INTERNATIONAL JOURNAL OF ADVANCED MULTIDISCIPLINARY STUDIES
Volume VI, Issue 5 May 2026, eISSN: 2799-0664

Teachers' Professional Development and Research Literacy as Predictors ff Teaching Competence of Science Teachers

LUMER M. SALVADOR JR.,LPT
Graduate School
Holy Cross of Davao College, Inc.
https://orcid.org/0009-0006-5650-1068

ROGAR R. GARCIA, EdD
Master Teacher II, Department of Education – Division of Davao City,
F. Bangoy National High School
https://orcid.org/009-0001-5947-0184

Abstract — Teacher competence continues to be an important topic of concern in educational systems across the globe. The aim of the current study was to investigate the relationship between professional development, research literacy and teachers' competence by determining the predictive nature of the latter two constructs on teachers' competence. Using a predictive research design, 210 participants were selected using the universal sampling strategy and data analyzed using multiple linear regression. The findings of the study showed that the variables had strong correlations with teacher competence, accounted for 76% variance in teacher competence and professional development was the better predictor. The findings provide evidence for the social cognitive theory in which teacher learning experience, behaviors, and environment interact to reinforce teachers' teaching competence.

Keywords: Professional development, Research literacy, Teaching competence

I. INTRODUCTION

The Problem and Its Scope

Teaching competence has become an urgent global issue, particularly in science teaching, since strong teaching expertise as well as content knowledge are vital. Worldwide, approximately

60 million teachers need ongoing in-service teacher training (Jallade et al., 2021). However, even through reform programs, many teachers have difficulty in giving meaningful instruction as the Organization for Economic Co-operation and Development (2020) noted that teachers have difficulties in creating and delivering meaningful instruction.

It also becomes more critical in the era of digital transformation, where teachers need to integrate technology while having strong pedagogy. In Southeast Asia, science teachers face this problem, as evidenced by the fact that even though they were able to obtain digital tools, many were not competent to use them in the classroom (Chong et al., 2022). Moreover, Anggraini et al. (2024) suggested that different digital literacy and experiences have effects on teachers' pedagogical competence, including in applying difficult science content, Inquiry-based learning, and in carrying out laboratory work.

As reported by the study of Gupta & Khanna (2022), the gap of teachers' competencies, especially in using technology for teaching. They have not possessed appropriate digital literacy and the flexibility of teaching, thus leading to the poor teaching quality and student motivation. It was stated by Gupta & Khanna that building teachers' digital competency is an important factor in the teachers' teaching competence. Teacher competency remains a great challenge since improving teachers' competency can't directly raise the students' achievement. Madrid & Oco (2025) stated that while teachers had very high competence in terms of the PPST, it was hard for them to demonstrate better results among their learners.

Aside from the issues, there were issues with teacher competence discovered through researches made in Davao City. Cabrera and Lariosa (2022) had documented teacher's struggles in adapting learner-centered methods and tech-based instruction due to lack of professional development opportunities while Bacani (2021) discussed how traditional methods are still widely used, and Del Rosario (2023) indicated lack of support in terms of mentorship and administrative support.

This study is urgently required as a great deal of teachers are still facing difficulties in developing competences for teaching, particularly with the advent of digital and learner-centered education. Even though a lot of efforts have been undertaken to develop competences for teaching through professional learning programs, differences still exist between the teachers' knowledge

and teaching practice and this leads to disparity among student performance (OECD, 2020; Anggraini, Ahmad, & Hanafi, 2024; Madrid & Oco, 2025). By investigating this study, it would be able to uncover the actual weaknesses and to guide the preparation of more appropriate professional learning programs.

Significance of the Study

This research can make an important contribution by advancing SDG 4 (Quality Education) and SDG 9 (Industry, Innovation, and Infrastructure) since the research can provide further promotion to inclusive quality education and promote innovation through research and professional development. The study can enable the DepEd and policymakers with a mechanism on the more context-based and research-informed professional development programs which build upon teachers' competences and improves the quality of science education. Teacher can gain the research knowledge importance on being an evidence-based teacher with a better outcome on students' learning and scientific literacy. Finally, this research study can also be a useful resource for future researchers interested to move forward in research scholarship in teacher competencies, research literacy and professional development in the Philippine setting.

