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Teacher Competence and the Effectiveness of ProsPIM: Evidence from Malaysian Preschool Settings

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Abstract

This study examined preschool teachers' knowledge and instructional skills in implementing the Program Saringan dan Intervensi Murid Prasekolah (ProsPIM) in Seremban, Negeri Sembilan, Malaysia. Guided by the Teacher Competency Model for Education 4.0 (Tai et al., 2022), the study employed a quantitative research design to assess the levels of teacher knowledge and instructional skills and to examine their relationships with ProsPIM implementation effectiveness. Data were collected from 74 government preschool teachers using a structured questionnaire. Descriptive statistics, Pearson product-moment correlation, and multiple linear regression were used to analyse the data. The findings indicated that teacher knowledge ($M = 4.21$) and instructional skills ($M = 4.14$) were at high levels, while perceived ProsPIM implementation effectiveness was also high ($M = 3.95$). Pearson correlation analysis showed significant positive relationships between teacher knowledge and ProsPIM implementation effectiveness ($r = .780$, $p < .001$) and between instructional skills and ProsPIM implementation effectiveness ($r = .679$, $p < .001$). Multiple linear regression further indicated that the model explained 62.4% of the variance in ProsPIM implementation effectiveness ($R^2 = .624$, $F(2, 71) = 58.93$, $p < .001$). Teacher knowledge was a significant predictor of ProsPIM implementation effectiveness ($\beta = .632$, $p < .001$), whereas instructional skills did not make a statistically significant independent contribution ($\beta = .193$, $p = .095$). These findings highlight the importance of strengthening preschool teachers' knowledge as part of efforts to enhance the effective implementation of ProsPIM.

Keywords: preschool teachers, teacher knowledge, instructional skills, ProsPIM, developmental screening, teacher competence

1. Introduction

Early childhood represents a critical developmental window during which cognitive, social, emotional, and physical foundations are established, with timely identification of developmental delays associated with significantly improved long-term outcomes for children (Shonkoff & Phillips, 2000; Guralnick, 2011). Globally, systematic developmental screening within preschool settings is recognised as a foundational component of inclusive education systems (UNESCO, 2009). In Malaysia, this priority is reflected in the Education Act 1996 and the Malaysia Education Blueprint 2013–2025, which led to the introduction of the Program Saringan dan Intervensi Murid Prasekolah (ProsPIM).

ProsPIM is a structured school-based screening and early intervention programme for preschool children aged four to six years with potential developmental delays (Bahagian Pendidikan Khas, Kementerian Pendidikan Malaysia, 2024). ProsPIM repositions preschool teachers as the primary agents of early developmental identification and classroom-based intervention, representing a significant shift from the previously reactive, clinic-based model of identification prevalent in Malaysia (Zainol et al., 2025).

The effectiveness of this repositioning, however, depends on teachers' competence. Effective ProsPIM implementation requires knowledge of child development and screening procedures, practical instructional skills in conducting screening and delivering intervention, and professional readiness for inclusive practice (Abdullah, 2020; Tai et al., 2022). This is a demanding profile, particularly as preschool teachers must simultaneously manage classrooms comprising typically developing children and those with developmental delays. Without adequate competence, ProsPIM risks functioning as procedural compliance rather than effective early intervention (Florian & Rouse, 2009; Suprihatiningrum, 2025). In the present study, particular attention is given to teacher knowledge and instructional skills as measurable dimensions of competence in relation to ProsPIM implementation effectiveness.

Empirical evidence raises serious concerns about whether Malaysian preschool teachers are adequately prepared for this role. The overwhelming majority implementing ProsPIM have received no formal training in special needs education, yet are expected to conduct complex developmental screening and targeted intervention as part of their regular classroom duties (Nurul Izzah & Hazhari, 2020). This preparation deficit is compounded by the inconsistent availability of professional support structures including specialist mentoring, interdisciplinary collaboration, and structured in-service training across school settings (Zainol et al., 2025). Without sufficient competence and institutional support, the programme's capacity to achieve its intended developmental outcomes remains uncertain.

Despite ProsPIM's growing implementation, empirical research examining teacher competence in relation to this specific programme remains scarce. Existing studies have largely addressed teacher attitudes or general readiness toward inclusive education, rather than the specific competencies required for effective screening and intervention delivery (Mohd Zulkefli & Hamzah, 2021; Nur Haziqah, 2024). Crucially, the levels of teacher knowledge and instructional skills and their contribution to ProsPIM implementation effectiveness have not been adequately examined. This gap limits policymakers' capacity to strengthen evidence-based strategies for effective ProsPIM implementation.

