Automated PPKI Application System via Google Forms and WhatsApp: Development and Evaluation Using Rasch Measurement Model

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Abstract. This study reports the development and evaluation of SMARTSERVE-PPKI, an automated digital system designed to streamline the application and placement process for the Special Education Integration Program (PPKI) in Sarawak, Malaysia. Developed using no-code tools including Google Forms, Google Sheets, WhatsApp, and Google Apps Script, the system was evaluated through operational indicators and a structured user perception instrument. The instrument was constructed from five theoretically informed administrative dimensions: time efficiency, cost and paper reduction, manpower efficiency, workload reduction, and service professionalism. Nineteen education officers from the Northern Zone of Sarawak participated in the pilot evaluation. Responses were analysed using the Rasch rating scale model to examine item fit, person fit, rating-scale functioning, respondent reliability, and construct coherence. A unidimensional Rasch approach was used because the five dimensions were designed as content domains contributing to one overarching construct, namely officers' positive perception of SMARTSERVE-PPKI, rather than as separate latent traits. Operational findings demonstrated notable improvements, including communication turnaround times within one working day, an 85% success rate for automated notifications, and more systematic interview scheduling. Rasch analysis indicated generally satisfactory item functioning, coherent response patterns, and a rating scale dominated by agreement categories, although underuse of the lower categories and two misfitting items suggest areas for instrument refinement. Given the small purposive sample, the findings should be interpreted as pilot validation evidence rather than population-level generalization. Overall, SMARTSERVE-PPKI represents a low-cost, user-friendly, and scalable digital innovation aligned with Malaysia's Digital Education Policy (2021), offering a replicable model for administrative transformation in special education.

Keywords: SMARTSERVE-PPKI, automation, special education, Rasch model, digital transformation.

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1 Introduction

The digitalization of administrative processes in education has become a strategic imperative in many countries, including Malaysia. The Ministry of Education (MOE) has emphasized the importance of adopting digital tools and automation to improve service delivery, especially in areas requiring high coordination such as special education. In line with the Digital Education Policy (2021), schools and district education offices are increasingly exploring cost-effective and scalable solutions to enhance operational efficiency and reduce the burden on educators and administrators.

One area that continues to face administrative challenges is the management of applications for Program Pendidikan Khas Integrasi (PPKI), or Special Education Integration Programs. These applications often involve multiple steps including verification of documents, parent communication, status tracking, and manual issuance of placement letters. Delays and inconsistencies in this process not only affect parents and students but also create workload bottlenecks for officers at the district level. To address these issues, an innovative solution called SMARTSERVE-PPKI was developed. This system integrates Google Forms for structured data collection, Google Sheets for tracking and automation, and WhatsApp for real-time parent notifications. By automating key components of the application and placement workflow, SMARTSERVE-PPKI aims to reduce redundancy, improve transparency, and provide timely updates to stakeholders.

2 Background

The SMARTSERVE-PPKI system emerged as a grassroots innovation from district education officers in Sarawak aiming to digitalize and streamline the placement process for PPKI students. Traditional methods were time-consuming and heavily dependent on manual follow-ups via phone calls, letters, and physical document handling. This not only delayed placement decisions but often led to miscommunication and administrative errors. SMARTSERVE-PPKI leverages a combination of Google Form submissions, automated Google Sheets dashboards, and WhatsApp notifications to reduce dependency on individual officers and physical paperwork. The process ensures that parents can receive timely notifications, schools can view placement status in real-time, and district officers can monitor and coordinate placements more efficiently. The prototype was tested among 19 education officers and refined based on their feedback.

3 Problem Statement

Despite the push for digitalization, many district-level administrative processes remain heavily manual. This includes the management of special education applications, which involves multiple steps across stakeholders and is prone to delay, miscommunication, and duplicated effort.

Officers often have to manually contact parents, track physical submissions, and handle document verification without centralized systems. As a result, placement processes are delayed, and officers face an unnecessary workload. These inefficiencies undermine service quality and stakeholder confidence.

