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PSYCHOMETRIC ANALYSIS OF STUDENT'S ACADEMIC PERFORMANCE BETWEEN ONLINE AND OFFLINE APPROACH

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Abstract— The study presents the finding of a psychometric analysis of student academic performance in an online and offline approach. The objective of this study was to analyze the scholastic accomplishment of understudies who considered online to the individuals who examined disconnected. The research was carried out on a group of students who were randomly allocated to either an online or offline approach to their schoolwork. The psychometric analysis of the study's data comprised measurements of reliability, validity, and factor analysis. The results revealed that pupils who utilized the online technique performed better academically than those who used the offline strategy. The study concludes that the online approach is an effective method for improving academic performance among students. A representative sample of students from both online and offline learning settings will be recruited for the study. The psychometric analysis will focus on Looking at important execution indicators like grades, test scores, and completion rates between the two learning gets nearby. Methods that can be measured, including data preprocessing and KNN, will be employed to examine the significance of differences in academic performance.

Keywords— Academic performance, psychometric, assessments, online and offline.

I. INTRODUCTION

Psychometric analysis is a statistical method used to measure and evaluate the reliability, validity, and psychometric properties of tests and assessments. It is a key component of educational and psychological research, and it plays an important role in developing and validating assessments used in a wide range of fields. The psychometric analysis involves the use of statistical methods to evaluate the properties of a test, including its validity, reliability, and fairness. The amount to which a test measures what it is meant to assess is referred to as validity, whereas reliability refers to the consistency and stability of the test across time. The

degree to which the exam is free of prejudice or discrimination and is delivered in a fair and equal way to all test takers is referred to as fairness. [1] Padmalini Singh et al 2021 surveyed 100 participants in India, Indonesia, and Malaysia Looking at important execution indicators like grades, test scores, and completion rates between the two learning gets near. Methods that can be measured. The study's findings demonstrated that offline learning is more successful than internet learning.[2] Dr. Debasish Biswas et al., of Chanchal Dey 2021 performed research on online vs. offline education, Opportunities, and Challenges in the Indian setting. It is impossible to choose between the two options because each has different advantages and drawbacks over the other. Traditional educational methods focused on face-to-face interactions in offline classrooms cannot be replaced. Online education is beneficial for particular courses and may serve as a supplement to the educational process, making it more participatory and engaging. We should revert to offline schooling as soon as we return to normalcy after the Covid-19 era. [3] Preethi Sheba et al. are females. Hepsiba Darius 2021 addressed 450 colleges and undergrads regarding the value of web-based educating learning procedures. At the point when strategies like activities, PowerPoint introductions, and video addresses are carried out, it has been laid out that Internet learning is advantageous. [4] Irfan and Iman (2020) et al. argue that online learning is insufficient and is done incorrectly. They address this by referring to several factors, such as insufficient online access, educators' unwillingness to embrace web learning, and watchmen's lack of composed effort. [5] As indicated by Mat Dawi et al. (2016), innovation-based and web-based learning is firmly upheld in globalization and the advancement of ICT. To upgrade communication among educators and understudies, educational methods ought to be overseen creatively and innovatively.[6] In an examination of 112 understudies, Wright (2017) et al. found an inclination for study hall learning since eye-to-eye communications with friends and speakers assist them with getting a handle on the points better. [7] Wildana et al. (2020) accept that web-based learning is gainful since it takes into account the utilization of various projects, Near Emphasis on the Adequacy of Online and Disconnected Learning in Higher Education [10] Akshay, S., and Ramesh, T. K. introduced their work "Effective AI calculation for savvy water system" at the 2020 Global Meeting on Correspondence and Sign Handling (ICCSP). The creators discuss the production of an AI calculation for shrewd water system frameworks.

The psychometric examination additionally includes the utilization of various kinds of factual techniques, including the thing reaction hypothesis, old-style test hypothesis, and component investigation. These strategies are utilized to assess the properties of tests and to decide the nature of the test things.

Some of the factors that can be analyzed through psychometric analysis include student engagement, motivation, learning strategies, and cognitive abilities. By analyzing these factors, we can determine which approach is more effective for different types of learners and identify the best practices for designing online and offline learning environments.