This study holds significant value for multiple stakeholders. For policymakers, particularly the Ministry of Education Malaysia, the findings provide empirical evidence to guide the strengthening of ProsPIM implementation strategies and professional development planning. For teacher training institutions, the study highlights the need to prioritise practice-oriented competencies in both pre-service and in-service training programmes. For school leaders and practitioners, the findings offer practical insights into improving classroom-level implementation of developmental screening and early intervention. Collectively, the study contributes to enhancing the effectiveness and sustainability of inclusive early childhood education in Malaysia.

1.1 Research Objectives

To address the identified research gap, this study focuses on preschool teachers' knowledge and instructional skills in implementing ProsPIM and their relationship with perceived programme effectiveness. The study specifically aims to provide empirical evidence on the level of these competencies and their contribution to effective ProsPIM implementation in preschool settings.

RO1: To determine the level of preschool teachers' knowledge and instructional skills in implementing the ProsPIM programme in Seremban, Negeri Sembilan.

RO2: To determine the level of perceived ProsPIM implementation effectiveness among preschool teachers in Seremban, Negeri Sembilan.

RO3: To examine the relationship and predictive contribution of teacher knowledge and instructional skills to ProsPIM implementation effectiveness.

1.2 Research Questions

Based on the research objectives, three research questions were formulated to guide the quantitative investigation. The questions focus on the level of teacher knowledge and instructional skills, the perceived effectiveness of ProsPIM implementation, and the relationship and predictive contribution of the two teacher competence dimensions.

RQ1: What is the level of preschool teachers' knowledge and instructional skills in implementing the ProsPIM programme in Seremban, Negeri Sembilan?

RQ2: What is the level of perceived ProsPIM implementation effectiveness among preschool teachers in Seremban, Negeri Sembilan?

RQ3: To what extent do preschool teachers' knowledge and instructional skills relate to and predict the effectiveness of ProsPIM implementation?

2. Literature Review

This section reviews the literature related to preschool teacher competence and the implementation of ProsPIM, with particular emphasis on teacher knowledge, instructional skills, and programme effectiveness. The review establishes the conceptual and theoretical basis for examining the role of preschool teachers in developmental screening and early intervention and provides the foundation for the variables investigated in the present study.

2.1 Preschool Teacher Competence

Preschool teacher competence is widely recognised as a critical determinant of the quality and effectiveness of early identification and intervention for children with developmental delays (Shulman, 1987; Florian & Rouse, 2009; Odom, Buysse, & Soukakou, 2011; Abdullah, 2020). This study is guided by the Teacher Competency Model for Education 4.0 (Tai, Omar, Musa, & Ghouri, 2022), which conceptualises teacher competence as a multidimensional construct comprising interrelated dimensions, including knowledge, instructional skills, and professional readiness. Teacher competence extends well beyond theoretical knowledge; it encompasses the applied capacity to conduct structured screening activities, deliver differentiated intervention, and respond flexibly to the diverse developmental needs of children within preschool classroom environments (Suprihatiningrum, 2025). In the present study, teacher competence is operationalised through two measurable dimensions, namely teacher knowledge and instructional skills, which are examined in relation to ProsPIM implementation effectiveness.

Internationally, teachers who possess stronger pedagogical competence are more effective in identifying developmental risk early and delivering targeted intervention that produces meaningful developmental gains (Guralnick, 2011; Gómez-Marí, Sanz-Cervera, & Tárraga-Mínguez, 2021). Within the Malaysian context, preschool teachers' knowledge of children with special educational needs remains an important consideration in supporting early identification and intervention. Rosli and Alias (2020), for example, examined preschool teachers' knowledge of the characteristics of children with special educational needs. Nevertheless, teachers may continue to require relevant preparation and professional development to translate knowledge into appropriate classroom practices. This issue is particularly important given the increasing recognition of developmental conditions including global developmental delay (GDD), autism spectrum disorder (ASD), Down syndrome, and attention deficit hyperactivity disorder (ADHD) within Malaysian preschool populations (Peng, 2024; Zainol et al., 2025). Three theoretical perspectives inform the present study's understanding of teacher competence. First, Shulman's Pedagogical Content Knowledge (PCK) theory (1986, 1987) posits that effective teaching requires the meaningful integration of subject-matter knowledge with context-appropriate pedagogical strategies. This perspective is relevant to ProsPIM because teachers require both an understanding of developmental screening concepts and the ability to apply that knowledge appropriately within preschool practice.

Second, Bronfenbrenner's Ecological Systems Theory (1979) contextualises how institutional support mechanisms, including access to professional development, interdisciplinary collaboration, and school leadership engagement, can shape teachers' professional practice and implementation capacity (Zainol et al., 2025). Although these contextual factors are not directly tested as variables in the present study, the theory provides a broader perspective on the environment in which teacher competence is developed and applied.

