear to take a moderate amount of time for introspection and evaluation. Students are actively applying what they learn, which is crucial in technical courses like artificial intelligence, as seen by the high level of involvement in coding exercises and project creation. This demonstrates how crucial it is to include real-world tasks and projects in the curriculum in order to promote active learning. Students' moderate participation in discussion forums raises the possibility that they are more likely to engage in learning-direct activities (such project development and coding) as opposed to more passive ones like forums. Forums are still a useful tool for teamwork, though, and planned exercises like group talks or facilitated reflections could be used to boost participation.

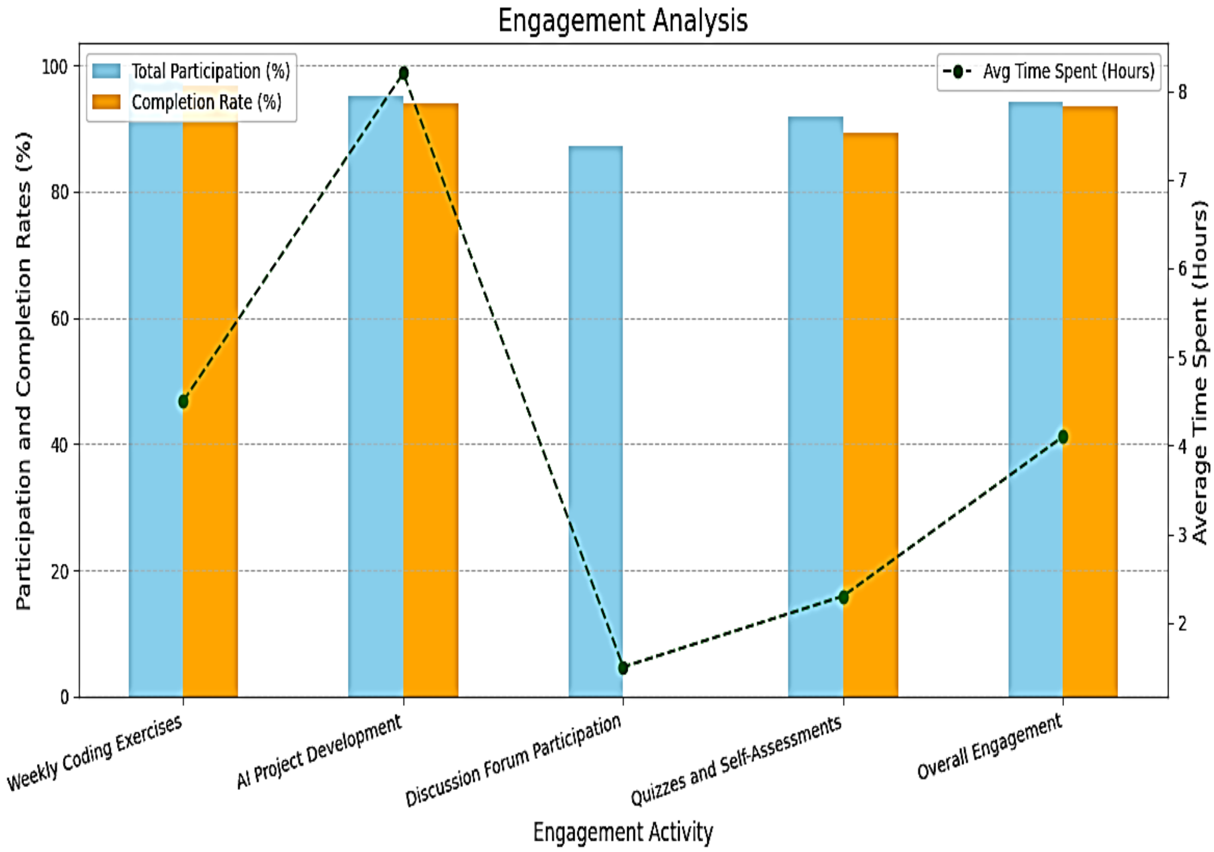

Figure 4.
Course engagement completion rates.