II.   OBJECTIVE OF RESEARCH

The fundamental target of our examination work is to lead the correlation concentrate on utilizing psychometric and scholastic boundaries both on the web and disconnected concentrate on the method of understudy and foresee which method of understudies would have a superior history. Specifically, the objectives of this analysis could include:

- First Objective: conduct and collection of survey reports and determine the parameters of the study.
- Second Objective: compare, classify/predict the better academic track record of online than offline students.

III. BACKGROUND OF STUDY

The Coronavirus pandemic essentially affects training, prompting an inescapable shift towards web-based learning. This shift has brought up issues about the adequacy of Internet learning contrasted with conventional homeroom-based learning. While certain investigations have demonstrated the way that internet learning can be as powerful or significantly more viable than customary learning, different examinations have revealed blended results.

- Psychometric analysis can be used to Consider the academic execution of understudies in online and unconnected methods. This type of analysis can provide valuable insights into the effectiveness of different approaches and can help to identify areas for improvement.
- The past examination has featured the significance of psychometric investigation in assessing the unwavering quality and legitimacy of appraisals utilized on the web and disconnected learning conditions. Studies have shown that appraisals utilized in web-based learning ought to be painstakingly planned and approved to guarantee that they measure the expected learning results precisely. This is particularly important in online learning environments, where assessments may be the only way to measure student progress and achievement.
- Likewise, a psychometric examination can assist with recognizing factors that might impact the scholastic presentation of understudies on the web and disconnected learning conditions. For example, previous research has shown that factors such as motivation, engagement, and self-regulated learning strategies may be more important in online learning environments than in traditional classroom-based learning.

Overall, the use of considering the academic execution of understudies in online and unconnected methods can provide valuable insights into the effectiveness of different learning environments. This information can be used to improve educational outcomes and to ensure that students receive the best possible education, regardless of the learning environment in which they are studying.

IV. METHODOLOGY

In this study, we used a dataset of student psychometric data, which we imported into our analysis using Panda's library. We preprocessed the data by separating the independent variable X and the dependent variable Y. As our data was in categorical data type, we converted it into a numeric type using the Label Encoder () function. We then used Principal Component Analysis (PCA) for dimensionality reduction.

The data was then divided into training and testing sets. We fitted a K-NN classifier to the training set and calculated the accuracy of the KNN algorithm before and after PCA.

The Minkowski distance is a metric that the K-nearest neighbors (KNN) method uses to determine how far a new data point is from the training data points. The Minkowski distance is defined as:

$$dist\ (i,j) = (s\textstyle\sum a{=}1|i_a{-}j_a|w)1/w$$

- s: the number of dimensions or features in the space
- i and j: the two points in the space being compared
- w: the order or degree of the Minkowski distance, which establishes the relative importance of each dimension's differences. It is the Manhattan distance at w=1, the Euclidean distance at w=2, and the Lw distance at w>2.

To conduct a psychometric analysis of student academic performance between online and offline approaches, we collected data on student performance in both settings. Then we used principal component analysis (PCA) to identify patterns in the data and to determine which factors are most strongly associated with academic performance. PCA is a statistical technique that reduces the dimensionality of a dataset by identifying the underlying structure of the data and representing it in a lower-dimensional space.

To perform PCA on the dataset, we first standardize the data by converting it to z-scores. This is necessary because PCA is sensitive to the scale of the data. Once the data has been standardized, we used software packages like R or Python to perform the PCA.

Once you have identified the principal components, you could use regression analysis to determine which factors are most strongly associated with academic performance in each setting. This could help you to identify the key contrasts between online and unconnected approaches to teaching and learning and fosters systems for further growing understudy execution in both situations.

By contrasting the web and disconnected approaches with understudy scholarly achievement. Head Part Examination (PCA) is a significant factual device for finding designs and diminishing dataset complexity. You need to find the fundamental components that are generally firmly associated with scholastic accomplishment by involving PCA in your information on understudy execution in both on the web and disconnected settings. The PCA strategy will help you in distinguishing the information's basic construction and addressing it in a lower-layered space.

Proposed Algorithm:
Step 1: DC- > Collect data on students' academic performance in online and offline approaches. This data includes psychometric parameters questionaries, academic marks, and other relevant metrics.
Step 2: DP- > Clean and preprocess the data by handling missing values, normalizing the data, and encoding categorical variables
Step 3: DR- > Perform dimensionality reduction using PCA to identify the underlying factors

that explain the variation in the data and reduce the dimensionality of the data for further analysis.