Third, Bandura's Social Cognitive Theory (1986) highlights the role of self-efficacy in shaping professional behaviour; teachers who feel adequately prepared and confident are more likely to engage consistently with screening and intervention procedures (Peng, 2024). Together, these theoretical perspectives provide a basis for understanding teacher competence as involving both knowledge and the capacity to apply knowledge in practice. In the present quantitative study, particular attention is given to teacher knowledge and instructional skills as predictors of ProsPIM implementation effectiveness.

The study is grounded in three complementary theoretical perspectives that explain how preschool teacher competence develops and influences the effective implementation of ProsPIM.

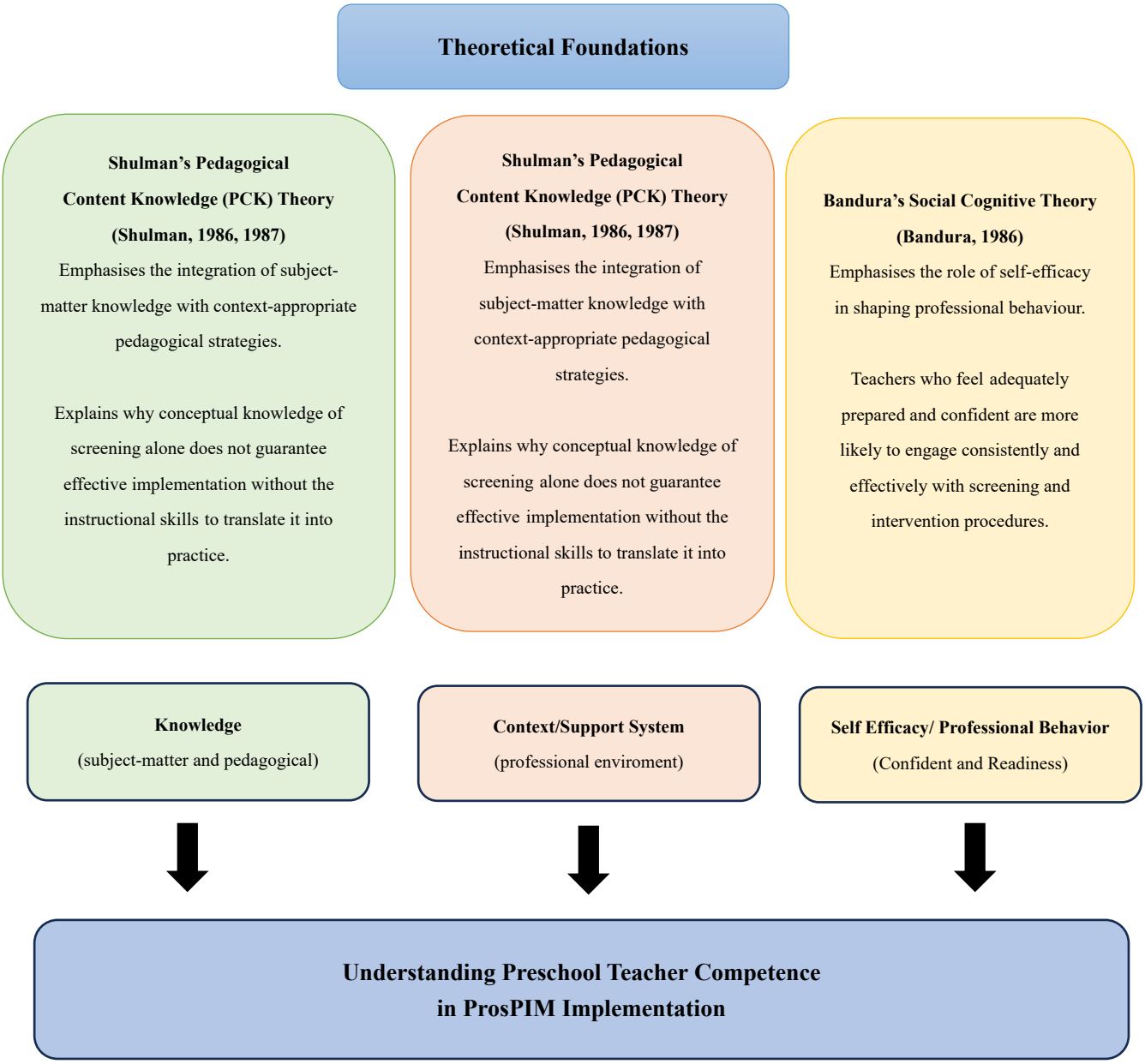


Figure 1. Theoretical Framework of the Study

2.2 ProsPIM Implementation and Programme Effectiveness

Early developmental detection within preschool settings is important for identifying children who may require further assessment, intervention, and educational support. In Malaysia, the Ministry of Education Malaysia introduced the Program Pengesanan Perkembangan dan Intervensi Murid Prasekolah (ProsPIM) to support early developmental detection among preschool children aged four to six years in KPM schools. The programme is intended to help identify children whose developmental progress may not correspond to their age and to support the provision of appropriate intervention, additional learning materials, and other forms of educational support.