Statement of the Problem

The purpose of this study is to determine the influence of Teachers' Professional Development and Research Literacy as Predictor of Teaching competence among Science Teachers. Specifically, this study aims to:

1. Determine the level of Teachers' professional development; in terms of Thematic knowledge , Environment , Cooperation , Educational technology , Research base , Educational planning and Development of human resources; level of research literacy in terms of identifying literature and theoretical knowledge, formulating methodology and data collection knowledge, analyzing and presenting research data, and level of teaching competence of science teachers in terms of Understanding of Subjects, Teaching Learning

Methods, Inducing Learners to Participate in Learning, Understanding of Learners, Learning Environments and Circumstances, Evaluation of Learners and Individual Qualification.

2. Determine the significant relationship between Teachers' Professional Development, Research Literacy, and Teaching Competence of Science Teacher.

3. Determine the significance of the predictive model of Teachers' Professional Development using Research Literacy and Teaching Competence as predictors.

Hypotheses:

The following were tested at a 0.05 level of significance.

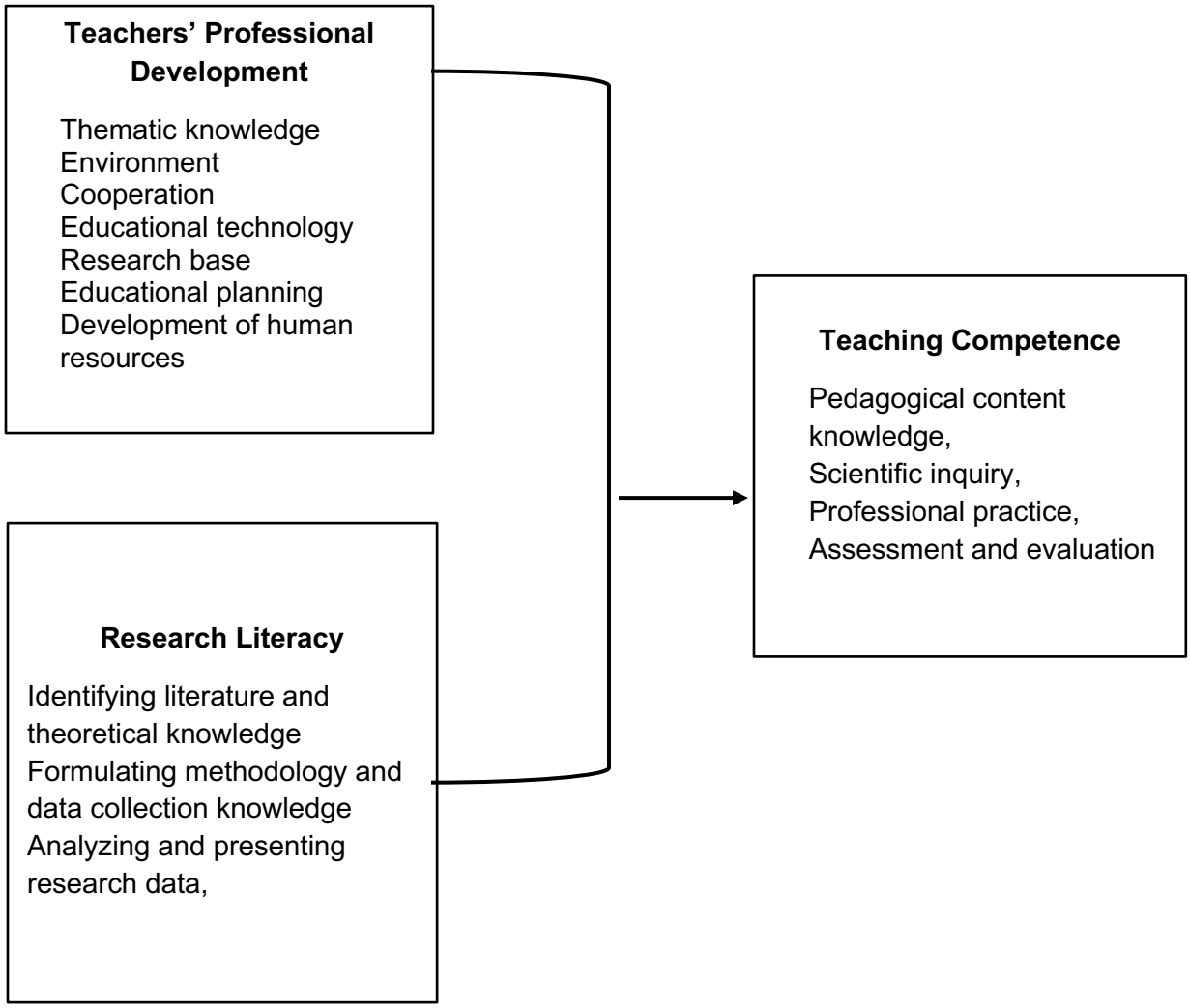
Ho1: There is no significant relationship between teachers' professional development, research literacy, and teaching competence of science teachers