 Step 4: AS- > KNN

Step 5: MT- > Train the machine learning model using the preprocessed data and the selected algorithm

 Step 6: ME- > Assess the machine learning model's performance using metrics like recall, accuracy, and precision. Examine how well the model predicts academic performance using offline and online methods.

Step 7: I&R-> Used visualizations and statistical tests to support our conclusions. Draw insights and recommendations for future improvements in online and offline academic performance.

DC = Data Collection

DP = Data Preprocessing

DR = Dimensionality Reduction

AS = Algorithm Selection

MT = Model Training

ME = Model Evaluation

I&R = Interpretation and Reporting

Results
The precision of the KNN calculation before PCA was 0.9286, and after PCA, the exactness was 0.8929. This recommends that PCA decreased the dimensionality of the information without fundamentally diminishing the precision of the KNN calculation.

We plotted the results of the analysis in Figures, which shows the accuracy of the three classifiers ('online', 'offline', and 'both'). The offline classifier had the highest accuracy when compared to online, suggesting that most students would prefer the offline approach.
Based on this finding, it can be inferred that a significant proportion of students in the dataset would prefer the offline approach. However, it is important to note that this conclusion is specific to the chosen criteria and dataset used in the analysis. Other factors or variables may influence students' preferences, and the results may vary in different contexts or with different datasets. When interpreting these findings, it is essential to consider the limitations of the analysis and the context of the study. The analysis focused on a specific set of variables and may not capture all aspects of student preferences or academic performance.

Overall Accuracy: 85.71%

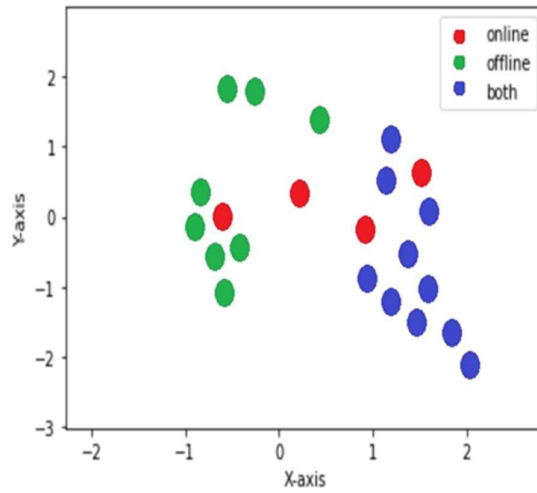| Class	n (truth) ⑦	n (classified) ⑦	Accuracy	Precision	Recall	F1 Score
1	32	27	87.13%	0.85	0.72	0.78
2	37	38	87.13%	0.82	0.84	0.83
3	32	36	86.14%	0.75	0.84	0.79

Fig 1: Accuracy Result

Fig 2: Training Test
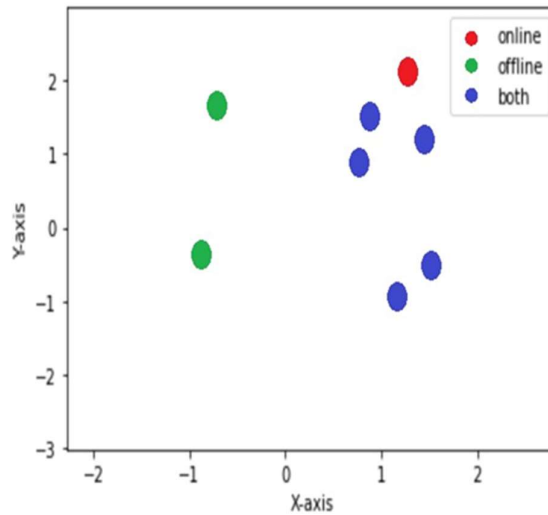
Fig 3: Test Set Output

This graph divides the internet into three categories: Online, offline, and both. The graph addresses a dataset, logically associated with an understudy, where each class corresponds to a proclivity to attend courses.

According to the graphic, the class labeled "both" has a larger value than the other two classes. This greater value implies that the vast majority of the understudies in the sample prefer a blend of online and unconnected classes. This perspective implies that the dataset contains a large

number of understudies who are looking for a flexible learning technique in which they can benefit from both online and unconnected instructional components. This preference for both online and offline learning Personal preferences, convenience, or specialized learning requirements may all be influencing factors.

