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Prediction of Grades Analysis at Primary School Level Pakistan

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Abstract

In the era of digital advancements, education has undergone a profound transformation through the integration of data science and predictive analytics. The application of data science methodologies in education revolves around the collection and analysis of extensive data from diverse sources, encompassing student demographics, attendance records, assessment scores, and more. This research offers an overview of the fundamental elements and implications of utilizing data science to predict student performance within educational institutions. The findings show that attitudes towards the current grading system are varied: 53% of respondents are satisfied with it, while 42% think there are many factors which need to be considered to determine academic success. Opinions differed as to whether the grading system reflects a child's true capabilities; 48% agreed, whereas 14% disagreed. There is also no consensus regarding how parents would like to be kept informed about their children's progress at school; some would rather have regular meetings with teachers, others for example, prefer sending emails, etc., so that each parent can choose his/her preferred communication channel. Thus, according to 48% of those surveyed believe there should be Parent-Teacher Conferences (PTCs) while another 42% feel more resources will make prediction and improvement better respectively.

Keywords: Education, Predictive Model, Statistical Analysis, Class Grades, Data Analysis.

INTRODUCTION

In the ever-evolving landscape of education, the integration of data science and predictive analytics is proving to be a revolutionary force, reshaping traditional norms and ushering in an era marked by informed decision-making. As educational institutions navigate the complexities of the digital age, the need to harness the power of data for improving learning outcomes has become increasingly evident. This introduction aims to highlight the crucial role played by data science in transforming education, particularly in the context of predicting student performance. In educational institutions, mostly higher education, they usually have an academic management system to record all data of

students having information about academic results in final exams and different grades for courses and program (Arkorful & Abaidoo, 2015). At the core of this paradigm shift is the fusion of diverse data sources within educational ecosystems. Ranging from student demographics to attendance records, assessment scores, and more, this wealth of information provides a unique opportunity to delve into the intricacies of academic progress. Through the application of data science methodologies, educators gain the capability to construct predictive models that move beyond retrospective analysis, foreseeing a student's future performance based on patterns discerned in historical data. The applications for data mining procedures in the educational field has attracted a lot of attention in past years. Data mining with Machine Learning is the new discovery of data. It is now a core field of finding new and useful information or meaningful insights from data (Bujang et al., 2021). Before applying an effective strategy of data mining, there are many decisions to make such as defining student`s achievements, finding important characteristics of students, and selecting the most useful and suitable machine learning way for particular use (Yağcı, 2022). The latest development in educational sector have been inspired significantly by Educational Data Mining (EDM). The whole range of research has been discovered and applied with new opportunities and possibilities for technological updating machine learning system based on student`s requirements (Alam & Mohanty, 2022). A key player in this transformative narrative is the "Prediction of Grades Analysis at School Level" project—an ambitious initiative employing cutting-edge data analytics and machine learning techniques.

This project responds to the urgent need for a proactive strategy, empowering educators, administrators, and parents with tools to identify and support students at risk of academic underperformance. There is a great need to be able to predict future of student`s behavior in order to upgrade curriculum design and strategy interventions for academic guidance and support on courses. This is where data mining comes into play (Albreiki et al., 2021). The project's methodology involves thorough data collection, encompassing a spectrum of academic records, attendance logs, extracurricular 2 engagements, and demographic details. Through a synthesis of statistical methods and domain expertise, relevant features are thoughtfully selected to construct a resilient predictive model. Machine learning algorithms, such as regression or classification models, then analyze historical data to ensure accurate predictions of future academic outcomes. Currently, analysis on basis of prediction has relied on Machine Learning to support business with decision making in educational institutions along with academic management (Rastrollo-Guerrero et al., 2020). In higher education level, student academic performance is researched extensively to maintain academic achievement, increase dropout rates of educational institutions along with other challenges. In simple words, student performance considers to extent of achieving long and short-term goals in education with help of machine learning (Zeineddine et al., 2021).

Beyond the technical complexities, the project offers a practical approach to addressing academic underperformance. The resulting predictive analysis provides valuable insights presented through user-friendly visualizations, enabling stakeholders to comprehend the factors influencing academic success. A crucial aspect of the initiative is the integration of an early intervention system, ensuring timely notifications for educators and parents of students in jeopardy, thereby streamlining support mechanisms. Academic performance of students in educational institutions is the source of great interest and concern for most

research with machine learning. It is very essential for educational institutions to monitor student`s performance and take respective measures (Namoun & Alshanqiti, 2020). For predicting performance of student is very important to make any educational institute. Harnessing ways of data mining with machine learning to predict performance based on data available in educational institutions which explain their behavior, the impact of every factor on the progress of students with help of machine learning (Adnan et al., 2021). However, in the pursuit of progress, the project remains committed to continuous improvement. By incorporating feedback and adapting to dynamic educational trends, it seeks ongoing refinement of its predictive models and support systems. The expanding role of data science in education, exemplified by this project, is undeniably shaping the future of learning. Through the lens of predictive analytics, educational institutions can proactively offer enhanced support, refine teaching methodologies, and ultimately contribute to the overall enhancement of educational outcomes. This narrative extends the technological advancements to a critical consideration of ethical privacy concerns, making sure that transformative power of data science is wielded responsibly for betterment of students and education (Aziz, 2020).

Nowadays, there is trend of digitalization. Rising new technologies have impact on education and every walk of life and it helps to rising our performance with new horizons. The use of new technology used in education allowed to implement new methods to upgrade learning and teaching process(Luan & Tsai, 2021). Understanding and predicting learning of student`s performance with help of machine learning is a standing task since long in educational sciences, which will surely benefit learning and teaching process (Hasan et al., 2020). Every program in educational institutions taught in person has quickly shifted to online learning to fulfill educational requirements and delays in student`s performance in pursuing further education and get a job quickly (Zhang et al., 2021). Learning with mobile has become an essential instruction in different platforms such as schools, colleges, universities and different online educational sectors. This will surely get a leverage of machine learning in order to understand student`s performance and behavior (Ho et al., 2021).

