**Title**: Identifying At-Risk Online Students: A Personalized Model for Predicting Course Failure and Dropout in Online Higher Education.

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# Abstract

The popularity of online learning in higher education has increased significantly, but the high rate of dropout and course failure remains a major concern. Despite the considerable amount of research on student retention and risk prediction, the dropout rate remains high in educational institutions. This research aims to address this issue by developing a personalized model for predicting course failure and dropout in online education. By leveraging log data generated by Learning Management Systems (LMSs), this research aims to develop robust features and tools that can help identify students facing challenges in a course. A literature review examines existing studies on risk factors and personalized risk models in learning management systems, highlighting the importance of factors such as low engagement, poor time management, and demographic variables in predicting student attrition. The methodology involves gathering general risk factors, analyzing the Moodle LMS database, identifying personal student behaviors, applying statistical analysis and machine learning techniques, and consulting experts. Statistical analysis techniques will be employed to identify potential risk factors, which will be used to create a generalized at-risk model. Furthermore, machine learning approaches will be utilized to train a personalized individual risk model. The research will culminate in the development of a user-friendly Moodle plugin that integrates the personalized risk model, assisting educators in identifying at-risk students and providing timely support to mitigate dropout rates. This research will significantly contribute to the state-of-the-art personalized prediction methods in education, offering a more personalized approach that fosters a supportive environment for students' success. The success of students in completing their programs has both individual and societal benefits, including financial advantages for students and a better-trained workforce for the economy.

# Introduction

In the field of education, identifying and supporting at-risk students is of paramount importance. Early detection of students who are at risk of academic underachievement or dropping out can enable timely interventions and personalized support, leading to improved educational outcomes. With the increasing availability of data and advancements in machine learning and artificial intelligence (AI) techniques, there is a growing opportunity to develop effective risk prediction models that can assist educators in identifying at-risk students and implementing targeted interventions.

This research proposal aims to address the challenges associated with student risk prediction and identification by leveraging data analytics, machine learning, and AI algorithms. The primary objective is to develop accurate and reliable models that can predict student risk factors based on various indicators such as academic performance, engagement, behavior, and socio-demographic characteristics. By identifying these risk factors, educators can intervene early and provide appropriate support to mitigate potential negative outcomes.

The proposed research will build upon existing literature on student risk prediction and identification methods, particularly focusing on the use of AI and personalization techniques. A comprehensive literature review will be conducted to identify effective risk factors associated with student outcomes and explore the diverse range of machine learning and AI algorithms used in this domain. This review will provide a foundation for refining the research questions and objectives, allowing for the development of robust risk prediction models.

Furthermore, this research aims to compare different machine learning and AI algorithms to determine their effectiveness in predicting student risk. By analyzing the strengths and limitations of these algorithms, educators and researchers can make informed decisions about selecting the most suitable approaches for their specific contexts. Additionally, the research will contribute to the development of ethical guidelines and best practices for data usage, ensuring the protection of student privacy and the responsible handling of sensitive information.

The anticipated outcomes of this research include the development of accurate risk prediction models, the identification of effective risk factors, the comparison of machine learning and AI algorithms, the creation of generalized and personalized risk prediction models, the evaluation of a Moodle plugin for identifying at-risk students, and the dissemination of research findings through publications and conferences. These outcomes will provide valuable insights and practical implications for educators, policymakers, and researchers, ultimately leading to improved educational practices and better support for at-risk students.

Overall, this research proposal seeks to contribute to the field of student risk prediction and identification by leveraging data analytics and advanced algorithms. By addressing the research gaps and developing innovative approaches, this study aims to enhance our understanding of student risk factors and provide valuable tools for educators to intervene proactively and improve educational outcomes for at-risk students.

# Research Goal

The primary goal of this research is to provide educators with an effective learning analytics approach that can identify students at risk on an individual level. By leveraging AI techniques and personalization, the research aims to develop an algorithm that calculates personalized risk models based on general at-risk factors and personal student behaviors. Additionally, the research aims to integrate this algorithm into an open-source, user-friendly Moodle plugin to facilitate widespread accessibility in online courses.