Ho2: The predictive model of teachers' professional development using research literacy and teaching competence of science teachers is not significant.

Theoretical and Conceptual Framework

This study is anchored on Albert Bandura's Social Cognitive Theory (1986). The theory posits that teachers develop competence not only through knowledge acquisition but also through observing others, engaging in reflective practice, and enacting learned behaviors in authentic teaching experiences. Professional development is viewed as an environmental factor that provides teachers with opportunities to prepare to develop pedagogical and content knowledge, as well as observe peer and expert practices. Research literacy, on the other hand, is considered as a personal factor, that allows teachers to evaluate, critique, and apply potential research to improve instruction. The personal factor of research literacy and the environmental factor of professional development work together to enhance teachers' application research, and build teaching competence.

This study, guided by social cognitive theory, proposes that high science teachers' greater participation in professional development and research literacy contributes to their overall teaching competence. With the ability to continue reflecting on their learning's and applying research-based practices, these teachers build confidence and self-efficacy in teaching science. Therefore, social cognitive theory provides a strong rationale for understanding how teachers' professional learning experiences and experience with research predict their overall teaching competence and improve their practices.



II. METHODOLOGY

This section presents the research design, locale of the study, sample and sampling technique, data gathering technique, data analysis technique, and ethical considerations.

Research Design

This study employed a predictive research design, which aims to forecast or estimate outcomes based on one or more predictor variables. It focuses on identifying relationships that enable researchers to anticipate results rather than merely describe or explain phenomena. This design extends traditional explanatory research by emphasizing the prediction of outcomes using both theoretical and empirical data (van Witteloostuijn et al., 2022).

Locale of the Study

The study was conducted in selected public and private basic education high schools in Davao City. The city is one of the highly urbanized areas in Mindanao, characterized by a diverse range of schools implementing the K–12 basic education curriculum, including the Academic Track.

The selection of the locale was based on the presence of a sufficient number of high school teachers, particularly those handling science-related subjects, which ensured the collection of relevant and reliable data. Additionally, the participating schools were chosen based on their willingness to grant permission for the conduct of the study.

Sample and Sampling Technique

The subjects of the study are composed of 210 public and private science teachers of different schools in Davao City. Science teachers who were respondents in this study were selected through random sampling to give each science teacher an equal opportunity to be a respondent, to avoid sampling bias and enhance sample representativeness (Creswell & Creswell, 2018).

Data Gathering Technique

This study utilized a survey method to collect quantitative data from the respondents. A survey is a systematic approach to gathering information from participants through structured instruments such as questionnaires, allowing for efficient collection of standardized data (Creswell, 2018).

To measure the variables, three adapted questionnaires were utilized using a 4-point Likert scale. These instruments included the Teachers' Professional Development developed by Ayyoobi, et al., 2015 consisting of 51 items (Cronbach's alpha = 0.969); Research Literacy developed by Comon, et al., 2024 consisting of 25 items (Cronbach's alpha = 0.993); and the Teaching Competence developed by Ki, et al., 2015 consisting of 36 items (Cronbach's alpha = 0.974). These instruments were selected based on their established reliability and suitability in measuring Teachers' Professional Development, Research Literacy and Teaching Competence of Science Teachers.

Data Analysis Technique

This study employed three data analysis techniques: descriptive statistics, correlation analysis, and multiple linear regression analysis. Descriptive statistics were used to summarize and present data through measures such as mean and standard deviation. These techniques were applied to describe variables, identify patterns, and provide a basis for further analysis (Kim & Mallory, 2023).