LITERATURE REVIEW

This literature review examines the case study of Gyorgy Denesat The Perse Schooling Cambridge, UK, which uses Artificial Intelligence (AI) for predicting GCSE grades. The study aims to provide a nuanced understanding of the practical implications of AI implementation in a selective independent school setting. The study focuses on the use of Ai algorithms to predict GCSE grades, aiming to assist educators and students in making more informed decisions regarding academic pathways and interventions. The unique context of a selective independent school adds layers of complexity, as expectations and standards may differ from mainstream educational institutions. The methodology employed in the case study is crucial for evaluating the reliability and validity of the findings. The implications for educational decision-making are significant, as AI can enhance educational decision-making by providing timely and accurate predictions. However, ethical considerations and biases are paramount, and the literature review should critically assess the challenges faced during the implementation of AI for GCSE grade prediction. Future directions and recommendations for the integration of AI in grade prediction for secondary education could involve refining predictive models, addressing ethical concerns, or exploring ways to enhance collaboration between AI

systems and human educators.[15]. The study by Satrio Adi Priyambada, Tsuyoshi Usagawa, and Mahendrawathi ER presents a two-layer ensemble prediction model that integrates learning behavior data and domain knowledge. The model incorporates study habits, engagement levels, and interaction patterns within educational platforms. It also includes domain knowledge, enriching its predictive capabilities. The model combines multiple models to improve predictive accuracy and robustness. It can inform interventions for at-risk students and play a role in personalized learning initiatives(Akour et al., 2021). The integration of Artificial Intelligence (AI) in education has become a significant focus for researchers, with a systematic literature review by Miguel MartínezComesana˜ et al. examining the multifaceted implications of AI on assessment methods in primary and secondary education. The review focuses on the context of AI's integration, its role in providing timely feedback, and its influence on reducing bias in evaluations. It also explores the potential of AI in formative and summative assessments, its ability to tailor learning experiences to individual students, and its potential to mitigate bias in assessment methods. However, the review also addresses challenges such as data privacy concerns, algorithmic transparency, and the potential for reinforcing existing educational inequalities. The review concludes by discussing the broader implications of AI's impact on assessment methods in education, such as how to leverage AI to enhance teaching and learning, and the practical implications for curriculum design and pedagogical approaches. The review serves as a guide for educators, policymakers, and researchers 3 seeking to navigate the dynamic intersection of AI and education, offering critical insights into the transformative potential, challenges, and ethical considerations associated with the integration of AI in educational assessment (Doshi & Chaturvedi, 2014).

The study by Iddrisu Issah, Obed Appiah, Peter Appiahene, and Fuseini Inusah provides a systematic review of machine learning applications in determining attributes influencing academic performance. The review focuses on the role of machine learning in education, its methodology, key themes and findings, types of attributes, machine learning algorithms, predictive accuracy and model validity, and practical implications for educational practices. The authors emphasize the importance of contextualizing the role of machine learning in education, the rigor of the methodology, the types of attributes considered, the machine learning algorithms employed, and the implications for educational practice. The review also discusses the predictive accuracy and model validity of the models, evaluating their predictive power and validity to inform educational decisions. The study also explores the practical implications of integrating machine learning into educational practices, such as how to leverage these insights to inform teaching strategies and interventions. The review acknowledges limitations, such as data quality issues and algorithmic biases, and suggests future directions for research in this domain. The review serves as a valuable resource for educators, researchers, and policymakers in understanding the complex web of factors influencing academic success (Marbouti et al., 2016).

This literature review explores the integration of machine learning and teaching-learning-based optimization in predicting individual learning performance. The authors, Mehrdad Arashpour, Emad M. Golafshani, Rajendran Parthiban, Julia Lamborn, Alireza Kashani, Heng Li, and Parisa Farzanehfar, contribute significantly to the field by combining machine learning with teaching-learning-based optimization. The research aims to understand the

symbiotic relationship between technology and pedagogy by examining the interplay between machine learning and teaching learning-based optimization. The review critically evaluates the choice of machine learning algorithms, the incorporation of teaching-learning-based optimization principles, and the parameters governing the hybrid model. Key themes and findings include the types of features considered in predicting learning performance, the effectiveness of the hybrid model, and the implications of the findings for educational practices. The review also discusses the use of different machine learning algorithms and their strengths in the hybridized predictive model. The review also addresses the practical implications of the research on educational practices, such as how to leverage insights from the hybrid model to inform teaching strategies and interventions. The review also discusses limitations and future directions for research in this domain (Xu et al., 2019). The article "Unveiling Educational Success: A Data Mining Approach to Predict the Success of Secondary School Students - A Saudi Arabian Case Study" by Amnah Saeed Alghamdi and Atta Rahman presents a case study in the Saudi Arabian context of using data mining techniques to predict the success of secondary school students. The research focuses on the transformative potential of data mining in predicting academic success, highlighting its potential to transcend traditional assessment methods. The literature review critically examines the methodologies, key findings, and broader implications of the research, offering insights into the transformative potential and challenges associated with employing data mining in predicting academic success. The review focuses on the role of data mining in education, the methodology rigor, key themes and findings, variables considered, data mining algorithms employed, predictive accuracy and model validity, and practical implications for educational practices.

It also discusses the limitations of the research, such as data quality issues, potential biases, and the need for further validation. The review concludes that Alghamdi and Rahman's research on predicting the success of secondary school students using a data mining approach in the Saudi Arabian context represents a significant contribution to the intersection of technology and education (Balaji et al., 2021). The article "Grade Expectations: How Well Can Past Performance Predict Future Grades?" by Gill Wyness, Lindsey Macmillan, Jake Anders, and Catherine Dilnot in Education Economics provides a comprehensive analysis of the predictive power of past academic performance on future grades. The research contributes to the understanding of the intricacies of forecasting academic outcomes and offers insights into the complex interplay between past academic performance and future grades. The review critically evaluates the methodology of the study, examining data sources, sample selection, and statistical techniques employed. Key themes and findings include the temporal span of past performance, subject-specific factors, variability across educational levels, and practical implications for educational policies.

