

Using Neural Networks to Analyze Teachers' Attitudes and Motivations Toward Student-Centered Learning-Based Curriculum in Timor-Leste

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ABSTRACT: This study explores the classification of teacher attitudes and motivations toward implementing a Student-Centered Learning (SCL)-based curriculum in Timor-Leste using a neural network approach. Teachers were categorized into three groups: Proactive, Moderate, and Resistant. Proactive teachers exhibit a high level of motivation and positive attitudes, actively overcoming obstacles to implement SCL. Moderate teachers require additional support, such as advanced training or incentives, to enhance their engagement and adapt to the curriculum. Resistant teachers show scepticism and prefer traditional teaching methods, often due to a lack of confidence and resources. The neural network model demonstrated high accuracy in identifying these patterns, with intrinsic motivation emerging as the dominant factor influencing teacher readiness. The findings highlight the necessity of targeted interventions to address challenges faced by resistant and moderate groups, including comprehensive training programs, administrative support, and innovative teaching aids. Additionally, this research underscores the importance of fostering intrinsic motivation and positive attitudes to enhance professional capacity and adaptability. These insights serve as a valuable resource for policymakers and educators aiming to optimize the implementation of SCL curricula, thereby improving educational outcomes in resource-constrained environments.

KEYWORDS: Student-Centered Learning (SCL), Neural Networks, Teachers' Attitude and Motivation, Curriculum Implementation

INTRODUCTION

In recent decades, student-centered learning (SCL) approaches have garnered significant global attention as a means of improving educational quality (Payton et al., 2022). SCL emphasizes students' active participation in the learning process, fostering independent exploration and the development of critical thinking skills. Its implementation has been promoted by various educational policies, including in developing countries such as Timor-Leste, which aim to enhance the quality of basic education (Kerimbayev et al., 2023). Education in Timor-Leste has undergone significant transformation in recent years. As part of post-conflict reconstruction efforts, a new SCL-based curriculum has been introduced to enhance student engagement and foster critical thinking skills (Owen & Wong, 2021a). However, the implementation of this approach faces substantial challenges, particularly in terms of teacher preparedness and the provision of adequate professional development support (Quinn, 2023). This context is crucial to understand, as the effectiveness of SCL is heavily contingent upon teachers' attitudes, motivation, and capacity to adopt and sustain this pedagogical shift (Cassity et al., 2023). Moreover, teachers play a pivotal role within the education system, and the success of any curriculum reform is intrinsically linked to their commitment and readiness to implement it effectively (Supermane et al., 2018).

The implementation of the SCL-based curriculum in elementary schools in Timor-Leste has revealed a spectrum of teacher attitudes and motivations. Teachers' responses range from enthusiastic acceptance to discomfort and resistance to this pedagogical shift (Owen & Wong, 2021a). A significant proportion of teachers view the SCL-based curriculum positively, recognizing its potential to enhance active student participation and foster critical and creative thinking skills. Those with favorable attitudes regard SCL as an opportunity to modernize teaching practices and align them with contemporary educational advancements. However, skepticism persists among some teachers, often attributed to challenges such as limited resources, inadequate infrastructure, and insufficient professional development opportunities. These constraints have led some educators to adhere to traditional teaching methods (Katawazai, 2021; Ngeno et al., 2021). Teacher motivation in adopting the SCL-based curriculum also exhibits considerable variation. Highly motivated teachers perceive SCL as a pathway to improving student autonomy and learning outcomes, demonstrating greater openness to innovation despite encountering obstacles (Ulker & Ali, 2023). Conversely,

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less motivated teachers are often reluctant to embrace this approach, citing unclear implementation guidelines and minimal institutional and governmental support as primary barriers (Martín-Del-Pozo et al., 2019)

This research is significant because teachers are the primary agents in implementing the SCL-based curriculum. Teachers with positive attitudes and high motivation can foster a conducive learning environment, enhance student engagement, and improve learning outcomes. In contrast, negative attitudes or low motivation among teachers can impede the effectiveness of the curriculum (Quinn, 2023). The research is driven by the critical need to understand teachers' attitudes and motivation in implementing the SCL-based curriculum in primary schools in Timor-Leste. To date, no comprehensive analysis utilizing machine learning techniques has been conducted to classify teacher attitudes and motivation regarding the adoption of the SCL-based curriculum. This gap poses a significant challenge in evaluating the curriculum's effectiveness (Pešková et al., 2019).