# Research Questions

To achieve the research goal, the following research questions will be addressed:

1. What are the effective risk factors in creating general at-risk models to predict students who will drop out or fail a course?
2. How can an effective algorithm be developed based on personalization approaches and AI techniques that calculates individual personalized risk models using general at-risk factors and personal student behaviors?
3. How can the algorithm be integrated into an open-source, user-friendly Moodle plugin to allow for widespread accessibility of the algorithm in online courses?

# Literature Review

Will be added

# Timeline

## COMP 676 (Thesis II - Proposal Writing)

Weeks 1-7:

* Conduct an extensive review of existing literature on student risk prediction and identification methods in education, with a specific focus on the use of AI and personalization techniques. Analyze and synthesize the findings to identify gaps and research opportunities.

Weeks 5-8:

* Refine the research questions and objectives based on the literature review to ensure clarity, focus, and alignment with the research domain. Additionally, conduct a comprehensive literature review to identify effective risk factors and explore the utilization of machine learning and AI algorithms and models in the field. Compare and contrast these factors, algorithms, and models to gain insights into their performance and characteristics, considering aspects such as accuracy, interpretability, and scalability.

Weeks 9-12:

* Develop an outline of the methodology to be used in the research, taking into account the identified risk factors and the selected machine learning and AI techniques. Plan the evaluation process, including the selection of appropriate evaluation metrics and data collection methods. Write an ethics application to obtain approval for accessing and using existing data in compliance with ethical guidelines and regulations.

Weeks 13-16:

* Draft the proposal, which will consist of approximately 30 pages and include sections such as an introduction, literature review, research questions, objectives, methodology, and ethical considerations. Provide a clear rationale for the research, highlighting its significance and potential contributions to the field. Ensure that the methodology section provides a detailed explanation of the data collection process, data preprocessing techniques, feature engineering methods, statistical analysis approaches, and machine learning model development strategies.

Weeks 17-20:

* Revise and refine the proposal based on feedback from the supervisor and other relevant stakeholders. Pay particular attention to improving the clarity of the research questions, the coherence of the literature review, and the soundness of the proposed methodology. In addition, prepare a literature review paper that synthesizes the findings from the review and submit it to a reputable academic research conference for consideration and dissemination.

Weeks 21-24:

* Schedule and conduct an oral defense of the proposal, presenting the research plan, methodologies, and expected contributions to the supervisor and supervisory committee. Defend the proposed approach, addressing any questions or concerns raised during the defense and incorporating constructive feedback into the final version of the proposal.

## COMP 677 (Thesis II - Research Stage 1)

Weeks 1-12:

* Access the existing log data from the Learning Management System (LMS) to obtain relevant information about student behaviors and performance. Perform exploratory data analysis and statistical analysis to identify potential risk factors that may contribute to course failure and dropout. Utilize machine learning and AI techniques, such as classification algorithms and predictive modeling, to develop a generalized at-risk model that can effectively predict the likelihood of students being at risk.

Weeks 13-16:

* Utilize the identified high-contributing risk factors from the statistical analysis and literature review to refine and enhance the generalized at-risk model. Evaluate different machine learning approaches, such as ensemble methods, deep learning, or support vector machines, to identify the most effective algorithms for the given dataset and research objectives. Ensure that the model is robust, accurate, and interpretable by performing rigorous evaluations using appropriate performance metrics.

Weeks 17-20:

* Write a research paper that presents the proposed generalized at-risk model, highlighting its design, implementation details, and evaluation results. Incorporate feedback received from the supervisor to improve the clarity and rigor of the paper. Pay attention to the structure of the paper, ensuring that it adheres to the guidelines and conventions of academic writing in the field.