The review also discusses the limitations of the research, such as potential biases, external factors, and the need for further validation. Future directions for research in this domain include refining predictive models, exploring additional variables, or conducting comparative studies across different educational systems. Overall, the research by Wyness, Macmillan, Anders, and Dilnot contributes significantly to the field of education economics (Sumitha et al., 2016). This literature review critically examines the integration of machine learning algorithms for predictive modelling and analytics of students' grades using machine learning algorithms. The research by Yudish Teshal Badal and Roopesh

Kevin Sungkur has the potential to revolutionize teaching strategies, personalize learning experiences, and informearly intervention initiatives. The review critically evaluates the methodology used in the study, including data sources, feature selection, algorithm choice, and model evaluation techniques. Key themes and findings are identified, including the types of machine learning algorithms used, predictive accuracy achieved, and implications for educational practices. The review also explores the types of data inputs used and how feature selection contributes to the predictive power of the models. The review also addresses the practical implications of the research for educational practices, such as how to leverage insights from machine learning models to inform teaching strategies and interventions. However, the review acknowledges limitations, such as potential biases, data privacy concerns, and the need for further validation. Future directions for research include refining algorithms, exploring novel variables, or conducting longitudinal studies (Al-Zawqari et al., 2022). This literature review critically examines Xin Jin's research on predicting academic success through machine learning analysis of student, parental, and school efforts. The review focuses on the context of predicting academic success, the methodology of Jin's research, the key themes and findings, the types of machine learning algorithms used, the role of individual 4 efforts and student characteristics, parental involvement and support, and school-related variables. The review also explores the practical implications of Jin's research for educational practices, such as how to use machine learning models to inform teaching strategies and interventions, and the potential benefits and challenges of integrating predictive analytics into educational practices. The review also discusses the limitations of Jin's research, such as potential biases, external factors, and the need for further validation.

Future directions for research in this domain include refining algorithms, exploring novel variables, or conducting longitudinal studies. In conclusion, Xin Jin's research on predicting academic success through machine learning analysis of student, parental, and school efforts is a significant contribution to the intersection of technology and education (Kuzilek et al., 2021). This literature review explores the use of deep learning in predicting and understanding readers' emotions. The authors, Anoop K., Deepak P., Savitha Sam Abraham, Lajish V. L., and Manjary P. Gangan, contribute significantly to the understanding of readers' emotions in the digital age. The review critically evaluates the methodology of their research, including data collection methods, feature extraction, deep learning architectures, and model evaluation techniques. Key themes and findings are identified, including the types of emotions predicted, the efficacy of deep learning models, and the implications for content creators and marketers. Thereview also discusses the types of deep learning architectures employed, their strengths, and how they align with the features extracted. The review also examines the feature extraction process and data inputs used in predicting readers' affect. The review also discusses the practical implications for content creators and marketers, highlighting how insights from deep learning models can be leveraged to tailor content, enhance user engagement, and inform marketing strategies.

The review also discusses potential limitations and future directions for research in this domain (Priyambada et al., 2017). The integration of artificial intelligence (AI) in education has become a transformative force, offering innovative solutions to monitor student performance and devisepreventive measures. This literature review critically examines the methodologies, key findings, and broader implications of their research, offering insights

into the transformative potential and challenges associated with employing AI in understanding and proactively addressing students' academic journey. The context of AI in education is essential to appreciate the significance of Khan et al.'s research, which goes beyond traditional assessment methods, offering real-time insights and predictive analytics. The literature review should delve into the specific AI algorithms employed by Khan et al., such as machine learning models and deep learning architectures. The review should also examine how AI is utilized to monitor student performance, examining the types of data inputs considered and how the AI model interprets and analyzes this data to provide insights into students' academic progress. The review should also explore how AI is employed to devise preventive measures, examining the types of interventions or recommendations generated and how these measures are implemented to address potential challenges in student performance. The review should also address the practical implications of the research for educational practices, such as how to leverage insights from AI to inform teaching strategies, interventions, and institutional policies. Limitations and future directions for research in this domain should be discussed (Sokkhey & Okazaki, 2020). This literature review explores Mustafa Yağcı's research on educational data mining for predicting students' academic performance using machine learning algorithms. The review critically examines the methodologies, key findings, and broader implications of Yağcı's research, offering insights into the transformative potential and challenges associated with leveraging data-driven approaches to enhance educational outcomes. The review focuses on the broader context of educational data mining, including the utilization of vast datasets to extract meaningful insights into students' learning patterns, performance trends, and potential challenges. The review also delves into the specific machine learning algorithms used, their predictive accuracy, and the implications for educational practices. The review also examines the feature selection process and the types of data inputs used in predicting students' academic performance.

The review also addresses the practical implications of the research for educational practices, such as how insights from machine learning models can inform teaching strategies, interventions, and institutional policies. The review also discusses potential limitations and future directions for research in this domain, such as refining algorithms, exploring novel variables, or conducting comparative studies across different educational systems (Siddique et al., 2021). This literature review explores the study of Sarah Alturki, Lea Cohausz, and Heiner Stuckenschmidt on predicting Master's students' academic performance in Germany. The study focuses on the complexities of postgraduate studies, varying academic backgrounds, and diverse program structures in Master's programs. The review critically evaluates the methodology used, including the selection of predictive variables, data sources, statistical methods, and model validation techniques. Key themes and findings are identified, including the types of predictive variables, the efficacy of the predictive model, and the implications for educational practices in Master's programs. The review also discusses the statistical methods employed, such as regression analysis and machine learning algorithms, and the validity of the predictive model.