Analysing teachers' attitudes and motivation toward implementing the SCL-based curriculum is essential, given their pivotal role in fostering active student engagement in the learning process. Studies indicate that teachers with positive attitudes and high motivation are more likely to succeed in adopting student-centered pedagogical approaches (Quinn & Buchanan, 2022). Machine learning approaches, particularly neural networks, offer a robust framework for in-depth data analysis. These methods facilitate the identification of patterns in teachers' attitudes and motivation, thereby enabling the design of targeted and effective intervention strategies. By employing a neural network approach, this study provides empirical insights into the intricate relationships between teacher attitudes and motivation. These findings offer valuable contributions to policymakers, educational institutions, and teacher training programs in designing targeted interventions to support teachers in Timor-Leste. This aligns with prior research indicating that educational reforms emphasizing capacity building for school leaders and teachers can significantly enhance student learning outcomes (Owen & Wong, 2021a).

Teacher motivation plays a critical role in performance and is often shaped by supportive educational policies (Marques et al., 2020). Continuous professional development programs have proven effective in enhancing teaching quality and student outcomes, particularly in the context of implementing new curriculum in Timor-Leste (Cassity et al., 2023). Beyond professional development, fostering a collaborative environment and encouraging peer support have been shown to significantly boost teacher motivation and commitment to curriculum reforms, creating a positive ripple effect on overall school performance (Nguyen et al., 2022). Additionally, access to adequate teaching resources and infrastructure plays a pivotal role in enabling teachers to adopt and sustain innovative pedagogical approaches (Owen & Wong, 2021a). This research, utilizing neural network-based analysis, provides a robust framework for uncovering the complex relationships between teacher attitudes, motivation, and readiness to implement curriculum reforms. By identifying key motivational factors, such as intrinsic drive and administrative support, this approach enables policymakers to design interventions that directly address the specific needs and challenges faced by educators (Doménech-Betoret et al., 2020). The findings of this study offer significant potential to inform the development of strategic, tailored interventions by policymakers, educational institutions, and teacher training programs. Ultimately, these efforts aim to foster a more effective and equitable education system in Timor-Leste, supporting sustainable improvements in teacher readiness and curriculum implementation.

Previous research indicates that many teachers lack a comprehensive understanding of or full support for SCL, resulting in inconsistent implementation across schools (Quinn & Buchanan, 2022). Additionally, the absence of advanced neural network-based analyses to classify teacher attitudes and motivation towards SCL poses a significant barrier to evaluating the program's success. This study seeks to address these gaps by providing insights into how teacher attitudes and motivation influence the successful implementation of SCL in Timor-Leste (Chainey & Cassity, 2021). The primary aim of this research is to employ a neural network approach to analyse teachers' attitudes and motivation towards the SCL-based curriculum in Timor-Leste. This analysis is expected to generate robust empirical data to assess teacher readiness and identify their professional development needs (Yunus, 2018). Specifically, the research seeks to identify key factors that contribute to positive attitudes and high motivation, while offering actionable recommendations to enhance professional support for teachers in implementing SCL (Hoidn & Reusser, 2020)

The core focus of this study is on analysing the attitudes and motivation of elementary school teachers in Timor-Leste who are engaged in implementing the SCL-based curriculum (Carneiro, 2020). This analysis evaluates various dimensions of teacher attitudes and motivation, including their perceptions of SCL effectiveness, the availability of support, and the challenges encountered in applying this pedagogical approach (Al., 2023). The study will not extend to factors beyond the formal school environment, such as socio-economic influences on student motivation. This research is anticipated to make a significant contribution to the educational landscape in Timor-Leste by utilizing a neural network approach to analyse teacher attitudes and motivation. The findings aim to enhance the quality of education by supporting the implementation of an SCL-based curriculum in elementary schools. Through the analysis results, policymakers and educational institutions can make more informed decisions to provide targeted support for teachers, improving their attitudes and motivation then to develop more effective and tailored educational policies (Simonyan & Zisserman, n.d.).