Weeks 21-24:

* Review and refine the paper based on feedback from the supervisor and other experts in the field. Address any comments raised, clarify any ambiguous sections, and strengthen the paper's overall coherence and logical flow. Ensure that the paper includes a comprehensive discussion of the model's performance, limitations, and potential implications for practical applications. Once the revisions are completed, submit the finalized research paper to a reputable academic research conference for peer review and potential publication.

## COMP 678 (Thesis III - Research Stage 2)

Weeks 1-12:

* Apply for ethics approval to ensure the research is conducted ethically and in compliance with relevant regulations. Develop and implement the personalized individual risk model based on the proposed algorithm. This involves designing and incorporating personalization techniques that take into account individual student behaviors, characteristics, and contextual factors. Utilize machine learning techniques, such as ensemble models or deep neural networks, to develop a predictive model that provides tailored risk predictions for each student.

Weeks 13-16:

* Evaluate the effectiveness of the personalized individual risk model using unseen samples from the dataset. Calculate precision, recall, F-measure, and other relevant evaluation metrics to assess the model's performance. Conduct comparative analysis between the generalized at-risk model and the personalized individual risk model to determine their respective strengths and limitations. Refine the model based on the evaluation results and feedback from the supervisor and supervisory committee.

Weeks 17-20:

* Review and incorporate feedback from the supervisor and supervisory committee on the personalized individual risk model. Pay particular attention to enhancing the model's interpretability, scalability, and generalizability. Ensure that the model accounts for potential biases and maintains fairness in its predictions. Consider alternative approaches or adjustments to improve the model's accuracy and predictive capabilities.

Weeks 21-24:

* Complete the drafted research paper detailing the personalized individual risk model. Provide a comprehensive description of the model's design, implementation, and evaluation results. Address any remaining comments or suggestions from the supervisor and other experts in the field. Ensure the paper adheres to the formatting and citation guidelines of a target journal or conference. Submit the finalized research paper for review and potential publication to disseminate the findings to the academic community.
* COMP 679 (Thesis IV - Research Stage 3)

Weeks 1-12:

* Apply for ethics approval, ensuring that the development and implementation of the user-friendly Moodle plugin integrating the personalized individual risk model comply with ethical guidelines. Focus on developing a plugin that seamlessly integrates with the existing Moodle LMS infrastructure, providing instructors and students with easy access to personalized risk predictions. Implement user-friendly interfaces and visualizations to effectively communicate the predictions and support decision-making.

Weeks 13-16:

* Review and incorporate feedback from the supervisor and supervisory committee on the Moodle plugin and the associated research paper. Ensure that the plugin is intuitive, robust, and aligned with user requirements. Conduct thorough testing to identify and address any usability issues or technical challenges that may arise during plugin integration.

Weeks 17-20:

* Integrate the finalized version of the personalized individual risk model into the existing course structure within the Moodle LMS. Conduct training sessions for end-users, including teachers, to ensure they are equipped with the necessary knowledge and skills to effectively utilize the Moodle plugin. Gather feedback through questionnaires or interviews from teachers and students to evaluate the plugin's usefulness, ease of use, and impact on supporting student success and retention.

Weeks 21-24:

* Analyze the collected feedback quantitatively and qualitatively to assess the plugin's performance and identify potential areas for improvement. Incorporate the feedback into the final version of the research paper, highlighting the plugin's usability, effectiveness, and potential for wider implementation in educational settings. Submit the paper to a reputable journal for publication, aiming to contribute to the academic discourse on personalized learning and student support.

## COMP 680 (Thesis V - Thesis Writing and Defense)

Weeks 1-16:

* Dedicate this period to writing up the manuscript of the thesis, which consolidates all the previous work conducted throughout the research stages. Start by organizing the thesis into logical chapters, including an introduction, literature review, methodology, results, discussion, and conclusion. Ensure that each chapter provides a clear and coherent narrative, linking the research questions, objectives, and findings. Elaborate on the theoretical foundations, research methodologies, data analysis techniques, and models employed in the study. Present the results obtained from the evaluation of the generalized at-risk model and the personalized individual risk model, along with their respective performance metrics.