The review also addresses the practical implications of the research for educational practices in Master's programs, such as admissions processes, personalized academic support, and program modifications to enhance student success. The review also discusses the limitations of the study, such as potential biases in data and the need for ongoing validation. The review concludes that Alturkiet al.'s study is a significant contribution to the intersection oftechologyand postgraduate education (Arkorful &

Abaidoo, 2015). The integration of AI and emerging technologies in smart classroom as revolutionized education, offering enhanced learning experiences and improved outcomes. Eleni Dimitriadou and Andreas Lanitis's research on the critical evaluation, challenges, and future perspectives of using AI and emerging technologies in smart classrooms provides a comprehensive analysis of the methodologies, key findings, and broader implications of their research. The evolution of smart classrooms is crucial to understand the significance of their research. The review critically evaluates the methodology, including the selection of smart classroom technologies, data sources, and analysis methods. Key themes and findings include the effectiveness of AI in enhancing learning experiences, the 5 challenges associated with implementation, and the future trajectories of smart classrooms. The review also examines the challenges in implementation, such as infrastructure, teacher training, and student adaptation. It also explores user experience and pedagogical considerations in smart classrooms, focusing on how teachers and students perceive AI and emerging technologies. Future perspectives and technological trajectories of smart classrooms are also discussed, including how AI evolves to better adapt to individual learning styles and emerging technologies. Ethical considerations and privacy concerns are also addressed, emphasizing the importance of ethical frameworks in educational technology. Dimitriadou and Lanitis's research on AI and emerging technologies in smart classrooms is a significant contribution to the intersection of technology and education(Bujang et al., 2021). This literature review critically examines the "StudentPerformulator" model, a machine learning model designed to predict students' academic performance at secondary and intermediate levels. The research contributes to the growing body of knowledge on utilizing machine learning for predictive analytics in education.

The review critically evaluates the methodology of the study, including data sources, feature selection, machine learning algorithms, and model evaluation techniques. Key themes and findings are identified, including the types of machine learning algorithms used, predictive accuracy achieved, and implications for educational practices. The review also examines the feature selection process and the types of data inputs used in predicting students' academic performance. The review also addresses the practical implications of the research for educational practices, such as how insights from the model can inform teaching strategies, interventions, and institutional policies. Limitations and future directions are discussed, including potential biases in data, the impact of external factors on predictive accuracy, and the need for ongoing validation. Future directions for research in this domain include refining machine learning models, exploring novel variables, or conducting longitudinal studies. In conclusion, the "Student-Performulator" model represents a significant contribution to the intersection of technology and education(Yağcı, 2022).

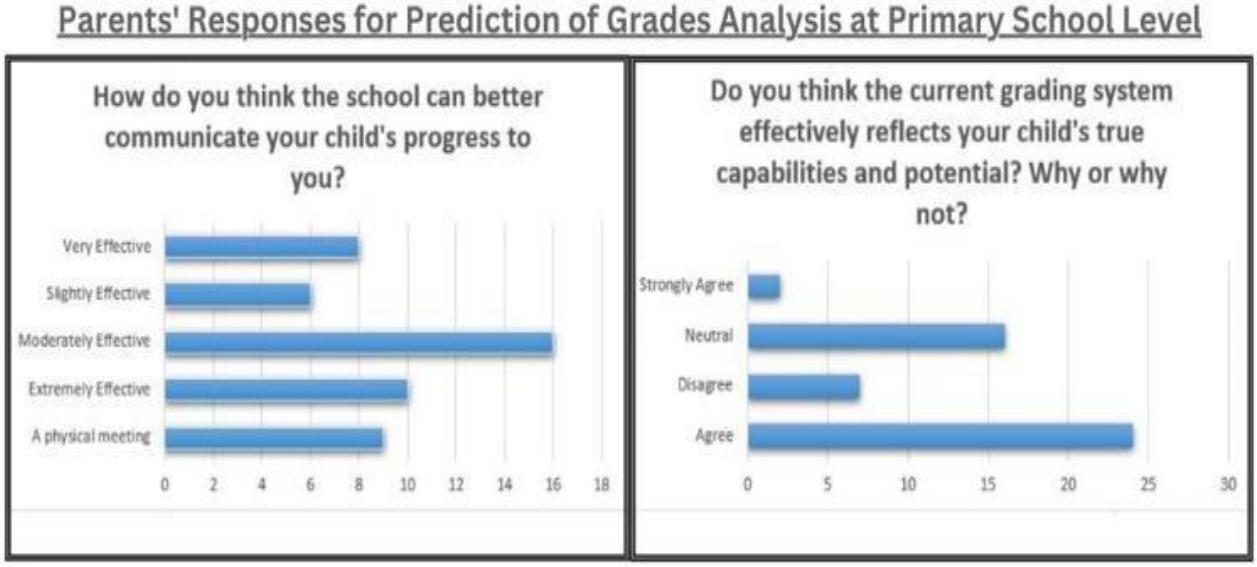
RECOMMENDATIONS AND FUTURE WORK

This system with AI and Machine Learning (ML) models can bring substantial benefits to students within an educational setting. Here are some recommendations for leveraging this integration. Integrating AI offers streamlined grading through automated assignment evaluation, freeing educators to focus on personalized support. AI-driven analysis of student creativity allows for identifying similarities among outputs, aiding tailored interventions and enriching learning experiences. This not only saves time but also provides

deeper insights for educators to refine teaching methods and improve overall educational quality. Predictive Analytics for Student Performance: Incorporate AI and ML algorithms within the ERP system to analyze historical academic data. This can predict student performance trends, identify areas needing improvement, and provide personalized recommendations for students' learning paths. Personalized Learning Journeys: Utilize AI algorithms to customize educational content within the ERP platform based on individual student learning styles, preferences, and progress. This personalized approach can enhance engagement and overall academic performance. Early Intervention and Support: Implement AI-driven early warning systems within the ERP to identify students at risk of falling behind academically. This proactive approach allows educators to intervene early and provide targeted support to struggling students. Resource Allocation and Optimization: AI can analyze data within the ERP to optimize resource allocation, such as faculty assignments, classroom scheduling, and curriculum planning. This ensures efficient utilization of resources and enhances the overall learning experience. Continuous Improvement through Feedback Loops: Implement ML models to analyze feedback and performance data collected within the ERP system. This information can be used to iteratively improve teaching methodologies, curriculum design, and overall educational strategies. Integrating AI and ML models within the ERP system holds the potential to revolutionize education by creating a more personalized, efficient, and effective learning environment for students while empowering educators with valuable insights to support student success. However, it's crucial to ensure proper data security, privacy, and ethical considerations throughout the integration process.