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Student-Centered Learning (SCL) is a pedagogical approach that positions students at the core of the learning process, emphasizing the development of cognitive, affective, and social skills through active and collaborative learning experiences (Amin et al., 2020). SCL promotes student autonomy by encouraging learners to take responsibility for their own learning, actively participate in classroom activities, and collaborate effectively within teams. Empirical studies highlight the positive impact of SCL on fostering critical thinking and problem-solving skills (Gonzalez-Cacho & Abbas, 2022). Teachers play a pivotal role in the successful implementation of SCL, serving as the primary facilitators who guide and support students in independent learning. This study underscores that the success of SCL implementation heavily relies on the analysis of positive attitudes and motivation among teachers regarding curriculum reforms. Teachers with high motivation are generally more adept at adapting to new instructional methods and more inclined to innovate in the classroom (Almulla & Al-Rahmi, 2023). Analysing teacher motivation is a critical factor influencing the effectiveness of SCL implementation. Motivation can be enhanced through various means, including administrative support, access to professional development opportunities, and recognition of teaching achievements (Sangadji et al., 2022). Motivated teachers are more likely to embrace curriculum changes positively and confront the challenges associated with implementing SCL (Simonyan & Zisserman, 2021).

In the context of Timor-Leste, many primary school teachers face significant challenges in adapting to the SCL approach due to limited educational resources, inadequate training, and insufficient administrative support (Pedagog, 2021). Therefore, enhancing teacher motivation requires targeted support from schools and government bodies. To address this need effectively, the application of machine learning techniques, particularly neural networks, is crucial. These techniques can identify the factors that influence teachers' attitudes and motivation, thereby providing actionable insights to support the implementation of an SCL-based curriculum. Research demonstrates that teacher attitudes and motivation directly influence student learning outcomes. Wang and Holton (2020) found that teachers with positive attitudes and high motivation are more likely to create a conducive learning environment, ultimately enhancing student engagement and achievement (Pinto et al., 2023). Within the context of SCL, motivated teachers are better equipped to foster critical thinking, collaborative skills, and problem-solving abilities in students. Moreover, the effective implementation of SCL by highly motivated teachers has been shown to improve students' literacy and numeracy skills. As such, a deeper understanding of teacher attitudes and motivation through neural network analysis can inform the development of more effective strategies to enhance student learning outcomes in primary schools (Silva et al., 2021).

The application of machine learning approaches, particularly neural networks, is essential for evaluating teacher attitudes and motivation in the implementation of an SCL-based curriculum in Timor-Leste. Such analyses must encompass key dimensions, including teachers' perceptions of SCL benefits, the challenges they encounter during implementation, and the level of support they receive from educational institutions and the school environment (Martín-Del-Pozo et al., 2019). Comprehensive neural network analysis can not only assess teachers' readiness to implement SCL but also identify areas requiring further training or additional support (Doménech-Betoret et al., 2020). These insights are critical for designing targeted interventions to strengthen teacher capacity and enhance the effectiveness of SCL implementation. Artificial neural networks are computational models inspired by the structure and function of the human brain, designed to recognize patterns and process complex data. Over the past five years, research in this field has advanced rapidly, particularly in architecture, training algorithms, and applications (Kartowisastro & Latupapua, 2023). Significant progress has been observed in architectures such as Convolutional Neural Networks (CNN) and Recurrent Neural Networks (RNN), which have been optimized to enhance efficiency and accuracy (Simonyan & Zisserman, 2019). Additionally, training algorithms like backpropagation have been improved to accelerate convergence and reduce overfitting. Recent studies have also explored the use of optimizers such as Adam and RMSprop to enhance neural network performance (Elmas et al., 2016). The application of neural networks has extended across various domains, including image recognition, natural language processing, and time-series data prediction. In image recognition, CNNs have achieved high accuracy in classification and object detection tasks (Zou et al., 2020).