Weeks 17-24:

* Revise and refine the manuscript in collaboration with the supervisor and supervisory committee. Incorporate their feedback to improve the structure, clarity, and overall quality of the thesis. Pay close attention to the coherence of the arguments, the logical flow of ideas, and the adherence to academic writing conventions. Strengthen the discussion section by critically analyzing the results, interpreting their implications, and relating them to the existing literature. Fine-tune the conclusion to summarize the key findings, discuss their significance, and propose avenues for future research.

Weeks 25-32:

* Schedule and conduct an oral defense of the thesis, which involves presenting the research, methodology, findings, and conclusions to the supervisor, supervisory committee, and external examiners. Prepare a compelling presentation that highlights the research contributions, addresses potential questions and critiques, and showcases the depth of knowledge acquired throughout the research process. Respond to the panel's feedback and engage in a scholarly discussion to defend the thesis's validity and significance. Make any necessary revisions based on the defense discussions.

Upon successfully defending the thesis, finalize the manuscript, ensuring that it reflects the revisions and feedback received during the defense. Submit the completed thesis to the academic institution's library and archives, making it accessible to the broader academic community for reference and future research. Celebrate the successful completion of the thesis, recognizing the hard work, dedication, and contributions made throughout the research journey

# Methodology:

The methodology section outlines the systematic approach used to conduct the research and develop a personalized model for predicting course failure and dropout in online higher education. It encompasses the following steps:

## Step 1) Review of Existing Literature (Weeks 1-7):

Conduct an extensive review of existing literature on student risk prediction and identification methods in education, with a particular focus on the use of AI and personalization techniques. This review will provide a comprehensive understanding of the current state of the field, identify gaps and limitations in existing approaches, and serve as the foundation for the research.

## Step 2) Refining Research Questions and Objectives (Weeks 5-8):

Refine the research questions and objectives to ensure clarity and focus. This step involves revisiting the initial research questions, aligning them with the identified gaps in the literature, and establishing clear objectives that address the research aims. Additionally, perform a comprehensive literature review to identify effective risk factors and explore the utilization of machine learning and AI algorithms and models in the field. Compare and contrast these factors, algorithms, and models to conduct a thorough analysis of their respective performance and characteristics.

## Step 3) Ethical Considerations:

Throughout the research process, adhere to ethical considerations to ensure the privacy and confidentiality of student data. Apply data anonymization techniques to protect individual identities and comply with relevant data protection and privacy regulations. Obtain necessary ethical approvals for the usage of existing data and ensure that all data handling procedures follow ethical guidelines.

## Step 4) Data Collection and Preprocessing:

Access the log data from the Learning Management System (LMS) to gather relevant information about student behavior, demographics, grades, and assessment submissions. Ensure that the collected data is diverse and sufficient for analysis and model development. Preprocess the collected data by cleaning it, handling missing values, transforming variables if necessary, and ensuring data consistency. Apply preprocessing techniques such as normalization, feature scaling, and one-hot encoding as required.

The implementation steps

* 1. Access the log data from the Learning Management System (LMS) to gather relevant information.
  2. Preprocess the collected data to ensure data quality and consistency.
  3. Apply techniques such as data cleaning, handling missing values, and data transformation to prepare the data for analysis.

## Step 5) Feature Engineering:

Select, create, or transform features (input variables) in the dataset to improve the performance of the predictive model. Use domain knowledge and insights from the literature review to guide the selection and creation of features. Relevant features may include student engagement metrics, time management indicators, demographic variables, and academic performance indicators. Carefully consider the relevance and predictive power of each feature to enhance the model's accuracy.

## Step 6) Statistical Analysis:

Perform statistical analysis on the collected data to explore the relationship between the selected features and the target variable (course failure or dropout). Utilize descriptive statistics, correlation analysis, and hypothesis testing to identify significant predictors and gain insights into their impact on student performance and attrition. This analysis will provide a deeper understanding of the underlying patterns and factors contributing to course failure and dropout.