A central component of ProsPIM is the use of the Senarai Semak Pengesanan (SSP) Perkembangan Bayi dan Kanak-Kanak 1 Bulan hingga 6 Tahun bagi Tujuan Pendidikan. Preschool teachers serve as the primary administrators of the SSP and assess children who demonstrate characteristics of developmental delay based on their observations over a three-month period at school. The SSP covers several developmental domains, including motor skills, communication and language, cognitive development, personal-social development, vision, and hearing.

Following developmental detection, teachers are expected to implement appropriate developmental interventions for identified children. The ProsPIM implementation framework provides for early intervention over a period of approximately three to six months, after which children may be referred to the relevant Three-PK (3PK) service at the state level or to medical professionals when further intervention or diagnostic procedures are required. Importantly, ProsPIM is designed for developmental detection and not for diagnostic confirmation.

The implementation of these processes places preschool teachers in a critical position because they are responsible for administering the SSP, interpreting observations, and implementing developmentally appropriate interventions within the preschool setting. Previous research has highlighted challenges related to teachers' specialised knowledge, training, and access to professional support when supporting children with developmental needs (Nur Haziqah, 2024; Zainol et al., 2025). These challenges suggest that the effectiveness of ProsPIM implementation may depend not only on the availability of a structured screening programme but also on teachers' capacity to translate knowledge and procedures into effective classroom practice.

Accordingly, this study conceptualises ProsPIM implementation effectiveness as the outcome variable reflecting the extent to which teachers perceive the programme to be implemented effectively through systematic developmental detection, appropriate early intervention, and the provision of relevant learning support. Within this framework, teacher knowledge and instructional skills are examined as predictors of ProsPIM implementation effectiveness. Consistent with Shulman's (1987) Pedagogical Content Knowledge perspective, instructional skills are expected to play an important role in translating teachers' knowledge into effective classroom practice.

Based on the reviewed literature and theoretical perspectives, the present study conceptualises teacher knowledge and instructional skills as the independent variables and ProsPIM implementation effectiveness as the dependent variable. The conceptual relationships between the study variables are illustrated in Figure 2.

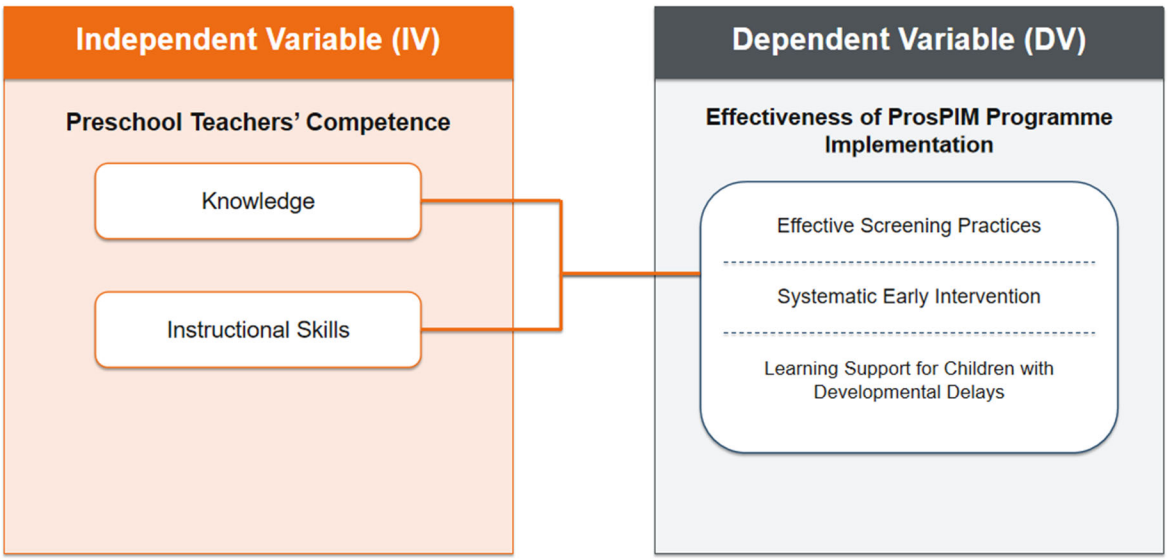


Figure 2. Conceptual Framework

3. Research Methodology

This study employed a quantitative research design to examine preschool teachers' knowledge and instructional skills in implementing ProsPIM in Seremban, Negeri Sembilan, Malaysia. The study assessed the levels of teacher knowledge and instructional skills and examined their relationships with ProsPIM implementation effectiveness using descriptive statistics, Pearson product-moment correlation, and multiple linear regression.