In the context of education, the application of machine learning approaches, particularly neural networks, is essential for evaluating teacher attitudes and motivation in implementing an SCL-based curriculum in Timor-Leste. Such analyses must encompass key dimensions, including teachers' perceptions of SCL benefits, the challenges they encounter during implementation, and the level of support they receive from educational institutions and the school environment (Moges, 2019). Comprehensive neural network analysis can not only assess teachers' readiness to implement SCL but also identify areas requiring further training or additional support (Trinidad, 2020). These insights are crucial for designing targeted interventions to strengthen teacher capacity and enhance the effectiveness of SCL implementation. Data collection methods such as questionnaires and surveys have proven effective in assessing teacher attitudes and motivation across various educational contexts. The data obtained from these instruments can be utilized as input for neural network algorithms to analyze patterns of teacher attitudes and motivation toward the SCL-based curriculum in Timor-Leste (Quinn, 2023). By employing a machine learning approach that is both valid and fit for purpose, this research aims to provide deeper insights into the challenges and opportunities associated with the implementation of SCL in this context (Garcia-Lopez et al., 2016).

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Evaluation metrics, such as Mean Squared Error (MSE) and other performance indicators, can be employed to ensure the neural network results are of high quality and aligned with the research objectives (Michelucci & Venturini, 2021). The application of neural networks in analyzing teacher attitudes and motivation offers a robust framework for identifying underlying data patterns. These insights will serve as a strong foundation for designing targeted strategies to support the effective implementation of the Student-Centered Learning (SCL) curriculum in Timor-Leste. In the context of this study, the analysis of teacher attitudes and motivation is conducted using a machine learning approach, specifically employing neural networks (Michelucci & Venturini, 2021). These neural networks facilitate the identification of patterns and relationships among teachers' attitudes and motivation without the need for prior factor analysis. This approach enables a data-driven analysis that uncovers groups of teachers with similar behavioral and motivational patterns, offering valuable insights into how support and professional development can be tailored to the specific needs of each group. By applying neural networks, the data can be processed efficiently to produce meaningful and relevant insights (Michelucci & Venturini, 2021).

Additionally, the results of neural network analysis can be evaluated using metrics such as MSE and regression performance metrics, which are instrumental in ensuring the quality of the analysis (Brownlee, 2021). This evaluation provides a solid foundation for developing more targeted intervention strategies tailored to the specific needs of each teacher group. This neural network approach offers deeper insights into teacher attitudes and motivation toward the SCL-based curriculum in Timor-Leste. Neural network analysis not only aids in understanding teacher needs but also provides structured insights that can enhance the effectiveness of SCL curriculum implementation (Owen & Wong, 2021a). By employing neural networks within a machine learning framework, this research contributes to the development of data-driven strategies aimed at improving support for and the overall effectiveness of SCL-based curriculum implementation in Timor-Leste.

I. METHOD

This research employs quantitative methods to analyze teacher attitudes and motivation toward the implementation of an SCL-based curriculum in elementary schools in Timor-Leste. Quantitative research was selected to obtain statistically measurable data regarding teachers' attitudes and motivation, which can subsequently be used to identify patterns that influence readiness and obstacles in the implementation of SCL through a machine learning approach, specifically utilizing neural networks.

The study population consists of elementary school teachers in Timor-Leste who have implemented an SCL-based curriculum. A sample of 100 teachers from 15 schools was selected, with 5 schools each from the eastern, central, and western regions of Timor-Leste. Purposive sampling was employed to specifically select participants who meet the criteria of having implemented the SCL-based curriculum. This sampling technique ensures that the data collected is both relevant and provides a comprehensive understanding of teacher attitudes and motivation toward the curriculum.

The data collection technique employed in this research was a survey instrument in the form of a questionnaire distributed to elementary school teachers in Timor-Leste. The questionnaire included statements designed to assess teachers' attitudes and motivation toward Student-Centered Learning (SCL). These statements covered various dimensions, such as teachers' understanding of the SCL-based curriculum, their comfort and acceptance of SCL, the implementation of SCL in the classroom, teaching goals and aspirations, teacher autonomy and initiative, persistence in overcoming challenges, and satisfaction with the teaching process.

Once the data was collected, a machine learning approach was used to analyze teacher attitudes and motivation toward the SCL-based curriculum. Neural network algorithms were applied to identify patterns in teacher attitudes and motivation based on the questionnaire data. This approach enables researchers to uncover relationships and dependencies between various factors, offering deeper insights into the challenges and opportunities influencing SCL implementation. Furthermore, evaluation metrics, such as Mean Squared Error (MSE) and regression accuracy, were utilized to assess the quality of the analysis, ensuring that the results accurately reflect meaningful data patterns.