The implementation steps

* 1. Perform statistical analysis on the collected data to identify potential risk factors for at-risk students. Apply descriptive statistics, correlation analysis, and hypothesis testing to explore the relationship between variables.
  2. Conduct an in-depth literature review to identify effective risk factors from existing studies. Synthesize the findings from the literature and compare them with the results of the statistical analysis.

## Step 7) Machine Learning Model Development:

Employ various machine learning techniques and algorithms to develop a predictive model for identifying at-risk students. Utilize the selected features and the target variable to train and evaluate different models, including but not limited to Long Short-Term Memory (LSTM) deep learning, Convolutional Neural Network (CNN), Decision Trees, Random Forest, XGBoost, and LightGBM. Train the models on a subset of the data and evaluate their performance using appropriate evaluation metrics such as accuracy, precision, recall, and area under the curve (AUC).

The implementation steps

Part | Development of Generalized At-Risk Model:

* 1. Utilize machine learning approaches and algorithms to develop a generalized at-risk model. Train the model using the identified risk factors and other relevant features from the data.
  2. Incorporate the high-contributing risk factors identified from the statistical analysis to enhance the model's accuracy and predictive capabilities.

Part || Development of Personalized Individual Risk Model:

* 1. Design and implement an algorithm that combines the generalized at-risk factors with personal student behaviors. Develop a personalized individual risk model that provides tailored predictions for each student based on their unique characteristics.
  2. Utilize techniques such as feature engineering and algorithm customization to optimize the model's performance in capturing individual student risks.

## Step 8) Model Evaluation and Selection:

Evaluate the performance of the developed machine learning models using cross-validation techniques to assess their generalization capabilities. Compare the models based on their predictive accuracy, robustness, and interpretability. Select the most effective and reliable model(s) for further analysis and integration into the personalized prediction system.

The implementation steps

* 1. Assess the effectiveness of both the generalized at-risk model and the personalized individual risk model. Utilize unseen samples from the dataset to evaluate the models' performance.
  2. Calculate evaluation metrics such as precision, recall, F-measure, and accuracy to measure the models' predictive performance.
  3. Conduct a comparative analysis to determine the strengths and limitations of each model and identify areas for improvement.

## Step 9) Integration and Deployment:

Integrate the selected model(s) into an open-source Moodle plugin to facilitate widespread accessibility. Develop the necessary software components and APIs to seamlessly integrate the predictive model into the existing Moodle LMS infrastructure. Implement user-friendly interfaces and visualizations to present the prediction results to instructors and students.

The implementation steps

* 1. Develop a user-friendly Moodle plugin that integrates the personalized individual risk model. Ensure seamless integration of the plugin within the existing course structure to assist in identifying at-risk students.
  2. Implement user interfaces and visualizations to present the risk predictions to teachers and students effectively.

## Step 10) Model Validation:

Validate the developed personalized prediction model(s) using real-world data. Test the integrated system with a diverse set of student data to evaluate its performance in accurately identifying at-risk students and predicting their likelihood of course failure or dropout. Validate the model's predictions by comparing them with ground truth data to measure the accuracy, precision, recall, and other relevant metrics. This step ensures that the developed model(s) are reliable and effective in practical scenarios.

The implementation steps

* 1. Conduct training sessions for end users, including teachers, on effectively utilizing the Moodle plugin. Provide guidance on interpreting the risk predictions and taking appropriate actions.
  2. Gather feedback through personal questionnaires from teachers and students to evaluate the usefulness and ease of use of the plugin.
  3. Analyze the collected feedback quantitatively and qualitatively to assess the plugin's performance, usability, and identify potential areas for improvement.