The methodology comprised five components: research design, participants and sampling, research instrument and data collection, pilot study and validity, and data analysis. The overall research procedure involved the collection of quantitative data using a structured questionnaire, followed by statistical analysis to examine the levels, relationships, and predictive contributions of the study variables.

3.1 Research Design

This study employed a quantitative research design to examine preschool teachers' knowledge and instructional skills and their relationships with ProsPIM implementation effectiveness. Quantitative data were collected using a structured questionnaire and analysed using descriptive statistics, Pearson product-moment correlation, and multiple linear regression. This design was appropriate because it enabled the study to determine the levels of the study variables and to examine the relationships and predictive contributions of teacher knowledge and instructional skills to ProsPIM implementation effectiveness.

The overall research procedure involved questionnaire administration, data preparation, descriptive analysis, correlation analysis, and multiple linear regression analysis to address the research objectives and questions.

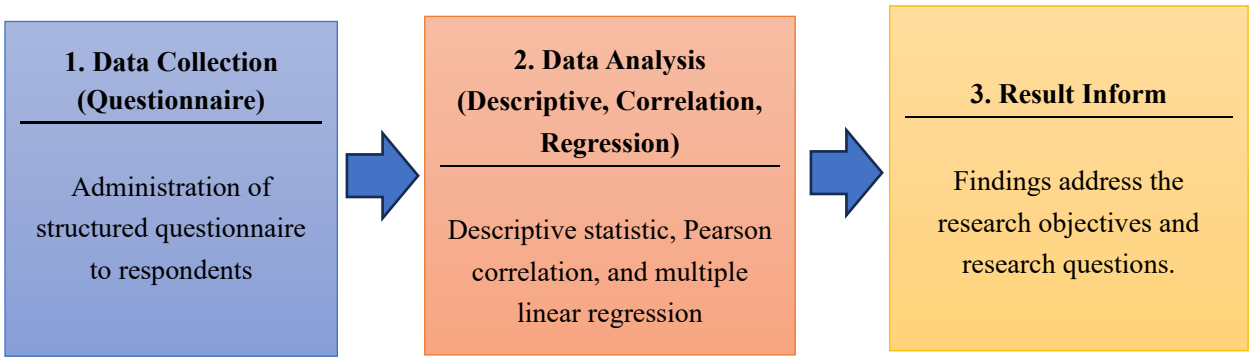


Figure 3. Quantitative Research Procedure

3.2 Participants and Sampling

The target population comprised 165 government preschool teachers in the Seremban district, Negeri Sembilan, who were involved in the implementation of the Program Saringan dan Intervensi Murid Prasekolah (ProsPIM). Simple random sampling was employed using the official teacher registry as the sampling frame, giving each teacher an equal probability of selection. A total of 74 teachers provided complete responses to the quantitative survey, representing a response rate of 44.8% of the target population.

An a priori power analysis was conducted using G*Power for multiple linear regression with two predictors, assuming a medium effect size ($f^2 = .15$), a significance level of .05, and statistical power of .80. The analysis indicated a minimum required sample size of 68 participants. The final sample of 74 respondents exceeded the minimum sample size recommended by the power analysis, providing an adequate basis for the planned quantitative analysis.

Based on the survey responses, 39 teachers reported direct experience with ProsPIM implementation. Of these, 25 teachers had been involved in one year of ProsPIM implementation, while 14 teachers had been involved in both years of implementation. The remaining 35 teachers reported that they had not yet had a child identified or been directly involved in ProsPIM. The inclusion of teachers with different levels of exposure to ProsPIM provided a broader understanding of teachers' knowledge and skills related to the programme.

3.3 Research Instrument and Data Collection

Quantitative data were collected using a structured, self-administered questionnaire grounded in the Teacher Competency Model for Education 4.0 (Tai, Omar, Musa, & Ghouri, 2022). The instrument comprised four sections: demographic information (Section A); teacher knowledge of child development and screening procedures (Section B); instructional skills in conducting screening and classroom-based intervention (Section C); and perceived effectiveness of ProsPIM implementation (Section D). All items were measured using a five-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree).