II. RESULT

The following presents the results of a neural network analysis aimed at uncovering patterns of teacher attitudes and motivation regarding the implementation of a Student-Centered Learning (SCL)-based curriculum in Timor-Leste. The analysis demonstrates the model's ability to capture and represent complex relationships between variables. This study focuses on identifying patterns in teacher attitudes and motivation and their relationship to readiness for adopting this pedagogical approach.

The dataset for this study comprises data from 100 teachers across 15 elementary schools located in the eastern, central, and western regions of Timor-Leste. Six primary variables were analyzed: Positive Attitude, Negative Attitude, Neutral Attitude, Intrinsic Motivation, Extrinsic Motivation, and Lack of Motivation. To ensure data quality, outliers were addressed using the Winsorizing method with a trimming level of 5%, and all variables were standardized using the z-score method to maintain scale consistency and enhance the accuracy of the analysis.

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TABLE 1: SUMMARY OF NEURAL NETWORK ANALYSIS RESULTS

Results Section	Details
Data Processing	- Data consists of 6 main variables (Positive Attitude, Negative Attitude, Neutral Attitude, Intrinsic Motivation, Extrinsic Motivation, Lack of Motivation). - Outliers are addressed using Winsorizing (5%). - Data is standardized using the z-score method.
Model Architecture	6 neurons in the input layer, 2 hidden layers (2 neurons per layer), and 1 neuron in the output layer. - Activation function: Sigmoid. - Model output: Output score prediction.
Model Evaluation	Mean Squared Error (MSE): 0.000101389.
Visualization	- Network structure diagrams illustrate the relationships between input and output variables. - Network weights indicate that Intrinsic Motivation has the greatest influence on output predictions.
Prediction Results	- Prediction error is very small (± 0.03). - The model accurately predicts patterns of teacher attitudes and motivation.
Interpretation of Results	- Intrinsic Motivation and Positive Attitude significantly influence the successful implementation of SCL. - Negative Attitude and Lack of Motivation negatively impact the prediction score.
Implications	- The model helps identify teachers requiring additional support. - Insights from the model can inform the planning of training programs and policy interventions.

The neural network analysis results demonstrate that the model effectively predicts patterns of teacher attitudes and motivation toward implementing a SCL-based curriculum with a remarkably high level of accuracy. This is evidenced by the exceptionally low Mean Squared Error (MSE) value of 0.000101389, indicating a minimal error rate and the model's strong ability to accurately represent data patterns. The data preparation process was meticulously conducted, encompassing the selection of six key variables: Positive Attitude, Negative Attitude, Neutral Attitude, Intrinsic Motivation, Extrinsic Motivation, and Lack of Motivation. Additionally, the data underwent thorough pre-processing, including outlier management using the Winsorizing method and standardization through z-score normalization to ensure consistency in scale and enhance analysis accuracy.

The model architecture was designed to optimize performance, featuring six neurons in the input layer, two hidden layers each comprising two neurons, and a single neuron in the output layer. A sigmoid activation function was employed to effectively capture non-linear relationships among the variables, while a linear output activation was utilized to generate continuous predictions. To accommodate the complexity of the dataset, the maximum number of iterations (stepmax) was set to one million, ensuring that the model possessed adequate capacity to learn and represent intricate patterns. This comprehensive approach underscores the robustness and reliability of the neural network in analysing and predicting teacher attitudes and motivation.

The visualization and model evaluation results indicate that *Intrinsic Motivation* is the variable with the highest weight, highlighting its dominant role in predicting teacher readiness for implementing the SCL-based curriculum. Similarly, *Positive Attitudes* make a significant contribution by fostering successful implementation through their impact on encouraging pedagogical innovation. Conversely, the variables *Negative Attitude* and *Lack of Motivation* exhibit negative weights, indicating significant barriers to teacher readiness that require strategic interventions to address.

With an exceptionally low prediction error rate, the model demonstrates its capability to provide consistent and reliable results, making it a robust tool for advanced analysis and data-driven decision-making. Overall, the model's design offers comprehensive insights into patterns of teacher attitudes and motivation, thereby supporting the development of more effective intervention strategies to enhance readiness for implementing the SCL-based curriculum in Timor-Leste.