## Step 11) Thesis Writing and Defense:

Thesis writing and defense are crucial stages in the research process. These stages involve documenting the research findings, methodologies, and conclusions in a comprehensive thesis manuscript and presenting it to the academic community through an oral defense. I will flow steps outline the thesis writing and defense process:

1. Write-up of the Manuscript:
   1. Compile all the research work, including the literature review, methodologies, results, and conclusions, into a cohesive and well-structured thesis manuscript.
   2. Ensure that the manuscript adheres to the guidelines and formatting requirements of the academic institution or the targeted journal/conference.
2. Review and Revision:
   1. Collaborate with the supervisor and supervisory committee to review and revise the thesis manuscript. Incorporate their feedback, suggestions, and recommendations to improve the clarity, coherence, and overall quality of the document.
   2. Pay close attention to addressing any concerns or gaps identified during the review process.
3. Refinement and Polishing:
   1. Refine the language, grammar, and style of the thesis manuscript to ensure readability and coherence.
   2. Pay attention to the organization of the content, logical flow of ideas, and proper citation of references.
   3. Ensure that all figures, tables, and other visual aids are appropriately labeled and referenced.
4. Final Review and Approval:
   1. Schedule a final review with the supervisor and supervisory committee to ensure that all revisions have been incorporated correctly.
   2. Seek their approval and endorsement of the final version of the thesis manuscript before proceeding to the defense stage.
5. Scheduling the Oral Defense:
   1. Coordinate with the academic institution and the examination committee to schedule the oral defense.
   2. Provide the necessary documentation, including the thesis manuscript and any additional materials required by the institution or committee.
6. Presentation Preparation:
   1. Prepare a comprehensive presentation that highlights the key aspects of the research, including the research objectives, methodologies, results, and conclusions.
   2. Practice the presentation to ensure clarity, coherence, and effective communication of the research findings.
7. Oral Defense:
   1. Present the research during the oral defense session, which typically involves a public presentation followed by a question-and-answer session with the examination committee.
   2. Clearly articulate the research problem, the significance of the study, the research methods employed, the results obtained, and the implications of the findings.
   3. Respond to the questions and feedback from the committee members, demonstrating a deep understanding of the research and its implications.
8. Evaluation and Assessment:
   1. After the oral defense, the examination committee evaluates the thesis manuscript, the oral presentation, and the responses provided during the defense.
   2. The committee assesses the quality of the research, the validity of the methodologies, the interpretation of the results, and the overall contribution to the field.
   3. The committee may provide feedback and suggestions for further improvements or revisions.
9. Incorporating Feedback and Finalizing the Thesis:
   1. Address any feedback or recommendations provided by the examination committee.
   2. Revise and refine the thesis manuscript accordingly, ensuring that all suggestions and concerns are adequately addressed.
   3. Finalize the thesis manuscript, incorporating the revisions and improvements based on the feedback received during the defense.
10. Submission and Archiving:
11. Submit the final version of the thesis manuscript to the academic institution or the targeted journal/conference, following their specific submission guidelines.
12. Ensure that all necessary forms, signatures, and paperwork are completed as required.
13. If applicable, submit an electronic copy of the thesis to the institutional repository for archival purposes

# Expected Outcomes

The proposed research on student risk prediction and identification in education is expected to yield several outcomes that will contribute to the advancement of the field and have practical implications for educational institutions. The anticipated outcomes of this research are as follows:

1. Ethical Guidelines for Data Usage: The research will ensure compliance with ethical guidelines by obtaining necessary approvals for data usage and implementing measures to protect student data privacy and security. The development of ethical frameworks and practices will serve as a guide for future studies in the field.
2. Development of Effective Risk Prediction Models: Through the analysis of existing data and the application of machine learning and AI algorithms, the research aims to develop accurate and reliable risk prediction models. These models will identify at-risk students based on relevant risk factors, enabling proactive interventions and support.
3. Identification of Effective Risk Factors: The literature review conducted as part of this research will contribute to the identification of effective risk factors associated with student academic performance and well-being. This understanding will enhance our knowledge of the factors that contribute to student risk and inform the development of more targeted interventions.
4. Comparison of Machine Learning and AI Algorithms: By comparing different machine learning and AI algorithms, the research will provide insights into their effectiveness in predicting student risk. This comparative analysis will highlight the strengths and limitations of each approach, aiding educators and researchers in selecting the most suitable algorithms for their specific contexts.
5. Generalized and Personalized Risk Prediction Models: The research aims to develop both generalized and personalized risk prediction models. The generalized models will provide a comprehensive overview of risk factors applicable to a wide range of students, while the personalized models will consider individual student characteristics to offer tailored risk assessments.
6. Evaluation of Plugin Usability: The proposed Moodle plugin will be evaluated for its usability and effectiveness in identifying at-risk students. Feedback from teachers and students will be collected through personal questionnaires, providing insights into the plugin's usefulness, ease of use, and potential areas for improvement.
7. Dissemination of Findings: The outcomes of this research will be disseminated through research papers published in respected conferences and journals. These publications will contribute to the existing body of knowledge on student risk prediction and personalized learning approaches, enabling researchers, educators, and policymakers to benefit from the research findings.