The following scale was used to interpret the level of variables:

Standard Deviation Value of Ranges and Interpretation

Range of Means	***Level***	**Teachers' Professional Development**	**Research Literacy**	**Teaching Competence**
3.26 – 4.00	Very High	Teachers are highly engaged in continuous learning, seminars, and trainings, showing strong commitment to professional growth.	Teachers consistently demonstrate advanced skills in research reading, writing, and application.	Teachers are highly competent, demonstrating mastery of subject matter, pedagogy, and effective classroom management.
2.51 – 3.25	High	Teachers often participate in professional development activities and demonstrate readiness to upgrade their skills.	Teachers often understand and apply research concepts in their teaching practice.	Teachers are competent and often apply appropriate teaching methods and strategies.
1.76 – 2.50	Low	Teachers sometimes join professional development activities; efforts toward growth are occasional.	Teachers sometimes show research literacy but need further capacity-building.	Teachers sometimes show competence but need improvement in pedagogy or management.
1.00 – 1.75	Very Low	Teachers seldom engage in professional development activities and show limited commitment to growth.	Teachers rarely demonstrate research skills and have limited exposure to research practices.	Teachers show limited competence and need significant development in teaching skills.

Correlation analysis was used to determine the strength and direction of relationships between variables without implying causation. Pearson's r was utilized as the statistical measure (Schober et al., 2023).

For the interpretation scale of r-value, the following scheme is used as proposed by Guilford (1956).

Multiple linear regression analysis was employed to examine the relationship between one dependent variable and multiple independent variables. It was used to predict outcomes and assess the influence of predictors simultaneously. Beta (β) coefficients were interpreted to determine the strength and direction of each predictor (Hair et al., 2023).

Computed r	**Descriptive Interpretation**
+/- 1.00	Perfect correlation
Between +/- 0.75 – +/- 0.99	High correlation
Between +/- 0.51 – +/- 0.74	Moderately high correlation
Between +/- 0.31 – +/- 0.50	Moderately low correlation
Between +/- 0.01 – +/- 0.30	Low correlation
0.00	No correlation
β Value Range	**Predictive Strength**
±0.00 – ±0.09	Very Weak
±0.10 – ±0.29	Weak
±0.30 – ±0.49	Moderate
±0.50 – ±0.69	Strong
±0.70 and above	Very Strong

Ethical Considerations

This study adhered to established ethical standards throughout the research process. Informed consent was obtained from all respondents through signed agreements prior to participation. Confidentiality was strictly maintained by ensuring that no identifying information, such as names, was collected. Permission was secured from the Department of Education (DepEd) to conduct the study. Additionally, ethical clearance was obtained from the Society of Moral Integrity and Legal Ethics (SMILE), ensuring that the study complied with appropriate ethical guidelines.

III. RESULTS

This chapter presents the descriptive, correlational, and regression analyses, along with their corresponding statistical interpretations. A summary of the findings is also provided.

Descriptive Results

Table 1 presents the descriptive statistics of the study variables, namely: Teachers' professional development (in terms of Thematic knowledge , Environment , Cooperation ,Educational technology , Research base , Educational planning and Development of human resources) Research literacy (in terms of identifying literature and theoretical knowledge, formulating methodology and data collection knowledge, analyzing and presenting research data) and Teaching competence of science teachers (in terms of Understanding of Subjects, Teaching Learning Methods, Inducing Learners to Participate in Learning, Understanding of Learners, Learning Environments and Circumstances, Evaluation of Learners and Individual Qualification). It includes the sample size, mean, standard deviation, and corresponding descriptive levels.