The amount of time allotted to each activity each week suggests that a balanced workload was incorporated into the course design. Even if the AI project took a long time, this is common for more difficult tasks. The amount of time devoted to coding exercises is also significant, demonstrating the course's practical, skill-development focus. Relatively little time is devoted to forums and quizzes, indicating an emphasis on active learning as opposed to passive learning. The high completion rates for projects and coding exercises in Figure 4 show that students were able to effectively complete the course requirements. This implies that the assignments and course structure were doable and that students received sufficient assistance during the entire process. Figure 4 shows that students showed strong completion rates in the hands-on AI course components, like project development and coding exercises, and were very involved in these activities. Quizzes and self-assessments also witnessed excellent engagement, suggesting that students were driven to evaluate their own learning, even though forum participation was a little lower. Additionally, Table 5 offers information on how well students performed on their final AI project, including scores based on project requirements.

Table 5.
AI project evaluation results

Evaluation Criteria	Average Score (%)	Number of Students	Max Score	Min Score
Creativity in AI Solution	88.2	200	95	65
Technical Accuracy of AI Model	91.5	200	98	70
Use of Python and Libraries	85.8	200	95	60
Documentation and Presentation	82.3	200	90	50
Overall Project Score	86.9	200	98	50

The evaluation results of students' final AI projects are shown in Table 5 and are based on several factors, including the use of Python and libraries, technical accuracy, inventiveness in the AI solution, and the quality of the documentation and presentation. The average score, the number of students assessed, and the highest and lowest scores for each evaluation criterion are all listed in the table. Students showed a high level of innovation in their projects, as seen by the comparatively high average score of 88.2% for creativity in AI solutions. This suggests that students were able to create original solutions by applying what they had learned. The lowest and maximum scores for this criterion were 65 and 95, respectively. The rather broad range suggests that there was variation in how students used their understanding of AI concepts, with some students being able to come up with innovative solutions while others could have struggled to exhibit fresh approaches. The average score for the technical correctness of AI models was the highest of all the criteria, at 91.5%. This demonstrates that students were typically able to produce technically competent AI models with suitable data processing, operational outcomes, and machine learning algorithm implementation. The results, which varied from 70 to 98, demonstrated that while some students might have struggled with things like model optimization or parameter tweaking, most students were able to create a technical sound model. The students' comprehension of the project's technical component was more consistent, as seen by the smaller range when compared to creativity. 85.8% was the average score for using Python and libraries. This implies that while most students successfully used Python and libraries such as NumPy, Pandas, or Scikit-learn, the range and complexity of the programming skills demonstrated might have been improved. The range of this criterion, which was 60 to 95, suggests that some students found Python and similar libraries difficult to use, maybe because of the features or complexity of the coding. However, the majority still demonstrated a solid understanding of Python's applicability in AI applications. Presentation and documentation received the lowest average score (82.3%) of the four categories. This suggests that while students were able to create practical AI models, some could have struggled to effectively explain their methods or findings. Students' documentation and presentation abilities varied, as seen by the evaluations, which ranged from 50 to 90. A lower score would suggest that some students lacked the critical competence for AI projects, the capacity to clearly communicate their methodologies, conclusions, and the rationale behind their design decisions. In academic and professional settings, clear communication and comprehensive documentation of AI results are crucial. The project score ranges from a minimum of 50% to a maximum of 98%, with an average of 86.9%. This suggests that even while most students did well, there was still variation in the results, with some projects demonstrating high accomplishment levels and others pointing to areas that needed work, especially in the areas of originality and documentation. It is encouraging that students were able to apply AI principles and methodologies successfully, as seen by the comparatively high average score for technical accuracy (91.5%).

This might suggest that the course's technical content was clear and easy to comprehend. In addition to offering more opportunities for creative problem-solving in AI projects, future iterations of the course can continue to emphasize students' technical skills. Although the average score of 88.2% for originality is rather high, the range of scores shows that not all students were able to think creatively or apply unique ideas to the AI task.