Overall, the expected outcomes of this research encompass the development of accurate risk prediction models, identification of effective risk factors, comparison of algorithms, creation of generalized and personalized models, evaluation of plugin usability, establishment of ethical guidelines, and dissemination of research findings. These outcomes will enhance our understanding of student risk prediction and support the improvement of educational practices to better serve at-risk students.

# Significance and Contribution

The proposed research on student risk prediction and identification methods in education, leveraging AI and personalization techniques, holds significant importance and is expected to make several contributions to the field. The key significance and contributions of this research are outlined below:

1. Enhanced Student Support: By developing effective risk prediction models, this research aims to enhance student support systems in educational institutions. The identification of at-risk students at an early stage will enable timely interventions and personalized support, ultimately improving their academic performance and well-being.
2. Improved Decision-Making for Educators: The proposed research will provide educators with valuable insights into the factors contributing to student risk. By analyzing data and utilizing machine learning algorithms, educators will be equipped with evidence-based information to make informed decisions and implement targeted interventions to support at-risk students effectively.
3. Advancement of AI and Personalization Techniques: The research will contribute to the advancement of AI and personalization techniques in the education domain. By developing and comparing different machine learning and AI algorithms, this study will expand the knowledge base regarding the effectiveness and applicability of these techniques in predicting student risk.
4. Generalized and Personalized Models: The research will contribute to the development of both generalized and personalized risk prediction models. The generalized model will provide a broad overview of risk factors applicable to a wide range of students, while the personalized model will cater to individual student characteristics, enabling tailored interventions and support.
5. Open-Source Moodle Plugin: The development of an open-source Moodle plugin will contribute to the accessibility and widespread adoption of the proposed risk prediction models. This plugin will facilitate seamless integration of the models within the Moodle learning environment, allowing educators to easily utilize the predictive capabilities to identify at-risk students and provide targeted support.
6. Ethical Considerations: The research will prioritize ethical considerations by obtaining necessary approvals for data usage and ensuring data privacy and security. This focus on ethical practices will contribute to responsible research conduct and provide a framework for future studies in the field of student risk prediction.
7. Academic Contributions: The findings of this research will be disseminated through research papers submitted to respected conferences and journals in the field, contributing to the existing body of knowledge. These publications will serve as valuable resources for researchers, educators, and policymakers interested in student risk prediction and personalized learning approaches.

Overall, the proposed research holds significant potential to positively impact the education sector by providing valuable insights into student risk prediction, improving student support systems, and advancing the utilization of AI and personalization techniques for enhanced educational outcomes.

# Limitations

Acknowledge the limitations of the study, including the reliance on a specific LMS (Moodle), the availability and quality of data, and the generalizability of the developed model(s) to other online higher education settings. Provide recommendations for future research and improvements to address these limitations and contribute to the advancement of student risk prediction in the field of education.

By following this methodology, the research aims to develop a personalized model that utilizes AI and machine learning techniques to effectively predict course failure and dropout in online higher education. The systematic approach ensures that the research is conducted rigorously, with a strong theoretical foundation, and produces reliable and actionable insights to support educational institutions in identifying and supporting at-risk students.