1. Neural Network Diagram

The network weight diagrams illustrate the strength and direction of connections between neurons. Higher weights indicate a more significant contribution of the input variable to the output, reflecting its relative importance in the prediction process.

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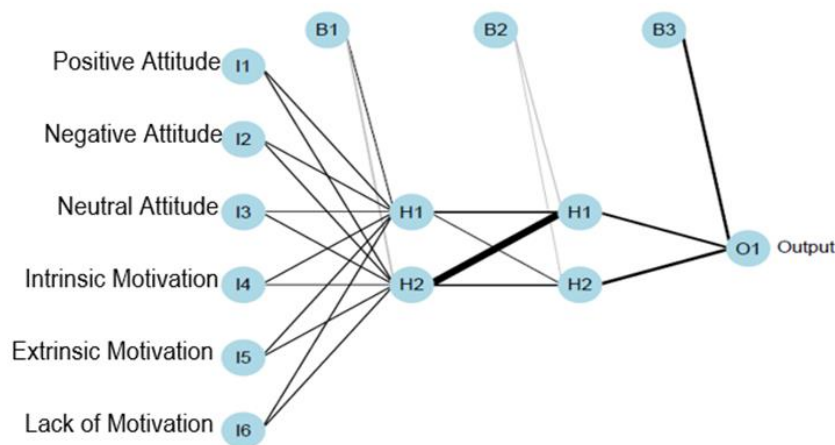


Figure 1. Neural Network Diagram

The neural network model depicted in this diagram is designed to capture the complex relationships between teacher attitudes and motivation in implementing a SCL-based curriculum. By modeling the relationships non-linearly, the model enables the identification of patterns that are challenging to detect using traditional statistical methods. The architecture comprises three main layers: an input layer with six neurons representing the key variables (*Positive Attitude*, *Negative Attitude*, *Neutral Attitude*, *Intrinsic Motivation*, *Extrinsic Motivation*, and *Lack of Motivation*), two hidden layers each containing two neurons, and a single neuron in the output layer.

The input layer receives data standardized using the z-score method to ensure scale consistency and analytical precision. The first hidden layer (H1 and H2) is responsible for processing non-linear interactions among the variables, capturing their complex interdependencies. The activations generated by H1 and H2 are passed to the second hidden layer (B1 and B2), which refines the patterns further before forwarding them to the output layer (O1). The output layer produces the final predicted total score, reflecting teachers' readiness to implement the SCL-based curriculum based on a combination of their attitudes and motivation.

2. Neural Network Diagram with Weight Visualization

The network weight diagrams illustrate the strength and direction of connections between neurons. Higher weights indicate a more significant contribution of the input variable to the output, reflecting its relative importance in the prediction process.

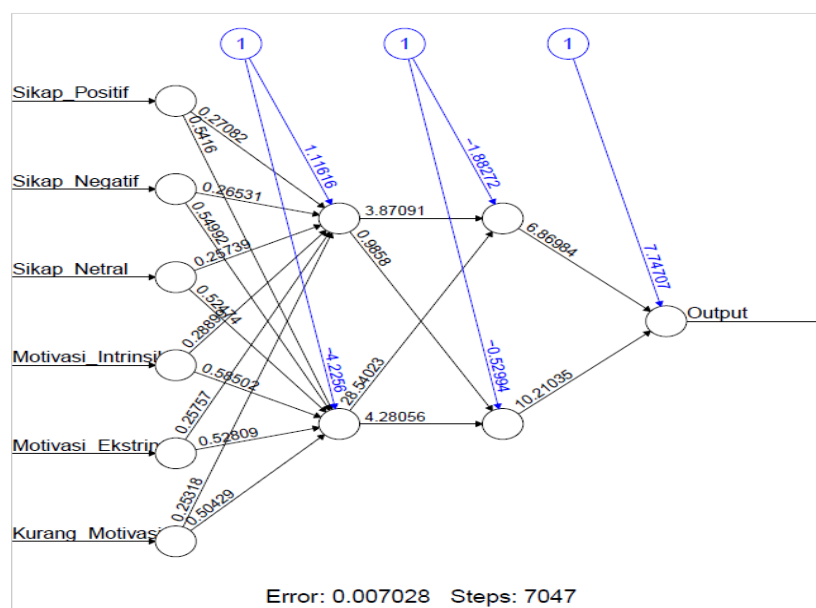


Figure 2: Neural Network Diagram with Weight Visualization

The neural network model depicted in the diagram comprises three primary layers: the input layer, hidden layers, and output layer. The input layer includes six neurons, each representing one of the key variables in the analysis: *Positive Attitude*, *Negative Attitude*, *Neutral Attitude*, *Intrinsic Motivation*, *Extrinsic Motivation*, and *Lack of Motivation*.