METHODOLOGY AND RESULTS DISCUSSION

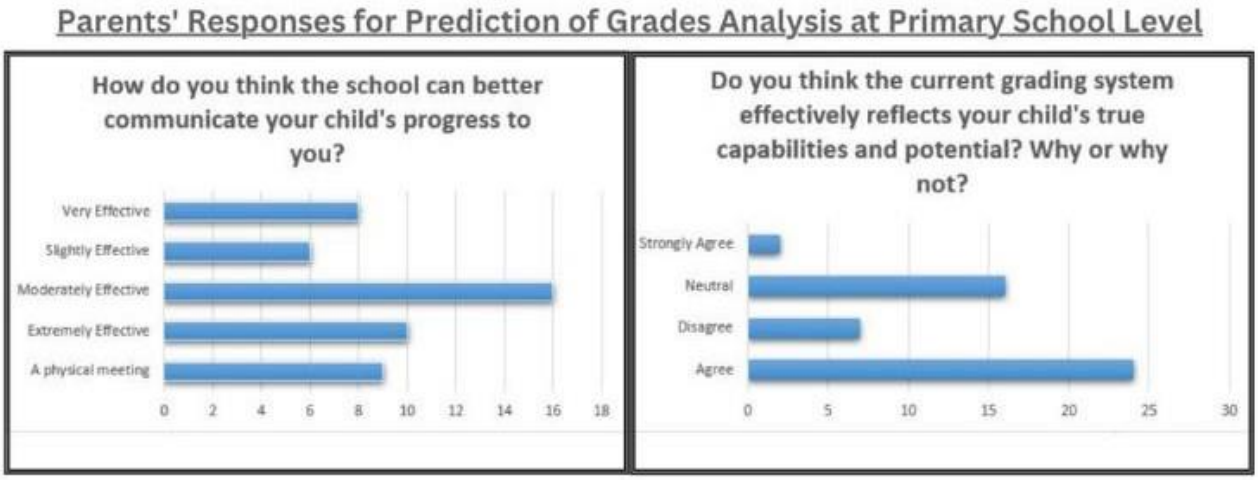
We have conducted a survey among parents, management, and faculty members of the school in England that yielded valuable insights into the use of AI for General Certificate of Secondary Education (GCSE) grade prediction. We gathered the data into the structured format of the questionnaire and composed our dataset out of it to analyze the responses. After all, we analyzed the data using the different techniques of data mining and presented the data in the visualization below, where we extracted valuable insights attached to the captions. Overall, the findings indicated a considerable interest and cautious optimism regarding the implementation of AI in predicting GCSE grades.



Parents expressed a mixture of curiosity and concerns regarding the accuracy and fairness of AI predictions, emphasizing the importance of maintaining transparency and accountability in the process. Management and faculty members showed a keen interest in leveraging AI for personalized student support, highlighting its potential to identify individual learning needs and tailor educational strategies.

Figure 1:
Parents Response

However, there were also reservations about over-reliance on AI predictions and the need to strike a balance between technological advancement and human intervention in educational decision-making. The analysis of this data revealed a nuanced perspective, acknowledging both the potential benefits and the necessity for careful integration and oversight when utilizing AI in predicting GCSE grades. The survey revealed that approximately 53% were satisfied with the current grading system in the primary school, while 23% expressed dissatisfaction. Regarding factors contributing to academic performance, around 42% agreed on significant influence, with 24% considering these factors as highly contributing. The diverse perceptions underscore the need for a nuanced



approach to support student achievement [30].

Figure 2:
Child's capabilities

Figure 1.2: The survey indicated varied opinions on whether the current grading system reflects a child's capabilities, with approximately 48% agreeing and 14% disagreeing. About 32% remained neutral, and only 4% strongly supported its accuracy. Concerning communication about a child's progress, preferences differed: around 20% preferred physical meetings, while 20% found them extremely effective. Flexible communication approaches are crucial to accommodate diverse parental preferences and enhance understanding of a child's academic development.

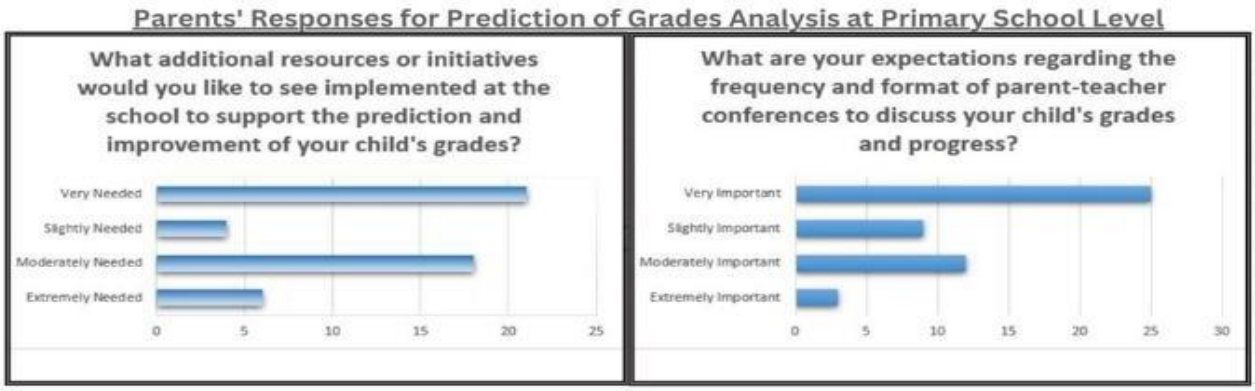
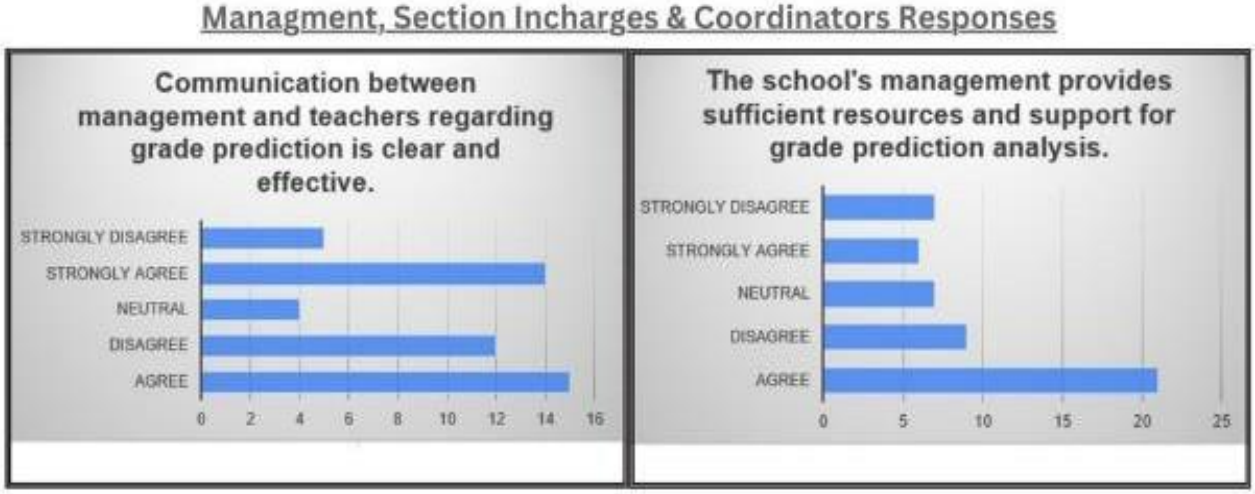