3.4 Pilot Study and Validity

Content validity was established through expert review by four experts in early childhood education, comprising two curriculum specialists who were also preschool teachers and two lecturers in early childhood education. The experts evaluated each item for clarity, relevance, and alignment with the intended constructs (Creswell & Creswell, 2018). A pilot test was subsequently conducted with a separate group of preschool teachers to assess the reliability of the instrument, item clarity, and completion time. Internal consistency was measured using Cronbach's alpha, with a

threshold of .70 adopted as the minimum acceptable value (Creswell & Creswell, 2018). Reliability analysis of the main study data confirmed acceptable internal consistency across all subscales.

3.5 Data Analysis

Quantitative data were analysed using descriptive and inferential statistical procedures based on the complete responses obtained from the questionnaire. Descriptive statistics were computed for all subscales, with mean scores interpreted on a three-tier scale of low (1.00 to 2.33), moderate (2.34 to 3.66), and high (3.67 to 5.00). Pearson product-moment correlation analysis was used to examine the bivariate relationships between teacher knowledge, instructional skills, and ProsPIM implementation effectiveness. Multiple linear regression analysis was subsequently conducted using teacher knowledge and instructional skills as predictors to determine their relative independent contributions to ProsPIM implementation effectiveness. The regression model was specified with teacher knowledge and instructional skills as the predictors because these were the two teacher competence dimensions directly operationalised and examined in relation to ProsPIM implementation effectiveness in the present study. Professional readiness was therefore not included as an independent predictor in the regression model. Collinearity diagnostics were applied to assess potential multicollinearity among the predictors, with variance inflation factor (VIF) values below 5.0 considered indicative of an acceptable level of multicollinearity. A significance level of $p < .05$ was adopted for all inferential analyses.

4. Results

This section presents the findings of the study according to the three research questions. The quantitative findings address the levels of teacher knowledge and instructional skills, the perceived effectiveness of ProsPIM implementation, and the relationships and predictive contributions of teacher knowledge and instructional skills to ProsPIM implementation effectiveness.

4.1 Level of Teacher Competence (RQ1)

Table 1 presents the mean scores for teacher knowledge and instructional skills. Both dimensions were rated at a high level based on the interpretation scale of low (1.00–2.33), moderate (2.34–3.66), and high (3.67–5.00). Teacher knowledge recorded a high overall mean ($M = 4.21$, $SD = 0.81$), while instructional skills also recorded a high overall mean ($M = 4.14$, $SD = 0.72$). At the item level, teacher knowledge ranged from $M = 4.12$ to $M = 4.28$, while instructional skills ranged from $M = 3.95$ to $M = 4.23$. These findings indicate that the participating preschool teachers reported high levels of knowledge and instructional skills related to ProsPIM implementation.

Table 1. Overall Means for Teacher Knowledge and Instructional Skills (N = 74)

Dimension	Overall M	SD	Item Range	Items	Level
Knowledge	4.21	0.81	4.12–4.28	5	High
Instructional Skills	4.14	0.72	3.95–4.23	5	High

Note. High = M ≥ 3.67; Moderate = 2.34–3.66; Low = 1.00–2.33.

4.2 Relationship Between Teacher Competence and ProsPIM Effectiveness (RQ2)

Table 2 presents the overall mean score for perceived ProsPIM implementation effectiveness. The overall mean was high ($M = 3.95$, $SD = 0.76$), indicating that teachers generally perceived ProsPIM implementation as effective. Item-level means ranged from $M = 3.69$ to $M = 4.14$. The lowest mean was recorded for the item relating to the organised and systematic implementation of ProsPIM ($M = 3.69$), which nevertheless remained within the high category. The highest mean was recorded for the item indicating that ProsPIM helps teachers identify children with developmental delays earlier ($M = 4.14$).

Table 2. Overall Mean for ProsPIM Implementation Effectiveness (N = 74)

Dimension	Overall M	SD	Item Range	Items	Level
ProsPIM Effectiveness	3.95	0.76	3.69–4.14	5	High

Note. High = M ≥ 3.67; Moderate = 2.34–3.66; Low = 1.00–2.33.

4.3 Relationship and Predictive Effects of Teacher Knowledge and Instructional Skills (RQ3)

Pearson product-moment correlation analysis revealed significant positive relationships between teacher knowledge and ProsPIM implementation effectiveness ($r = .780$, $p < .001$) and between instructional skills and ProsPIM implementation effectiveness ($r = .679$, $p < .001$). Teacher knowledge was also significantly correlated with instructional skills ($r = .769$, $p < .001$). These findings indicate that higher levels of teacher knowledge and instructional skills were associated with higher perceived ProsPIM implementation effectiveness.