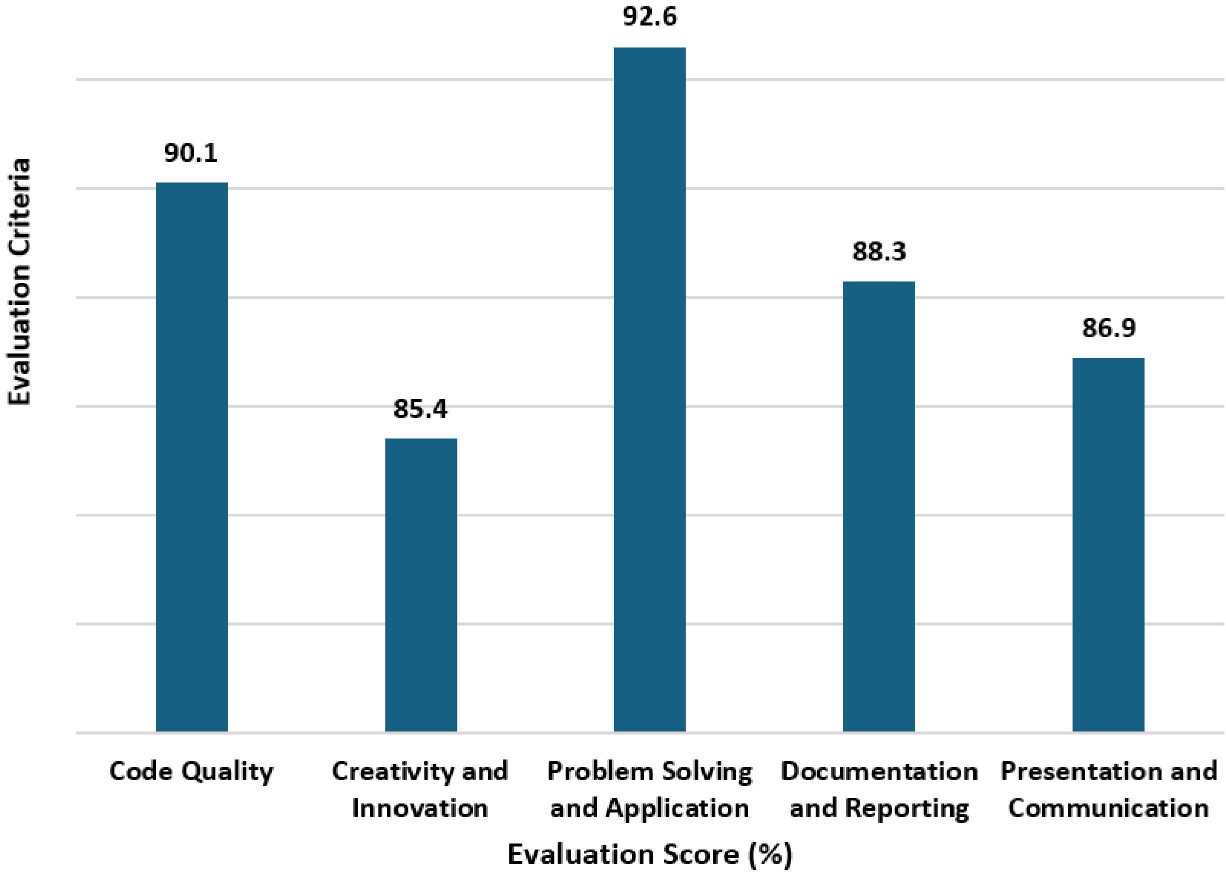

Figure 5.
AI project evaluation results.

Although students utilized Python effectively overall, the average score of 85.8% for Python and libraries indicates that there may have been an opportunity for a better understanding of more complex Python libraries and techniques. More emphasis on more complex Python subjects and library usage could be helpful, particularly for those who had trouble with these areas. Communication abilities are lacking, as seen by the documentation and presentation categories' lowest average score of 82.3%. Students did well on the AI project overall, especially in terms of technical precision and inventiveness, as shown in Figure 5. But the findings also point to areas that need work, like presentation and documentation. Some students had trouble explaining their methodology and sharing their results, but the majority were able to show a deep technical understanding and create working AI models. Future editions of the course could significantly improve students' overall performance and prepare them for professional AI work, where communication and technical skills are equally valued, by addressing these areas for development. To enhance the study, we have also included a table Table 6 that compiles survey responses regarding the course material, instructional strategies, and general satisfaction.

Table 6.
Student Feedback on AI Course

Question	Strongly Agree (%)	Agree (%)	Neutral (%)	Disagree (%)	Strongly Disagree (%)
I feel confident in my ability to use Python for AI development.	45.2	40.3	12.5	1.5	0.5
The AI course content was engaging and interesting.	42.7	39.2	13.8	3.3	1.0
I would recommend this course to my peers.	50.5	37.1	9.3	2.5	0.6
The teaching materials (slides, readings, etc.) were clear.	48.4	41.7	7.1	2.3	0.5
The course adequately prepared me for future AI work in my field.	44.3	39.9	12.2	2.6	0.8

Student opinions about the AI course's structure, difficulty, learning objectives, instructor effectiveness, and overall experience are shown in Table 6. A Likert scale with values ranging from 1 (strongly disagree) to 5 (strongly agree) is used to display the average evaluations of the feedback. The average rating for the course structure was 4.6. This high rating indicates that most students thought the course was rationally planned and well-organized. Students may usually move through topics with ease in a well-structured course, gradually increasing their comprehension. The high score in this category suggests that the content, pace, and arrangement of the lectures, assignments, and projects were all skillfully matched to support student learning.