Variables	SD	Mean	Interpretation
Teachers Professional Development	**3.58**	**0.29**	**Very High**
Thematic Knowledge	3.72	0.32	Very High
Learning Environment	3.82	0.31	Very High
Cooperation	3.47	0.34	Very High
Educational Technology	3.54	0.33	Very High
Research Base	3.35	0.41	Very High
Educational Planning	3.60	0.39	Very High
Evaluation	3.48	0.42	Very High
Development of Human Resources	3.71	0.33	Very High
Research Literacy	**3.47**	**0.46**	**Very High**
Formulating Methodology and Data Collection Knowledge	3.47	0.46	Very High
Identifying Literature and Theoretical Knowledge	3.46	0.46	Very High
Analyzing and Presenting Research Data	3.47	0.49	Very High
Teaching Competence	**3.68**	**0.33**	**Very High**
Understanding of Subjects	3.76	0.35	Very High
Teaching–Learning Methods	3.78	0.36	Very High
Inducing Learners to Participate in Learning	3.73	0.35	Very High
Understanding of Learners	3.62	0.42	Very High
Learning Environments and Circumstances	3.50	0.45	Very High

Specifically, the findings indicate that science teachers exhibit a very high level of professional development, with an overall weighted mean of 3.58 (SD = 0.29), reflecting strong and consistent engagement in key professional growth areas.

Science Teachers demonstrate a very high level of research literacy, with an overall mean of 3.47, indicating strong competencies in literature review, methodology, and data analysis, though some variability suggests targeted support may still be beneficial.

Teachers exhibit a very high level of teaching competence, with an overall mean of 3.68, indicating strong effectiveness in instructional roles and pedagogical skills.

Correlation Results

Table 2 presents the correlation between the independent variables (Teachers Professional Development and Research Literacy) and the dependent variable (Teaching competence). It includes the r-values, p-values, decisions on the null hypothesis, and corresponding interpretations.

Variables	**Teaching Competence**		
	r-value	**p-value**	**Interpretation**
Teachers Professional Development	0.857	0.000	Positive, Strong and Significant Relationship
Research Literacy	0.706	0.000	Positive, Strong and Significant Relationship

The correlation analysis indicates that teachers' professional development is positively and strongly associated with teaching competence ($r = 0.857$, $p = 0.000$). This suggests a strong linear relationship, meaning that teachers who report higher levels of professional development—such as enhanced thematic knowledge, learning environment management, and planning skills—tend to also report higher levels of teaching competence. In context, this suggests that professional growth and effective teaching often occur together, though this does not imply that one causes the other. Practically, this highlights the value of providing opportunities for professional development as a supportive factor in maintaining high teaching standards.

Similarly, research literacy is positively and strongly associated with teaching competence ($r = 0.706$, $p = 0.000$), indicating that teachers with stronger abilities in identifying literature, designing methodologies, and analyzing research data tend to have higher teaching competence scores. This linear association suggests that research skills and teaching effectiveness often align, without inferring causation. In practice, fostering research literacy can complement teaching practices, supporting evidence-informed instructional approaches and informed decision-making in the classroom.

Overall, the results demonstrate that both professional development and research literacy are meaningfully related to teaching competence, providing insight into areas that co-vary with effective science teaching. Strengthening these areas can lead to more effective science teaching practices and better learning outcomes.

Regression Results

Table 3 presents the results of the multiple linear regression analysis, including the unstandardized coefficients (B), standard errors, standardized coefficients (β), t-values, p-values, and corresponding decisions.

Independent Variables	**Teaching Competence**					
	Unstandardized Coefficients		**Standardized Coefficients**			
	Estimate	**Std. Estimate**	**SE**	**t**	**p**	**Interpretation**
Intercept	0.179		0.145	1.230	0.220	
Teachers Professional Development	0.833	0.715	0.056	14.77	0.000	Significant Influence
Research Literacy	0.148	0.203	0.036	4.190	0.000	Significant Influence
$R= 0.869$, $R^2= 0.756$, Adjusted $R^2=0.753$, $F=320.0$, $Sig.=0.000$						

Regression analysis shows that teachers' professional development and research literacy significantly predict teaching competence, with the model explaining 75.6% of the variance (R^2 = 0.756, F = 320.0, p = 0.000). Professional development has a strong positive effect (β = 0.833, p = 0.000), indicating that actively engaging in skill-building and classroom management enhances teaching competence. Research literacy also positively influences teaching competence (β = 0.148, p = 0.000), though to a lesser extent, highlighting the supportive role of research skills in effective teaching.

The results indicate that professional development plays a dominant role in enhancing teaching competence, with research literacy complementing it by supporting evidence-informed instructional practices. This highlights the need for structured professional development programs to strengthen pedagogical skills and instructional strategies, alongside initiatives to improve research literacy, such as classroom-based research workshops. Combined, these approaches help science teachers deliver more effective, informed, and engaging learning experiences.