4 Objectives

This study aims to:

1. To design and implement an automated application management system (SMARTSERVE-PPKI) for Special Education Integration Program (PPKI) placements using accessible, no-code digital tools such as Google Forms, Google Sheets, and WhatsApp.
2. To evaluate the effectiveness of the SMARTSERVE-PPKI system in improving administrative efficiency, reducing processing time, and minimizing communication bottlenecks in the placement process at the district education office.
3. To assess user perceptions of the system's functionality, usability, and impact on workload and professionalism, based on structured feedback collected from education officers.
4. To validate the evaluation instrument using the Rasch measurement model to ensure psychometric robustness in measuring perceptions of digital innovation implementation.

5 Literature Review

5.1 Digital Automation in Education Administration and Special Education

The digitalization of administrative processes has become a central strategy in improving efficiency, transparency, and service quality in public education systems worldwide. In Malaysia, this agenda is formalized through the Digital Education Policy, which emphasizes the adoption of scalable, cost-effective, and user-friendly digital solutions across schools and education offices [1]. Administrative processes related to special education are particularly complex, as they involve multiple stakeholders, high documentation requirements, and time-sensitive decision-making.

Previous studies have demonstrated that automation and cloud-based platforms can significantly reduce administrative workload and processing delays. Zahidi et al. [2] and Nasir and Khalid [3] reported that the use of Google Workspace tools enhanced data accuracy, communication efficiency, and task coordination in Malaysian school management contexts. Similar outcomes were observed in automated student tracking and placement systems, where structured digital workflows reduced human error and improved real-time access to information [4].

In special education settings, administrative efficiency directly affects service delivery and stakeholder confidence. Sullivan and McDonough [13] found that automated systems supporting Individualised Education Plan (IEP) management improved compliance and reduced administrative burden, particularly when two-way communication with parents was incorporated. In the Malaysian context, Abdullah et al. [14] highlighted that delays in special education services were often linked to fragmented administrative practices, underscoring the need for integrated digital solutions.

International studies further support the use of automation in managing student services. Ferguson et al. [6] demonstrated that automated monitoring systems improved documentation accuracy and staff efficiency in Australian schools, while Kumari and Rao [7] reported higher administrative satisfaction following the implementation of automated student management systems in higher education institutions. These findings collectively suggest that automation is not merely a technological enhancement but a structural improvement in education service delivery.

5.2 No-Code Platforms and Grassroots Digital Innovation

Recent literature highlights the growing role of no-code and low-code platforms in enabling non-technical users to develop functional and scalable digital systems. Alghamdi and Holland [8] emphasized that such platforms lower entry barriers for innovation, allowing frontline practitioners to design solutions that are closely aligned with operational needs. This approach aligns with design-based research principles, which argue that educational innovations are most effective when they emerge from real-world problems and iterative user feedback [9].

SMARTSERVE-PPKI reflects this grassroots innovation model by leveraging freely available tools such as Google Forms, Google Sheets, WhatsApp, and lightweight automation via Google Apps Script. Unlike large-scale proprietary systems, no-code solutions offer flexibility, minimal training requirements, and sustainability within resource-constrained public sector environments. This design philosophy supports broader calls for practitioner-led digital transformation in education administration [10].

5.3 Rasch Measurement Model in Educational and Administrative Evaluation

To ensure rigorous evaluation of digital innovations, the use of validated measurement models is essential. The Rasch measurement model provides a robust framework for transforming ordinal survey data into interval-level measures, enabling meaningful interpretation of latent traits such as user perception, competency, and system effectiveness [11]. Unlike classical test theory, the Rasch model evaluates item functioning and respondent ability independently, allowing for detailed examination of measurement quality.

Key indicators in Rasch analysis include item fit statistics, person reliability, item separation, and unidimensionality. Acceptable item fit indicates that individual items contribute meaningfully to the underlying construct, while person reliability reflects the consistency of respondents' response patterns. Item separation indices provide evidence of the instrument's ability to distinguish between different levels of endorsement, and unidimensionality confirms that the instrument measures a single dominant latent trait [11].

In Southeast Asian education research, Sumintono and Widhiarso [12] demonstrated the suitability of the Rasch model for validating perception instruments using Likert-scale data, particularly in small-sample contexts common in administrative studies. Rasch-based scalograms and Wright Maps have also been widely used to examine item hierarchy and respondent agreement patterns, offering insights into which aspects of an innovation are most readily endorsed and which require further refinement.