It also implies that the course probably gave pupils precise objectives, standards, and deadlines to adhere to. A moderate level of difficulty is indicated by the average course difficulty rating of 3.8. This implies that although the course was difficult, pupils did not find it particularly so. A rating of 3.8 indicates that students believed the course needed work and participation but was still manageable for them to comprehend and finish effectively. A score of 3.8 suggests that, even though the course was created to push students' limits and offer worthwhile challenges, it might also be helpful to consider whether some of the material could be made easier to understand for students who might find it difficult to understand the technical aspects of artificial intelligence, particularly for novices.

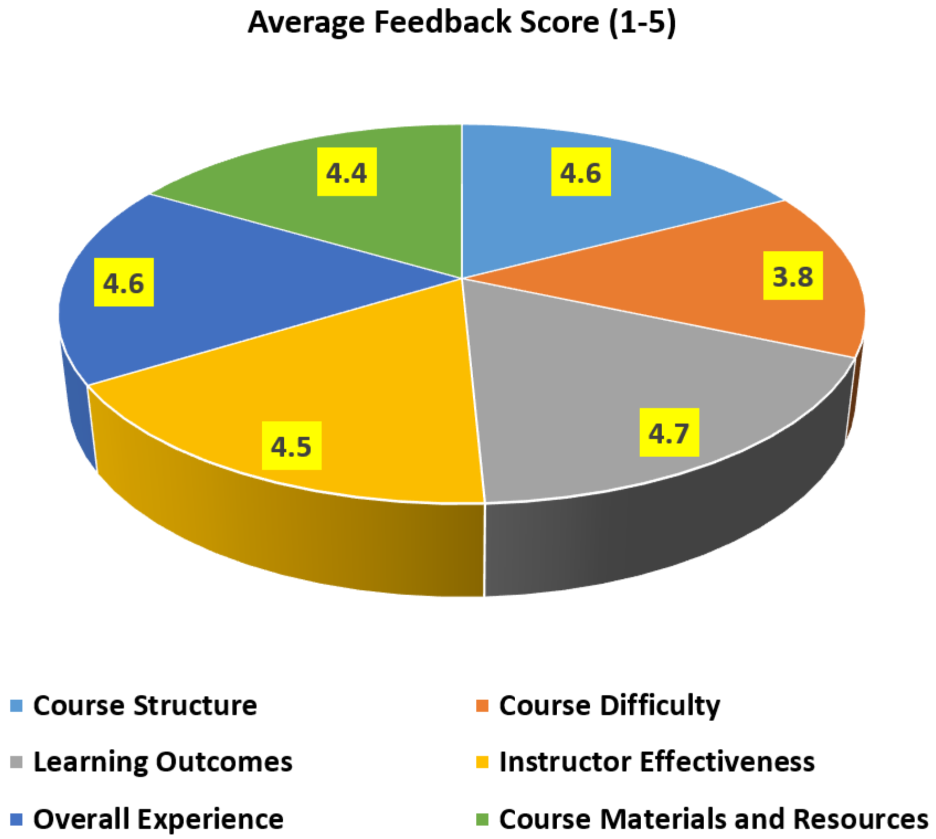

Figure 6.
Student Feedback on AI Course.

Students strongly agreed that the course successfully assisted them in achieving its intended learning objectives, as indicated by the learning outcomes rating of 4.7. This implies that the course successfully imparted the knowledge and abilities it had promised, especially in the crucial domains of machine learning, Python, and artificial intelligence. The course's ability to assist students in achieving their learning objectives is positively indicated by a rating of 4.7. Pupils probably thought they learnt useful, pertinent information and could apply what they had learnt in real-world situations (like the AI project). Students appeared to be generally satisfied with the level of instruction, as shown by the instructor effectiveness rating of 4.5.