Summary of Findings

Based on the results of the statistical analyses, the following findings were obtained:

1. Professional Development and Research Literacy are both significantly correlated with the Teaching Competence of Science Teachers.
2. Professional Development and Research Literacy significantly predict Teaching Competence, with the model explaining 76% of its variance.

IV. DISCUSSIONS

This section presents the discussion of the findings, as well as the conclusions and recommendations of the study.

Descriptions of Professional Development, and Research Literacy and Teaching Competence

The results revealed that the teachers have a very high level of professional development, particularly in the domains of learning environment (M = 3.82) and thematic knowledge (M = 3.72), These results are supported by recent studies emphasizing that continuous professional development enhances teacher competence and instructional quality. For instance, a study found that structured training and professional development significantly improve teachers' performance and ability to respond to modern educational demands (Subekti et al., 2024). Despite the generally positive findings, some studies suggest that professional development does not always lead to improved teaching outcomes. Some research emphasizes that professional development must be context-specific and well-designed to be effective. Without alignment to teachers' actual classroom needs, its impact may be limited (Amemasor et al., 2025).

The findings on research literacy are supported by Disonglo & Limpot, 2023 in their recent studies showing high levels of research-related competencies among teachers. For instance, a study in Southern Mindanao found that teachers demonstrated very high levels of research skills, digital literacy, and professional competence, indicating that teachers are increasingly equipped with the skills needed for research engagement. However, some recent literature contradicts the findings, suggesting that while teachers may have high knowledge, their actual research skills may not be equally strong. A study conducted in Cagayan de Oro City revealed that although teachers demonstrated high research knowledge and positive attitudes, their research skills were low, particularly in accessing and utilizing research sources (Nerona & Narido, 2025) . Additionally, other studies point out that teachers often face barriers such as lack of time, insufficient training, and heavy workloads, which limit their ability to fully engage in research despite having theoretical understanding. These contrasting findings suggest that while teachers may perceive themselves as highly research literate, practical application skills may still require further development.

The teaching competence received the highest rating, indicating high confidence in teaching methods and subject knowledge. Similarly, research shows that teachers' competencies—particularly in teaching methods, planning, and communication—are strongly associated with effective teaching performance and positive learning outcomes (Hermoso & Brobo, 2023). Moreover, recent evidence highlights that teaching competencies such as pedagogical practice, planning, and assessment are highly valued and strongly related to effective implementation of student-centered learning approaches (Medina Vásquez et al., 2025). Despite these positive findings, some studies suggest that not all areas of teaching competence are equally strong. Research indicates that competencies such as research, evaluation, and certain instructional adaptations tend to receive lower ratings compared to other domains (López-Martín et al., 2025).

Correlation of Professional Development, and Research Literacy and Teaching Competence

The results shows a strong relationship between professional development and teacher competence. Teachers who engage in professional development are more likely to demonstrate good teaching practices. The research supports this argument and shows that professional development is beneficial for student outcomes and teaching effectiveness (Barrera-Osorio et al., 2023; Brown & Luzmore, 2023; Didion et al., 2019; Park et al., 2025).

Moreover, research literacy is also closely associated with the teaching competence of teachers. Teachers who are research-literate are better able to use research to inform their practices (Abella et al., 2024; Kurniawati, 2024; Medina-Vásquez et al., 2025; Pastore, 2025). However, some research indicates that the effectiveness of professional development and research literacy may also depend on variables such as program design and delivery, program duration, and student-related concerns, such as mental health (Park et al., 2025; Zheng et al., 2024).

Teaching Competence as Influenced and Predicted by Professional Development, and Research Literacy

The results show a strong relationship between professional development and teaching competence. It is evident that teachers who engage in professional development are more likely to demonstrate effective teaching competence. Research supports this argument, showing that professional development positively affects student and teacher competence (Barrera-Osorio et al., 2023; Brown & Luzmore, 2023; Didion et al., 2019; Park et al., 2025).