Figure 3:
Child's grades and progress

The survey responses reflected diverse expectations regarding parent-teacher conferences for discussing a child's grades and progress. Around 48% considered these conferences very important, 24% found them moderately important, 18% marked them as slightly important, and 10% emphasized their extreme importance. Concerning additional resources or initiatives to enhance grade prediction and improvement, approximately 42% felt these were very needed, 36% considered them moderately needed, 12% marked



them as extremely needed, and 10% found them slightly needed. These findings underscore the varying degrees of emphasis placed on effective communication and desired support measures to aid in understanding and improving a child's academic performance.

Figure 4:
Management, Coordinator & Section In-charge Response

The survey indicated mixed perceptions about the school management's provision of resources for grade prediction, with approximately 42% agreeing, 18% disagreeing, and 28% strongly agreeing about clear communication between management and teachers. About 30% agreed, 24% disagreed, 20% strongly disagreed, and 8% remained neutral regarding the effectiveness of communication. These findings underscore varying opinions on resource sufficiency and communication clarity between school management and teachers in grade prediction analysis (Albreiki et al., 2021).

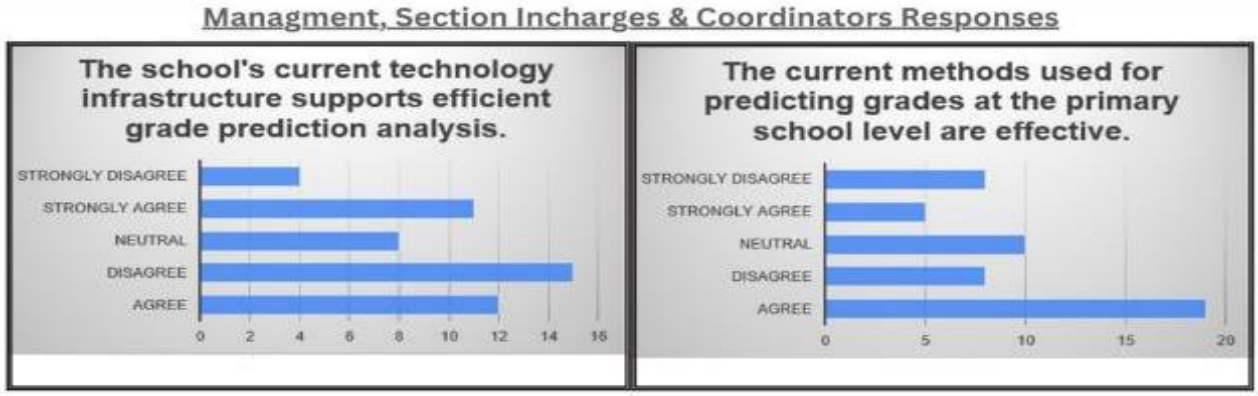


Figure 5:
Coordinator & Section In-charge Response

The survey depicted varied opinions on the effectiveness of current grade prediction methods at the primary school level, with approximately 38% agreeing and 16% disagreeing. Concerning the school's technology infrastructure for efficient grade prediction analysis, around 24% agreed and 30% disagreed, revealing mixed perceptions on the adequacy of the technology supporting these predictions