Table 3. Pearson Correlations Among the Study Variables (N = 74)

Variable	1	2	3
1. Teacher Knowledge	—	.769***	.780***
2. Instructional Skills	.769***	—	.679***
3. ProsPIM Implementation Effectiveness	—	.769***	.780***

Note. ***p < .001. N = 74.

To examine the relative predictive contributions of the two teacher competence dimensions, a multiple linear regression analysis was conducted with teacher knowledge and instructional skills as predictors of ProsPIM implementation effectiveness. The overall regression model was statistically significant, $F(2, 71) = 58.93$, $p < .001$, with $R^2 = .624$ and adjusted $R^2 = .613$. Thus, the two predictors jointly explained 62.4% of the variance in ProsPIM implementation effectiveness.

As shown in Table 4, teacher knowledge was a significant positive predictor of ProsPIM implementation effectiveness ($\beta = .632$, $p < .001$), whereas instructional skills did not make a statistically significant independent contribution ($\beta = .193$, $p = .095$). Collinearity diagnostics indicated no serious multicollinearity concerns, with VIF values of 2.45 for both predictors.

Table 4. Multiple Linear Regression: Predictors of ProsPIM Implementation Effectiveness (N = 74)

Predictor	B	SE B	β	t	p
(Constant)	0.624	0.327	—	1.908	.060
Teacher Knowledge	0.593	0.107	.632	5.551	< .001
Instructional Skills	0.202	0.119	.193	1.693	.095

Model statistics: $R^2 = .624$, adjusted $R^2 = .613$, $F(2, 71) = 58.93$, $p < .001$.

Note. N = 74. β = standardized regression coefficient.

4.4 Integrated Quantitative Findings

Across the three research questions, the findings indicate that preschool teachers reported high levels of knowledge and instructional skills in implementing ProsPIM, as well as a high level of perceived ProsPIM implementation effectiveness. The correlation findings further demonstrated significant positive relationships between teacher knowledge, instructional skills, and ProsPIM implementation effectiveness. However, the multiple regression analysis showed that teacher knowledge was the only significant independent predictor of ProsPIM implementation effectiveness, while instructional skills did not make a statistically significant independent contribution when both predictors were considered simultaneously.

The regression model explained 62.4% of the variance in ProsPIM implementation effectiveness, indicating that teacher knowledge and instructional skills jointly provide substantial explanatory value. The stronger independent contribution of teacher knowledge suggests that an adequate understanding of child development, developmental screening procedures, and the principles underlying ProsPIM may be particularly important in supporting effective programme implementation. Although instructional skills were significantly related to ProsPIM effectiveness at the bivariate level, their independent contribution was not statistically significant in the regression model.

Taken together, the findings suggest that strengthening teachers' knowledge should remain an important consideration in efforts to enhance ProsPIM implementation. The high levels of both knowledge and instructional skills reported by

the respondents provide a positive indication of teacher readiness, while the significant predictive effect of knowledge highlights the importance of ensuring that teachers possess a sound conceptual understanding of developmental screening and intervention processes.

5. Discussion

The findings of this study address three research questions examining preschool teachers' knowledge and instructional skills in implementing the ProsPIM programme, the perceived effectiveness of ProsPIM implementation, and the relationship and predictive contribution of the two teacher competence dimensions. With respect to the first research question, teachers reported high levels of knowledge and instructional skills, with mean scores of M = 4.21 and M = 4.14, respectively. These findings indicate that the participating preschool teachers perceived themselves as having a strong conceptual and practical foundation for implementing ProsPIM. The high level of teacher knowledge is consistent with Gómez-Marí et al. (2021) and Nur Haziqah (2024), who reported generally positive levels of teachers' knowledge and awareness concerning developmental screening and special educational needs.

The high level of instructional skills further suggests that teachers perceived themselves as capable of applying screening procedures and classroom-based intervention practices within their preschool settings. This finding is consistent with Mohd Zulkefli and Hamzah (2021) and Abdullah (2020), who highlighted the importance of teacher competencies in supporting inclusive early childhood education. However, the descriptive findings should be interpreted as teachers' reported perceptions of their competence rather than direct observations of classroom practice.

The second research question examined the level of perceived ProsPIM implementation effectiveness. The findings indicated a high overall level, with a mean score of M = 3.95. This suggests that teachers generally perceived ProsPIM as being implemented effectively in their preschool settings. The item-level findings also showed that all effectiveness items remained within the high category, although the item concerning organised and systematic implementation recorded the lowest mean (M = 3.69). This finding suggests that, while teachers generally viewed the programme positively, consistency and systematic implementation may remain areas for continued attention.