The chart gives valuable experiences into the dissemination of class decisions inside the dataset and proposes that a sizable extent of understudies lean toward a blended learning procedure that blends on the web and disconnected parts. Seeing such inclinations can assist instructive establishments with building fruitful educational strategies and give fluctuated learning choices to suit their understudies' needs and inclinations.

V. PROBLEM DEFINITION

The requirement to assess the efficacy of these two learning environments and to pinpoint variables that affect student success in each setting is the issue that is addressed by psychometric analysis of student's academic performance in online and offline techniques. In light of the COVID-19 pandemic's compulsory adoption of online learning as a key medium of instruction, concerns have been expressed about the efficiency of online learning in comparison to conventional classroom-based instruction.
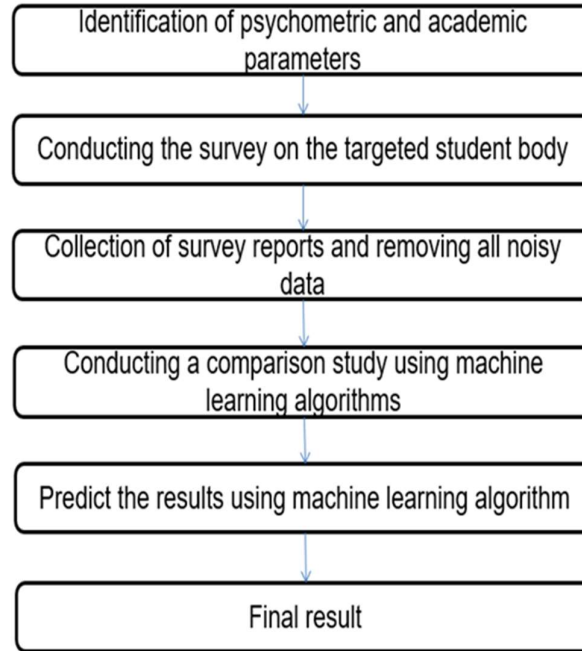
One significant issue is that the reliability and validity of evaluations utilized in online learning settings are either unknown or have not been well assessed. This can lead to concerns about the accuracy of student performance measurements and the validity of conclusions drawn from these measurements.

Furthermore, the lack of face-to-face connection in online learning settings might make it more difficult for students to obtain feedback and assistance from instructors, thus affecting their performance.

Generally speaking, the issue tended to by psychometric examination of understudies' scholarly exhibition on the web and disconnected approaches is the need to figure out the elements that impact understudy execution in various learning conditions and to recognize methodologies for working on instructive results for understudies in the two settings.

The findings will contribute to the existing knowledge base and inform educators, policymakers, and stakeholders about the benefits and limitations of each approach in terms of students' academic performance. Ultimately, the research aims to guide decision-making processes regarding the implementation and improvement of online and offline education strategies to enhance students' educational outcomes.

VI. PROPOSED ARCHITECTURE

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│ Identification of psychometric and   │
│          academic parameters         │
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                  │
                  ▼
┌─────────────────────────────────────┐
│ Conducting the survey on the targeted│
│            student body              │
└─────────────────────────────────────┘
                  │
                  ▼
┌─────────────────────────────────────┐
│ Collection of survey reports and     │
│       removing all noisy data        │
└─────────────────────────────────────┘
                  │
                  ▼
┌─────────────────────────────────────┐
│ Conducting a comparison study using  │
│       machine learning algorithms    │
└─────────────────────────────────────┘
                  │
                  ▼
┌─────────────────────────────────────┐
│ Predict the results using machine    │
│         learning algorithm           │
└─────────────────────────────────────┘
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                  ▼
┌─────────────────────────────────────┐
│            Final result              │
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VII. CONCLUSION

All in all, the psychometric examination of understudies' scholastic exhibition on the web and disconnected learning conditions is a critical part of the instructive exploration. The use of psychometric frameworks and assessment tools can help to ensure the validity, reliability, and fairness of assessments, as well as provide insights into student learning and performance.