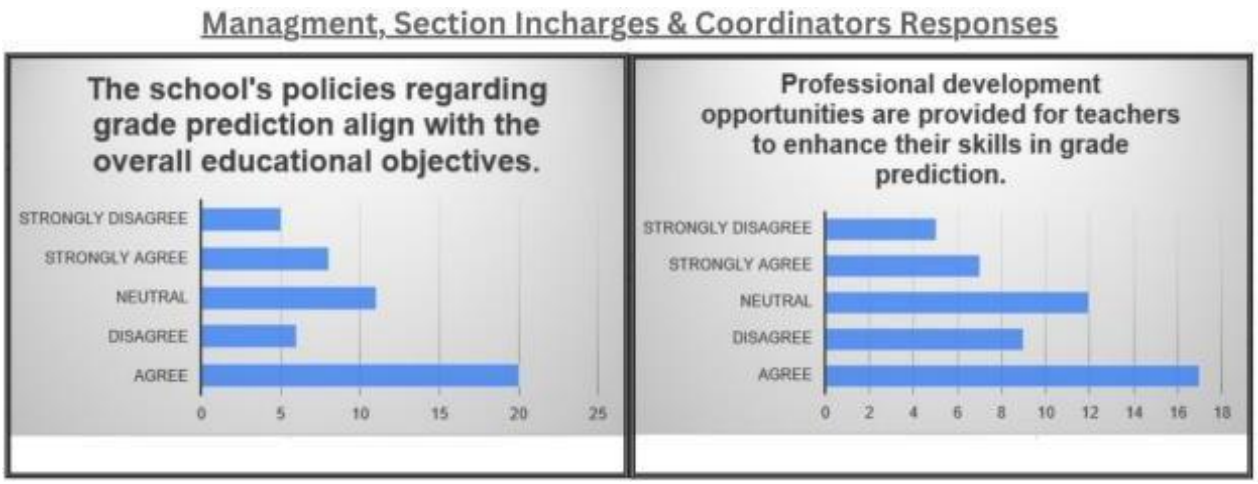
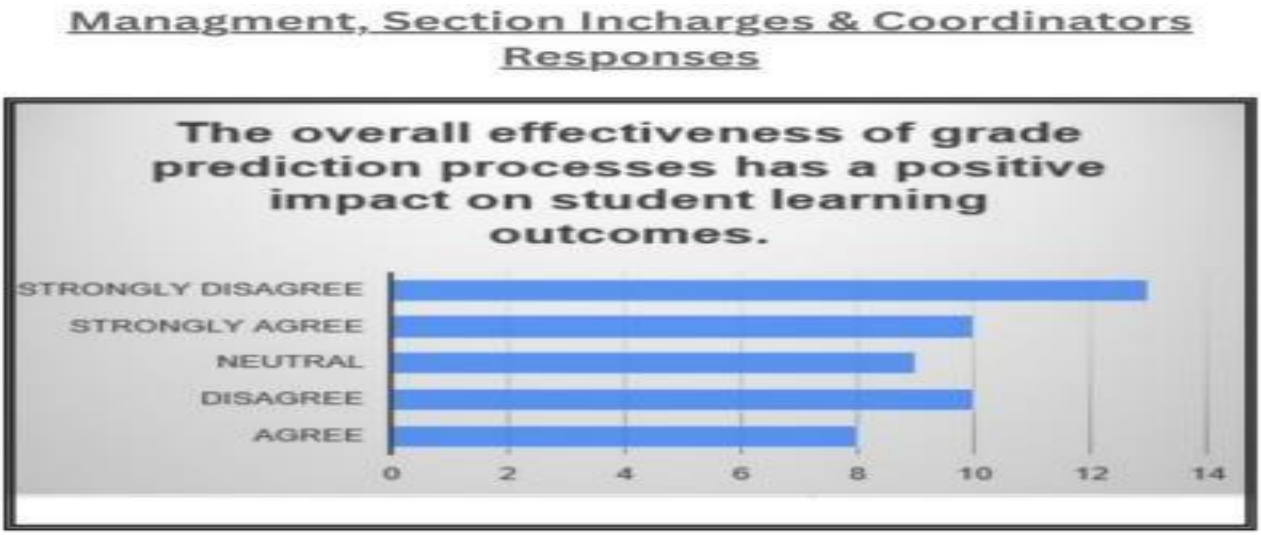


Figure 6
School's policies

The survey revealed diverse opinions on the alignment of the school's policies with educational objectives for grade prediction, with around 40% agreeing and 12% disagreeing. Regarding professional development opportunities for teachers in enhancing grade prediction skills, roughly 34% agreed and 18% disagreed, indicating varied perceptions among respondents about the provision of such opportunities



(Rastrollo-Guerrero et al., 2020).

Figure 7:
Grade prediction

The survey findings regarding the overall effectiveness of grade prediction processes and their impact on student learning outcomes showed diverse perspectives among respondents. Approximately18% strongly agreed, 16% agreed, 18% strongly disagreed, 20% disagreed, and 28% remained neutral regarding the positive impact of these processes on student learning outcomes. These varied opinions underline differing viewpoints on the relationship between grade prediction effectiveness and its influence on student academic achievement (Zeineddine et al., 2021).

RECOMMENDATIONS AND FUTURE WORK

This system with AI and Machine Learning (ML) models can bring substantial benefits to students within an educational setting. Here are some recommendations for leveraging this integration. Integrating AI offers streamlined grading through automated assignment evaluation, freeing educators to focus on personalized support. AI-driven analysis of student creativity allows for identifying similarities among outputs, aiding tailored interventions and enriching learning experiences. This not only saves time but also provides deeper insights for educators to refine teaching methods and improve overall educational quality.

Predictive Analytics for Student Performance: Incorporate AI and ML algorithms within the ERP system to analyze historical academic data. This can predict student performance trends, identify areas needing improvement, and provide personalized recommendations for students' learning paths.

Personalized Learning Journeys: Utilize AI algorithms to customize educational content within the ERP platform based on individual student learning styles, preferences, and progress. This personalized approach can enhance engagement and overall academic performance.