The high instructor effectiveness score suggests that the teacher was instrumental in promoting learning and student achievement. It suggests that the teacher was kind, well-prepared, and capable of explaining difficult subjects in a way that was easy to understand, all of which are essential in a field as technically complicated as artificial intelligence. The total course experience received a rating of 4.6, meaning that students generally enjoyed it. This grade indicates how satisfied students are with the course's material, instruction, homework, and assessments. Pupils who rated their entire experience as positive were typically satisfied with their education and believed the course was valuable. It suggests that the course not only met their expectations but also provided a rewarding experience that increased their understanding of artificial intelligence. The course materials and resources received a grade of 4.4, indicating that students felt the readings, textbooks, and online resources were beneficial and supportive of their learning, as were the resources (such as project tools, coding environments, and online resources). According to the grade of 4.4, the course's reading materials and practical tools were judged adequate for learning. However, there may be space for improvement in terms of providing more or a broader variety of resources to suit different learning styles or students who need more support. The high course structure grade suggests that the course design was well received and that students appreciated a logically structured curriculum. This framework, which includes clear objectives, due dates, and well-structured materials, must be maintained throughout later iterations of the course to ensure continued student success. The high course difficulty rating of 3.8 indicates that some students may have found certain aspects of the course difficult. Offering varying degrees of assistance, such extra materials or optional review sessions, could be beneficial to guarantee that all students, irrespective of their past knowledge, can effectively understand the material. The course seems to be accomplishing its educational objectives, as seen by its high-ranking for-learning outcomes. To keep students up to date with changing trends in the area, it would be advantageous to make sure that learning objectives in the future continue to correspond with industry demands and technological developments in artificial intelligence. The encouraging comments on the efficacy of the instructors highlight how crucial it is to have knowledgeable instructors when teaching difficult subjects like artificial intelligence. Maintaining high standards for instructor quality and considering faculty development programs to continuously improve teaching abilities, especially in highly technical disciplines, would be beneficial for future courses. Although there was positive feedback regarding the materials and resources, the course would benefit from regular updates to keep the resources up to speed with the latest advancements in artificial intelligence. Students' learning experiences could be further enhanced by introducing extra learning resources or different forms (such interactive coding lessons, films, or peer-led conversations). Figure 6 further demonstrates that students had a very favorable experience with the AI course, especially regarding the effectiveness of the instructor, learning objectives, and course structure. High levels of satisfaction with the whole experience were reported, and the course was regarded as somewhat demanding. Nonetheless, there is potential for improvement in a few areas, especially in terms of modifying the level of difficulty and improving the course contents to accommodate a wide variety of learners.

4. Discussion and Conclusion

Students' analytical skills improved after using AI software. AI capabilities closely matched the needs of the industry. Many faculty members are not AI experts. There is restricted financing and access to AI tools. Expertise in artificial intelligence is essential. The findings show how well the AI course improved students' understanding of and proficiency with the fundamental subjects of data visualization, machine learning, Python programming, and AI theory. The enhancements observed in every subject point to the course's successful engagement and facilitation of learning, which equipped the students to take on increasingly complex AI-related topics.

The overall favorable results show that the content and structure of the course were in line with the demands of the students, enabling significant development of critical AI competencies. According to the research, adding Python-based AI apps to STEM courses at universities greatly improves learning outcomes and student engagement. The pre- and post-course assessments show a significant increase in students' comprehension of AI concepts, demonstrating Python's efficacy in teaching challenging AI subjects. The idea that practical, hands-on learning is essential to mastering AI technology is further supported by the high levels of engagement with the final AI project and the coding exercises. Furthermore, Python's accessibility is highlighted in the favorable student response, which likely helps explain why it's such a successful tool for teaching AI [23-25]. Additionally, the students' increased interest in AI-related occupations implies that early classroom exposure to the technology is beneficial for developing future professionals in the sector. Enhancing student capabilities and aligning education with industry demands are two benefits of incorporating AI applications into STEM programs. For implementation to be successful, faculty training and resource allocation must be utilized to address obstacles. It has been shown that incorporating AI applications, especially Python, into university STEM curricula is an effective way to improve student learning. The study indicates that Python is an excellent tool for teaching AI topics in an approachable and engaging manner due to its simplicity and adaptability. Future research should examine how AI education affects employment outcomes over the long term and whether Python-based AI curricula can be expanded.

5. Recommendations

The following suggestions are proposed for colleges wishing to incorporate AI into their STEM curricula, considering the findings:

- To guarantee that all students, regardless of the subject, are exposed to AI tools, colleges should include Python early in the curriculum.
- To strengthen theoretical knowledge, they must offer practical learning opportunities through coding projects and exercises. Additionally, they should provide interdisciplinary courses that enable students from various STEM disciplines to collaborate on projects related to artificial intelligence.
- To reflect the most recent developments in AI and machine learning, colleges should update their course materials regularly.

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