By integrating Rasch measurement into the evaluation of SMARTSERVE-PPKI, this study aligns with best practices in educational measurement and strengthens the validity of conclusions drawn regarding system effectiveness and user acceptance.

5.4 Summary of Literature Gap

While existing studies confirm the benefits of automation and digital tools in education administration, there remains a limited body of research focusing specifically on the automation of special education placement processes at the district level, particularly within developing education systems. Moreover, few studies combine operational performance indicators with Rasch-validated user perception instruments to evaluate administrative innovations. This study addresses these gaps by presenting a low-cost, practitioner-developed automation system for special education administration and validating its effectiveness through rigorous Rasch measurement analysis.

6 Methodology

6.1 Research Design

This study adopted a quantitative evaluative research design to examine the effectiveness and user acceptance of the SMARTSERVE-PPKI system following its pilot implementation. The evaluation combined operational performance indicators with a Rasch-based analysis of user perception data, allowing both functional outcomes and measurement validity to be examined within a single framework. The Rasch measurement approach was selected to ensure robust psychometric evaluation, particularly given the relatively small sample size and the need to validate an internally developed instrument.

6.2 Participants and Context

The study involved 19 education officers from the Northern Zone of Sarawak, Malaysia encompassing the districts of Miri, Bintulu, Limbang, Lawas, Subis, and Baram. These officers were directly responsible for managing applications, placements, and communication related to the Special Education Integration Program (PPKI). Participants were selected using purposive sampling, as they were actively involved in the pilot use of SMARTSERVE-PPKI and possessed firsthand operational experience with both the manual and automated systems.

6.3 Instrument Development

The perception questionnaire was developed to evaluate SMARTSERVE-PPKI as a district-level administrative innovation. The instrument was guided by three complementary theoretical considerations: administrative efficiency theory, which emphasises reduced processing time, reduced duplication and improved resource utilisation; technology acceptance perspectives, particularly perceived usefulness and ease of use; and public service quality principles, especially responsiveness, reliability and professional transparency. These considerations were translated into operational dimensions that reflected the actual pain points identified in the manual PPKI application and placement workflow.

Although the instrument contains five administrative dimensions, these dimensions were used as a content blueprint rather than as five independent scales. The intended measurement construct was officers' positive perception of SMARTSERVE-PPKI as an integrated administrative system. The five dimensions therefore represent observable facets of the same overall construct: whether the system improves the efficiency, workload, resource use and professionalism of PPKI placement management.

The 18 items were constructed by mapping each dimension to a specific system function or expected administrative outcome. Time-efficiency items focused on faster application processing, status checking and interview scheduling. Cost and paper-reduction items focused on reduced printing, physical forms and repeated documentation. Manpower-efficiency items assessed whether the system reduced dependency on individual officers and enabled more systematic coordination. Workload-reduction items addressed repetitive parent inquiries, manual follow-up and duplicated recording. Service-professionalism items assessed transparency, parent communication, data availability and confidence in district service delivery.

Table 1 summarises the theoretical rationale, dimensions and item-construction logic used in developing the questionnaire.

Table 1. Instrument-development blueprint for the SMARTSERVE-PPKI perception questionnaire.

Dimension	Theoretical rationale	Item-construction focus
Time efficiency	Administrative efficiency and perceived usefulness	Speed of application processing, notification, scheduling and status tracking
Cost and paper reduction	Resource optimisation and digital workflow efficiency	Reduction of printed forms, physical records and repeated documentation
Manpower efficiency	Process standardisation and reduced dependency on individual officers	Coordination, monitoring and reduced manual follow-up
Workload reduction	Administrative burden and cognitive-load reduction	Fewer repeated parent inquiries, reduced duplication and simplified daily tasks
Service professionalism	Public service quality: responsiveness, reliability and transparency	Quality of communication, data availability, stakeholder confidence and professional image

Content validity was established through expert review by senior district officers familiar with special education administration and digital workflows. The reviewers examined item relevance, wording clarity and alignment with the intended dimensions. Minor wording refinements were made to reduce ambiguity before pilot administration. Each item was measured using a four-point Likert-type scale ranging from 1 (Strongly Disagree) to 4 (Strongly Agree), deliberately omitting a neutral midpoint to encourage definitive responses from officers who had direct operational experience with the system.