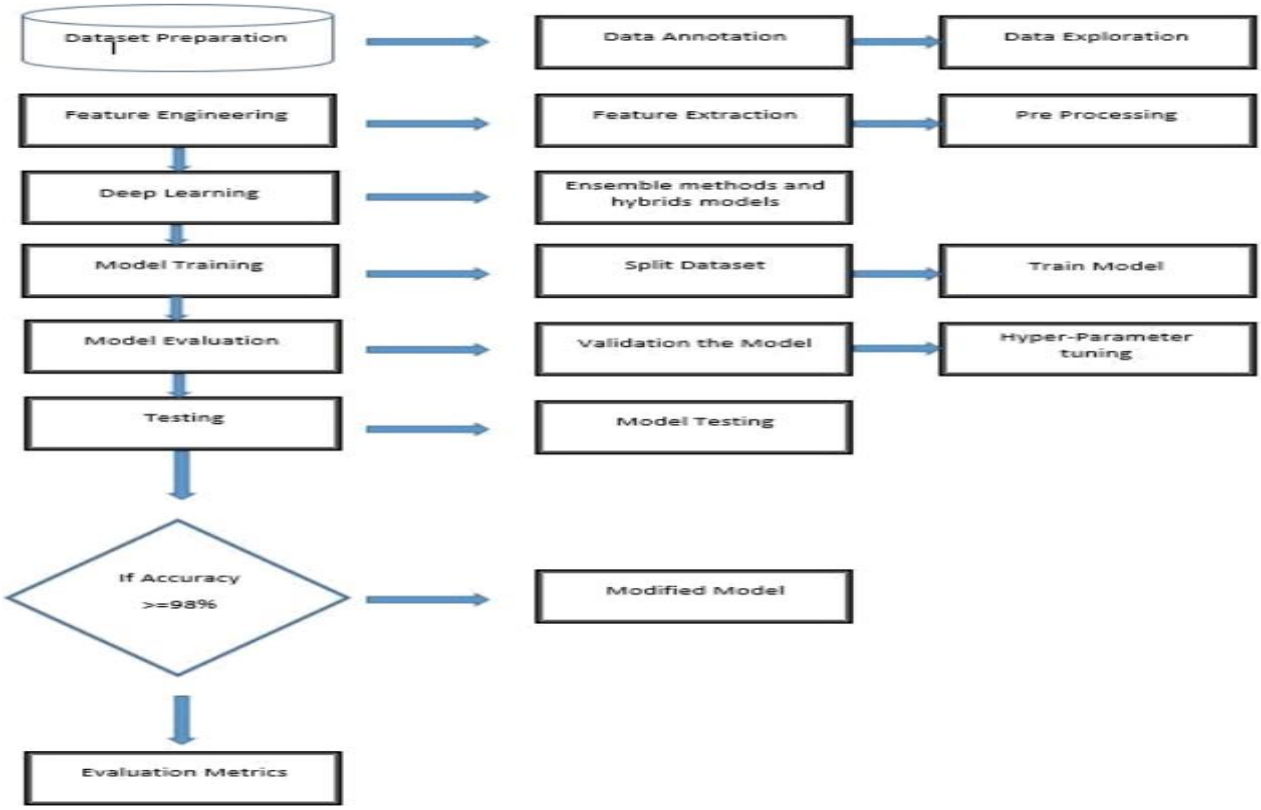


Figure 7:
Evaluation Metrics

Early Intervention and Support: Implement AI-driven early warning systems within the ERP to identify students at risk of falling behind academically. This proactive approach allows educators to intervene early and provide targeted support to struggling students.

Resource Allocation and Optimization: AI can analyze data within the ERP to optimize resource allocation, such as faculty assignments, classroom scheduling, and curriculum planning. This ensures efficient utilization of resources and enhances the overall learning experience.

Continuous Improvement through Feedback Loops: Implement ML models to analyze feedback and performance data collected within the ERP system. This information can be used to iteratively improve teaching methodologies, curriculum design, and overall educational strategies. Integrating AI and ML models within the ERP system holds the potential to revolutionize education by creating a more personalized, efficient, and effective learning environment for students while empowering educators with valuable insights to support student success. However, it's crucial to ensure proper data security, privacy, and ethical considerations throughout the integration process.

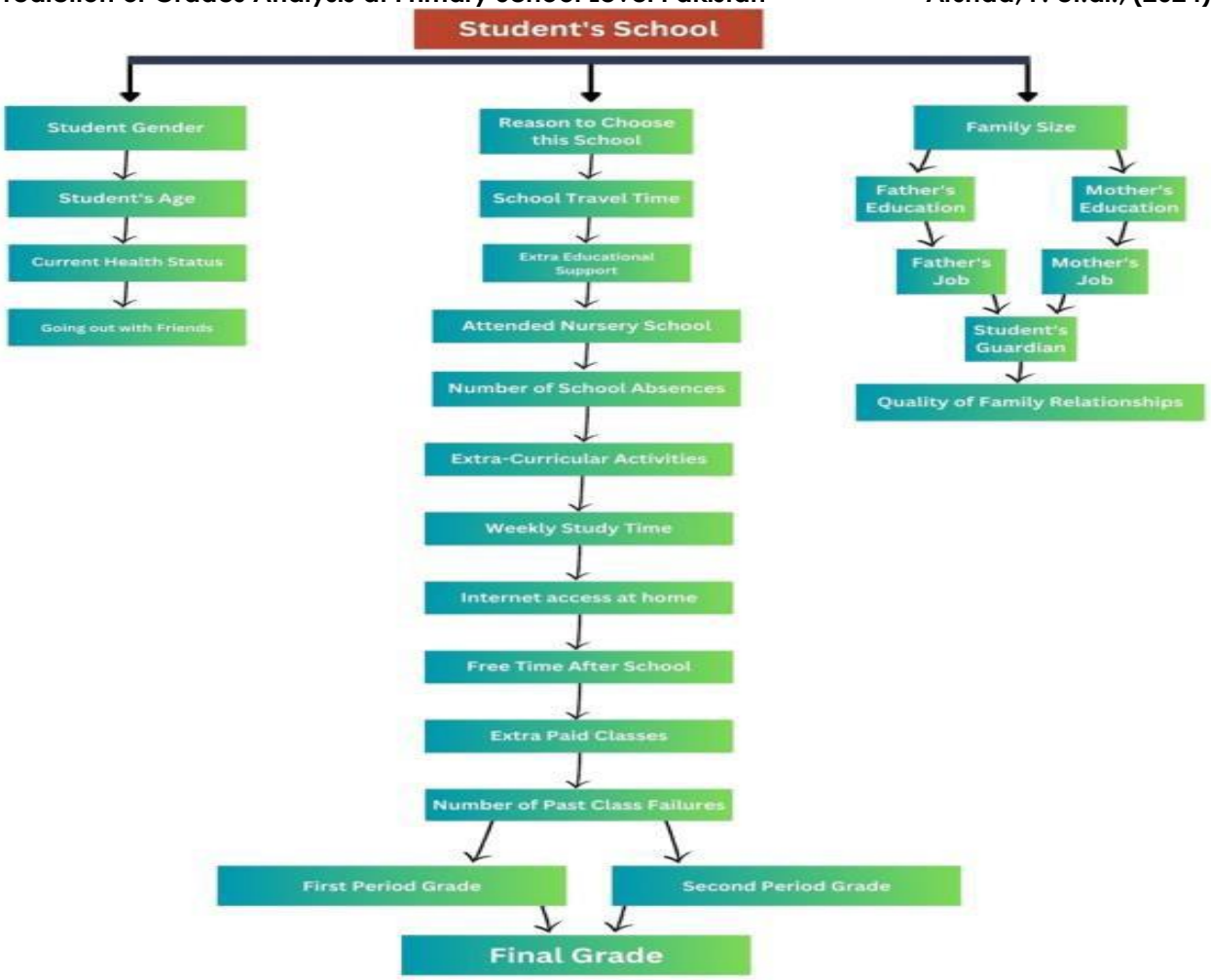


Figure 9:
Final grades

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