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Attitude, Neutral Attitude, Intrinsic Motivation, Extrinsic Motivation, and Lack of Motivation. Each neuron in the input layer processes standardized data to ensure scale consistency and enhance processing accuracy.

The hidden layers consist of two levels, each with two neurons, designed to capture non-linear relationships and manage the complex interactions among variables. The first hidden layer processes the input data and transmits the refined activations to the second hidden layer for further analysis. Finally, the output layer, which contains a single neuron, generates predictions in the form of a total score representing teacher attitudes and motivation, reflecting their readiness to implement a SCL-based curriculum.

The relationships between variables in this neural network model are represented by weights, illustrated through connecting lines between neurons. The weight analysis indicates that *Intrinsic Motivation* has the most significant influence, with a weight of 4.28056 directed toward neurons in the first hidden layer. This result underscores the critical role of internal factors, such as professional dedication and personal satisfaction, in enhancing teacher readiness. Likewise, *Positive Attitude* makes a notable contribution, with a weight of 1.1616, emphasizing the importance of an optimistic outlook in supporting the successful implementation of the SCL-based curriculum.

In contrast, variables such as *Negative Attitude* and *Lack of Motivation* exert negative influences, with weights of -4.2256 and -3.87091, respectively. These findings highlight the need to address psychological barriers and insufficient internal drive through strategic interventions to improve teacher readiness. The model demonstrates its reliability in capturing complex variable relationships, as evidenced by the minimal error value of 0.007028 achieved after 7047 iterations, indicating high efficiency and accuracy in model training. These findings provide a robust foundation for developing evidence-based policies to strengthen teacher readiness for the successful implementation of the SCL-based curriculum in Timor-Leste.

III. DISCUSSION

The findings of this research demonstrate that intrinsic motivation is the most dominant factor influencing teacher readiness to adopt a SCL curriculum. The high weight associated with this variable highlights the critical role of professional dedication and internal satisfaction in supporting the successful implementation of SCL. These results align with the study by (Almulla & Al-Rahmi, 2023), which emphasizes the importance of intrinsic motivation in strengthening teachers' commitment to pedagogical innovation. However, this success is also contingent upon teachers' willingness to embrace change, as evidenced by the significant weight associated with the Positive Attitude variable. An optimistic attitude not only fosters the adoption of innovative teaching methods but also cultivates a more interactive and engaging learning environment (Quinn & Buchanan, 2022).

Using a neural network approach, this study identified distinct patterns of teacher attitudes and motivation. The analysis revealed that teachers could be classified into three primary groups: Proactive Teachers, Moderate Teachers, and Resistant Teachers. Proactive teachers exhibit high levels of motivation and positive attitudes, actively exploring ways to implement SCL even in the face of challenges. Conversely, resistant teachers display scepticism toward new approaches and often prefer traditional teaching methods due to a lack of confidence or self-efficacy. The moderate group, while displaying some level of motivation, requires additional support, such as advanced training programs or targeted incentives, to further enhance their readiness and engagement with SCL (Harris & Jones, 2010; Webb et al., 2021)

Conversely, barriers identified through neural network analysis, such as negative attitudes and lack of motivation, warrant special attention. The negative weights associated with these variables indicate that psychological obstacles and insufficient external support can impede teachers' readiness to adopt SCL. Research by Nguyen et al., (2022) confirms that teachers with a sceptical attitude toward change often lack confidence in implementing new methods, particularly when educational resources are scarce. Addressing these challenges requires targeted interventions, such as practice-based training focused on SCL application techniques. Practical training programs can significantly enhance teacher confidence, while the provision of interactive learning resources is essential, especially in remote areas (Owen & Wong, 2021). Additionally, stronger administrative support, including effective supervision and incentive policies for teachers who successfully implement SCL, can mitigate resistance and foster greater motivation among teachers to innovate and embrace curriculum reforms.