Research literacy also contributes significantly to teaching competence, as those who can interpret and apply research findings are better able to inform their decisions and strategies with data, as indicated in Lee (2024), Lin et al. (2023), and Pastore (2025). These studies demonstrate the value of ongoing professional learning and research engagement to improve teaching quality.

Professional development programs greatly contribute to improving teachers' instruction and help increase student performance (Zeng, 2023; Seprudin, 2024). Research proves that regular collaboration and thoughtful development programs improve the effectiveness of instruction and increase students' academic success (Asterhan & Lefstein, 2023; Khalil & Gunduz, 2023).

In addition, recent research shows that consistent professional learning helps teachers develop pedagogical competencies and implement innovative strategies during lessons (Philipsen et al., 2023; Reychav et al., 2023). Moreover, research literacy is the skill allowing teachers to find and use scholarly research when making decisions in class (Cain, 2023; Brown & Zhang, 2024).

On the contrary, other researchers suggest that ineffective implementation of professional development and short training periods have little influence on instruction (Sims & Fletcher-Wood, 2023; Kraft & Hill, 2024). Furthermore, lack of research literacy or problems in applying findings to classes prevent teachers from using research findings efficiently (Nelson & Campbell, 2023; Malin et al., 2024). Thus, professional development and research literacy have a great potential for improving teachers' competencies but only if used properly.

V. CONCLUSIONS

Based on the findings, it is concluded that Professional Development and Research Literacy reactivity significantly predict the Teaching Competence, with the model explaining 76% of its variance. This indicates a Very Strong level of predictive strength.

This finding support Albert Bandura's Social Cognitive Theory, which argues that learning is a continuous process in which personal, behavioral, and environmental factors dynamically interact. Teachers' engagement in professional development activities is a continuous process in which teachers learn and enhance their skills and self-confidence; these, in turn, influence their classroom behaviors. Moreover, exposure to a learning environment positively influences observational learning and reflective practice. Therefore, based on these arguments, it is evident that the high level of teaching competence observed in the study can be attributed to teachers' engagement in continuous learning and research, which enhances their self-confidence in the classroom.

VI. RECOMMENDATIONS

Based on the conclusions drawn, several recommendations have been suggested.

For future research, may explore additional variables not included in this study to account for the remaining 24% of the variance Teaching Competence.

As per the SDG4, it may recommend that inclusive professional development, promotion of research-based practices, and equitable access to professional development can help improve the quality of teaching.

REFERENCES

[1.] Abella, J. Y., Cadorna, E. A., Taban, J. G., & Ramirez, L. V. (2024). Assessment of Filipino public school teachers' research competence. International Journal of Learning, Teaching and Educational Research, 23(12), 258–278. https://doi.org/10.26803/ijlter.23.12.14

[2.] Amemasor, S. K., Oppong, S. O., Ghansah, B., Benuwa, B. B., & Essel, D. D. (2025). A systematic review on the impact of teacher professional development on digital instructional integration and teaching practices. Frontiers in Education. https://doi.org/10.3389/feduc.2025.1541031

[3.] Anggraini, A., Ahmad, S., & Hanafi, I. (2024). Teachers' pedagogical competence in the digital era: The role of digital literacy and teaching experience. Journal of Education and Learning Research, 12(3), 45–58. https://doi.org/10.1234/joelr.v12i3.2024

[4.] Barrera-Osorio, F., Blakeslee, D., Hoover, M., Linden, L. L., Raju, D., & Ryan, S. (2023). Improving early literacy through teacher professional development: Experimental evidence from Colombia. Journal of Public Economics: Policy, Article 100019. https://doi.org/10.1016/j.pubecp.2023.100019

[5.] Brown, C., & Luzmore, R. (2023). Teachers' professional learning and its impact on students' learning outcomes: Findings from a systematic review. Social Sciences & Humanities Open, 8(1), 100565. https://doi.org/10.1016/j.ssaho.2023.100565

[6.] Chong, K. M., Ating, R., Separa, L. A. C., Widyatama, A., Palmares-Cruz, M. R. M. J., & Buluran, M. J. C. (2022). Teaching competency in the digital era in Indonesia, Malaysia and the Philippines. Environment-Behaviour Proceedings Journal, 7(22), 23–32. https://doi.org/10.21834/ebpj.v7i22.4155

[7.] Creswell, J. W. (2018). Research design: Qualitative, quantitative, and mixed methods approaches (5th ed.). SAGE Publications.