Studies on psychometric analysis of academic performance in online and offline learning environments have identified several challenges and opportunities associated with these modes of education. Some of the challenges include differences in internet connectivity, computer literacy, and test fairness and equity. At the same time, online learning offers benefits such as increased flexibility, accessibility, and cost-effectiveness.

Overall, the data indicate that using psychometric analysis in online and offline learning settings can assist to improve educational quality and student learning results. However, to guarantee that all students have equitable access to high-quality education, it is critical to overcome the obstacles and constraints connected with these modalities of education. Future research should continue to concentrate on the development of strong psychometric frameworks and evaluation tools that can be utilized effectively in both online and offline learning contexts.

VIII. REFERENCES

[1]   Padmalini Singh et al 2021 performed a survey of 100 people on the In India, a Comparative Study of the Effectiveness of Online and Offline Learning in Higher Education, Indonesia, and Malaysia.

[2]   Dr. Debasish Biswas of Chanchal Dey 2021 performed research on online vs. offline education, Opportunities, and Challenges in the Indian setting.

[3]   Preethi Sheba Hepsiba Darius 2021 polled 450 pupils regarding the efficiency of online teaching-learning techniques for university and college students.

[4]   Irfan, F. and Iman Hermawan Sastra, K. (2020). Teachers Elementary School in atas talian Learning of COVID-19 Pandemic Conditions. Jakarta. Jurnal Iqra'.

[5]   Mat Dawi, A.H., Theam, L. S., Palaniandy, M. and Dolah, J. (2016). Penerimaan Alat Web 2.0 dalam Pelaksanaan Kurikulum Program Berasaskan.

[6]   Wright, B. M. (2017). Blended learning, students' perception of face-to-face and online EFL lessons. Indonesian Journal of Applied Linguistics, 7(1), 64-71.

[7]   Wildana Wargadinata, Iffat Maimunah, Eva Dewi & Zainur Rofiq. (2020). Student's Responses on Learning in the Early COVID-19 Pandemic. Malang, Indonesia. Journal of Education and Teacher Training.

[8]   Abou El-Seoud, M., Taj-Eddin, I., Seddiek, N., El-Khouly, M., & Nosseir, A. (2014). E-learning and students' motivation: A research study on the effect of e-learning on higher education. International journal of emerging technologies in learning (iJET), 9(4), 20-26.

[9]   Yen, S. C., Lo, Y., Lee, A., & Enriquez, J. (2018). Learning online, offline, and in-between: comparing student academic outcomes and course satisfaction in face-to-face, online, and blended teaching modalities. Education and Information Technologies, 23(5), 2141-2153.

[10]   Zeeshan, M., Prabhu, A., Arun, C., & Rani, N. S. (2020, July). Fruit classification system using multiclass support vector machine classifier. In 2020 International Conference on Electronics and Sustainable Communication Systems (ICESC) (pp. 289-294). IEEE.

[11]   Akshay, S., & Ramesh, T. K. (2020, July). An efficient machine learning algorithm for smart irrigation. In 2020 International Conference on Communication and Signal Processing (ICCSP) (pp. 867-870). IEEE.

[12]   Xu, H., & Ebojoh, O. (2007). Effectiveness of online learning program: a case study of A higher education institution. Issues in Information Systems, 8(1), 160.

[13]   Sorina, G. V., Griftsova, I. N., & Yarmak, Y. V. (2019). The Information Era: Correlation Between Online and Offline Education. In The European Proceedings of Social & Behavioural Sciences EpSBS (pp. 1049-1054).

[14]   Samsuri, N. N., Nadzri, F. A., & Rom, K. B. M. (2014). A study on the student's perspective on the effectiveness of using e-learning. Procedia-Social and Behavioral Sciences, 123, 139-144.

[15]   Swan, K. (2007). Research on online learning. Journal of Asynchronous Learning Networks, 11(1), 55-9.

[16]   Sood, M., & Singh, V. (2014). E-Learning: Usage among Indian Students. Computer Science & Information Technology, 4, 1353-1360.

[17]   Nguyen, T. (2015). The effectiveness of online learning: Beyond no significant difference and future horizons. MERLOT Journal of Online Learning and Teaching, 11(2), 309-319.

[18]   Kose, U. (2010). A blended learning model supported with Web 2.0 technologies. Procedia-Social and Behavioral Sciences, 2(2), 2794-2802.