The third research question examined the relationships and predictive contributions of teacher knowledge and instructional skills. Pearson correlation analysis revealed significant positive relationships between teacher knowledge and ProsPIM implementation effectiveness ($r = .780$, $p < .001$) and between instructional skills and ProsPIM implementation effectiveness ($r = .679$, $p < .001$). These findings indicate that higher levels of teacher knowledge and instructional skills were associated with higher perceived ProsPIM implementation effectiveness. However, the multiple regression analysis provided a more specific interpretation of these relationships. The model explained 62.4% of the variance in ProsPIM implementation effectiveness ($R^2 = .624$, $F(2, 71) = 58.93$, $p < .001$). Teacher knowledge emerged as the only significant independent predictor ($\beta = .632$, $p < .001$), whereas instructional skills did not make a statistically significant independent contribution ($\beta = .193$, $p = .095$). This finding suggests that although instructional skills were positively associated with ProsPIM effectiveness at the bivariate level, teacher knowledge made a stronger independent contribution when both dimensions were considered simultaneously.

The finding that teacher knowledge significantly predicted ProsPIM implementation effectiveness can be interpreted through Shulman's (1987) Pedagogical Content Knowledge framework. Effective implementation requires teachers not only to perform procedural tasks but also to understand child development, developmental screening principles, and the purposes underlying intervention activities. A strong knowledge base may therefore support teachers in interpreting screening information appropriately and making informed decisions regarding developmental support. This interpretation is consistent with Shulman's (1987) view that effective professional practice involves transforming knowledge into contextually appropriate action. In the context of ProsPIM, the findings suggest that knowledge provides an important foundation for teachers to interpret screening information and apply intervention procedures appropriately.

The findings also contribute to the understanding of teacher competence within the Teacher Competency Model for Education 4.0 proposed by Tai et al. (2022). Although knowledge and instructional skills represent interrelated dimensions of teacher competence, the present findings indicate that their independent contributions to ProsPIM implementation effectiveness are not equivalent. Teacher knowledge emerged as the significant predictor, suggesting that, in a structured developmental screening programme, teachers' understanding of developmental concepts and screening procedures may provide an essential foundation for effective programme implementation. The findings do not diminish the importance of instructional skills; rather, they suggest that instructional skills may operate together with, and depend partly upon, an adequate knowledge base when teachers implement ProsPIM.

Overall, the findings suggest that strengthening teacher knowledge should remain an important component of efforts to enhance ProsPIM implementation. Although instructional skills remained positively related to programme effectiveness, their non-significant independent contribution in the regression model indicates that their influence may be intertwined with teachers' knowledge. Professional learning initiatives should therefore support both dimensions while placing particular emphasis on developing a sound understanding of child development, developmental screening procedures, and appropriate intervention practices.

6. Conclusion

This section summarises the main findings of the study, highlights their implications for ProsPIM implementation, and outlines the limitations and directions for future research. The discussion is based on the quantitative findings concerning preschool teachers' knowledge, instructional skills, and perceived effectiveness of ProsPIM implementation.

6.1 Practical Implications

Professional development initiatives should strengthen preschool teachers' knowledge of child development, developmental screening procedures, and appropriate intervention practices as a key component of ProsPIM implementation. Although both teacher knowledge and instructional skills were reported at high levels, teacher knowledge emerged as the only significant independent predictor of ProsPIM implementation effectiveness. The Ministry of Education should therefore ensure that competence-focused in-service programmes provide teachers with clear and practice-oriented knowledge related to developmental screening and early intervention. Such programmes may be further supported through classroom-based guidance, structured mentoring, and access to relevant professional expertise to strengthen the application of knowledge in preschool settings.

6.2 Limitations and Future Directions

This study was limited to government preschool teachers in a single district, which may restrict the generalisability of the findings to other districts or states. Although the final sample of 74 respondents exceeded the minimum sample size of 68 indicated by the a priori G*Power analysis, the study context remained geographically limited. Reliance on self-reported measures may also introduce common method bias, including social desirability and response consistency effects, which may influence the accuracy of the reported levels of teacher knowledge, instructional skills, and ProsPIM implementation effectiveness. In addition, the cross-sectional design does not permit causal interpretation of the relationships identified between the study variables. Future research should involve larger samples across multiple districts or states and consider longitudinal designs to examine changes in teacher competence and ProsPIM implementation over time. Future studies could also incorporate observation-based measures of instructional practice and examine contextual factors such as school leadership support, training intensity, and organisational climate.

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