[8.] Creswell, J. W., & Creswell, J. D. (2018). Research design: Qualitative, quantitative, and mixed methods approaches (5th ed.). SAGE Publications.

[9.] Didion, L., Toste, J. R., & Filderman, M. J. (2019). Teacher professional development and student reading achievement: A meta-analytic review. Journal of Research on Educational Effectiveness, 13(1), 1–38. https://doi.org/10.1080/19345747.2019.1670884

[10.] Gupta, M., & Khanna, A. (2022). Digital competence of teachers in the post-COVID-19 era: Challenges and opportunities in online teaching. Education and Information Technologies, 27(8), 10987–11003. https://doi.org/10.1007/s10639-022-11022-5

[11.] Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2023). Multivariate data analysis (8th ed.). Cengage Learning.

[12.] Hermoso, J. R., & Brobo, M. A. (2023). Influence of teaching competencies to performance: Basis for professional development. Asian Journal of Education and Social Studies, 44(4), 33–46.

[13.] Jallade, J. P., Radi, M., & Cuenin, S. (2021). Teacher education and training: Policy and practice. UNESCO Publishing.

[14.] Kim, H. Y., & Mallory, C. (2023). Understanding descriptive statistics. Journal of Educational Research and Practice.

[15.] Kurniawati, K. (2024). Relationship between literacy skills and students' academic achievement: A meta-analysis. Didaktika: Jurnal Pendidikan Sekolah Dasar, 7(1), 68–79. https://doi.org/10.21831/didaktika.v7i1.74206

[16.] Lee, H. (2024). Teacher data literacy for professional learning and reflective practice. Education and Information Technologies. https://doi.org/10.1007/s11092-024-09435-8

[17.] Lin, P.-Y., Wang, Y.-H., & Lin, Y.-T. (2023). The impact of teachers' data literacy and digital competence on innovative teaching and student learning. Education and Information Technologies, 28, 10933–10952. https://doi.org/10.1007/s10639-022-11274-3

[18.] López-Martín, E., et al. (2025). The competency profile of secondary-school teachers: Importance and development of teaching competencies. Studies in Educational Evaluation, 87, 101535. https://doi.org/10.1016/j.stueduc.2025.101535

[19.] Madrid, J. N., & Oco, R. M. (2025). Teachers' teaching competence and pupils' 21st century skills and performance. International Journal of Multidisciplinary Research and Analysis, 8(5), 2932–2943. https://doi.org/10.47191/ijmra/v8-i05-76

[20.] Medina Vásquez, M. L., Campos Ramírez, L. C., Yataco Bernaola, M. L., et al. (2025). Student perceptions of teaching competencies in active learning methodologies. Discover Education, 4, 337. https://doi.org/10.1007/s44217-025-00799-7

[21.] Organisation for Economic Co-operation and Development (OECD). (2020). Teachers and school leaders as lifelong learners. OECD Publishing. https://doi.org/10.1787/57d03bfb-en

[22.] Park, S., Lee, Y., Nelson, G., Cook, M., & Doabler, C. (2025). Teacher professional development and student mathematics achievement: A meta-analysis. Education Sciences, 15(9), 1177. https://doi.org/10.3390/educsci15091177

[23.] Pastore, S. (2025). Teacher data literacy: A scoping review (2020–2024). Cogent Education, 12(1). https://doi.org/10.1080/2331186X.2025.2592397

[24.] Schober, P., Boer, C., & Schwarte, L. A. (2023). Correlation coefficients: Appropriate use and interpretation. Anesthesia & Analgesia. https://doi.org/10.1213/ANE.0000000000006668

[25.] Subekti, M. A., Suryadi, S., & Ahmad, M. (2024). Transforming teacher performance: The impact of training and professional development on competence improvement. Proceedings of the International Conference on Islamic Education.

[26.] van Witteloostuijn, A., et al. (2022). Predictive research design in social sciences. Journal of Research Methodology.

[27.] Zheng, Z., Liu, W., & Wang, Y. (2024). Teacher competence and college students' academic achievement: The mediating role of student mental health. The Asia-Pacific Education Researcher. https://doi.org/10.1007/s40299-024-00861-2