The visualization of weights in neural networks offers profound insights into the relationships between variables that are often challenging to capture using traditional statistical methods. Through this analysis, researchers were able to uncover underlying patterns that influence teacher readiness for the implementation of SCL. As highlighted by (Doménech-Betoret et al., 2020), neural network-based approaches facilitate the evaluation of complex interrelationships among factors, providing a robust foundation for developing more targeted intervention strategies. Furthermore, the low Mean Squared Error (MSE) value observed in this model reflects its high predictive accuracy, underscoring its effectiveness in representing the intricate relationships between variables (Pinto et al., 2023). The neural network analysis also revealed that *Intrinsic Motivation* held the highest weight (4.28056), reinforcing the pivotal role of professional dedication in enhancing teacher readiness for SCL implementation. Conversely, *Negative Attitude* and *Lack of Motivation* emerged as significant barriers, with negative weights of -4.2256 and -3.87091, respectively. These findings emphasize the critical need for addressing psychological obstacles and motivational deficits

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through well-designed, evidence-based interventions to improve teacher readiness and support the successful adoption of SCL methodologies.

The practical implications of this research are highly relevant for policymakers and educational institutions in Timor-Leste. The findings highlight that practice-based training, non-financial incentives, and robust administrative support are effective strategies for enhancing teachers' motivation and attitudes toward SCL-based curriculum. For instance, the study by Boudouaia et al. (2024) demonstrates that interventions aimed at improving teacher capacity through practical training can significantly accelerate the implementation of curriculum reforms. Furthermore, the importance of providing adequate educational resources, such as interactive learning technologies, has been emphasized by Owen & Wong, (2021), who found that the availability of comprehensive facilities plays a critical role in supporting teacher readiness.

Using the neural network model developed in this research, teachers can be classified effectively into groups based on their attitudes and motivation, providing a strong foundation for evidence-based policymaking. This classification enables the design of targeted intervention strategies to address specific needs, ensuring the successful implementation of SCL-based curriculum reforms in Timor-Leste. These insights offer actionable recommendations for strengthening the educational framework and fostering teacher readiness to embrace innovative pedagogical approaches.

IV. CONCLUSION

This research successfully identified intrinsic motivation as the primary factor influencing the successful implementation of a Student-Centered Learning (SCL)-based curriculum in Timor-Leste. With the highest weight assigned to this variable in the neural network model, the findings underscore the critical role of teachers' professional dedication and personal satisfaction in driving educational transformation. Additionally, teachers' positive attitudes were found to significantly contribute to success, demonstrating that an optimistic perspective on the curriculum can enhance the acceptance of innovative teaching methods. Conversely, variables such as negative attitudes and lack of motivation negatively impacted readiness, highlighting barriers that require targeted interventions. These barriers can be addressed through additional training, robust administrative support, and incentive-based strategies. The neural network model employed in this study demonstrated high predictive accuracy, as evidenced by a remarkably low Mean Squared Error (MSE), reflecting its effectiveness in capturing complex interrelationships among variables.

Practically, the findings of this research offer actionable solutions for policymakers and educational institutions to optimize the implementation of an SCL-based curriculum. Interventions aimed at enhancing intrinsic motivation and fostering positive attitudes—through practice-based training, the provision of interactive learning resources, and non-financial incentives—can significantly accelerate educational transformation. The visualization of neural network weights provides profound insights into the relationships between variables, facilitating the identification of specific teacher needs. By adopting this data-driven approach, policy development can be more effectively tailored to support teachers across different categories, including those who are moderate or resistant to change. This research not only contributes valuable theoretical insights but also serves as a foundation for evidence-based strategic decision-making. These findings are critical for improving teacher readiness and effectiveness in implementing the SCL curriculum, ultimately supporting the broader goal of educational advancement in Timor-Leste.

CONFLICT OF INTEREST

The author declares that there is no conflict of interest in the publication of this research. All contributions are made with complete academic independence, with no financial or personal relationships that could influence the results or interpretation of this research.

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