6.4 Rasch Measurement Model and Data Analysis

Data were analysed using the Rasch rating scale model implemented through Winsteps software. The Rasch model transforms ordinal Likert-type responses into interval-level logit measures, enabling the evaluation of respondent endorsement and item difficulty on a common scale. The rating scale model was selected because all items used the same four-category response structure.

A unidimensional Rasch analysis was conducted for two reasons. First, the five dimensions were developed as content domains within one integrated evaluation construct rather than as empirically separate subscales intended for independent scoring. The study objective was to validate the overall perception of SMARTSERVE-PPKI as a digital administrative innovation, not to compare separate latent traits. Second, the pilot sample was very small (N = 19) and the number of items per dimension was limited, making a multidimensional Rasch model statistically unstable

and potentially over-parameterised for the available data. Therefore, multidimensional Rasch analysis was not conducted at this pilot stage. A larger future sample would allow testing of dimensional structure through multidimensional Rasch modelling or related dimensionality diagnostics.

The psychometric evaluation focused on item fit, person fit, reliability and separation indices, rating-scale category functioning, Wright Map targeting and Guttman-scaled response consistency. Infit and outfit mean-square (MNSQ) values were interpreted using the commonly applied productive-for-measurement range of approximately 0.5 to 1.5, while values above this range were treated as evidence of possible underfit requiring substantive review rather than automatic deletion [11,15,18]. Rating-scale functioning was interpreted using Linacre's category-diagnostic principles, including category frequency, monotonic use of categories and evidence of sparse or unused categories [16].

Given the pilot nature of the study, Rasch results were used primarily to examine item functioning and identify areas for instrument refinement. The small sample limits the stability of item calibrations and the generalizability of respondent measures. However, Rasch analysis can still provide useful preliminary evidence in small pilot studies when conclusions are framed cautiously and when fit statistics are interpreted alongside substantive item content [17,19].

6.5 Operational Performance Indicators

In parallel with the Rasch-based perception analysis, operational performance data were collected during the one-month pilot implementation at the Miri District Education Office. These indicators included notification delivery success rates, communication turnaround time following application approval, and system-supported interview scheduling. The triangulation of operational metrics with Rasch-validated perception data strengthened the internal validity of the evaluation.

6.6 Ethical Considerations

Participation in the study was voluntary, and respondents were informed of the purpose of the evaluation. Data were anonymized prior to analysis to ensure confidentiality. The study focused on system evaluation rather than individual performance appraisal, and findings were reported in aggregate form.

7 Findings

7.1 Pilot Study

The effectiveness of the SMARTSERVE-PPKI innovation was demonstrated through a one-month internal pilot implementation at the Miri District Education Office.

Evaluation was conducted using both system performance indicators and psychometric analysis of user perception data. The results confirm that the system improved administrative efficiency, enhanced service professionalism, and aligned with digitalization objectives in the education sector.

In the pilot study, approximately 85% of notifications were successfully delivered automatically through the system, compared to the previous manual method, which was time-consuming and prone to communication lapses. The average time taken by officers to inform parents of application status after receiving approval letters decreased to one working day or less, compared to the previous delay of 3–5 days, which was often caused by workload and out-of-office assignments. The system elevated the professionalism of district operations, especially in information handling and customer relations. Parents reported increased confidence in the department's efficiency, while officers expressed higher motivation levels due to reduced manual workload.

In addition, a feedback survey among placement unit officers revealed that 100% of respondents agreed the system saved time and helped streamline their daily tasks. The auto-reporting function allowed officers to present real-time data for meetings, monthly reporting, and audits without the need for manual data analysis, contributing to data-driven decision-making.

7.2 Psychometric Evaluation through Rasch Model

The SMARTSERVE-PPKI system was evaluated using the Rasch measurement model to validate the perception instrument used among 19 education officers in Northern Sarawak. The analysis included item and person fit statistics, a Wright Map, and a Guttman-scaled scalogram to assess the psychometric properties of the tool.

Item fit statistics evaluate how well each item conforms to the expectations of the Rasch model. Acceptable fit is typically within 0.5–1.5 for both infit and outfit Mean Square (MNSQ) values. Most items fell within the acceptable range, indicating that they contributed meaningfully to the underlying construct. Item_15 (OUTFIT MNSQ = 2.70) and Item_18 (OUTFIT MNSQ = 2.24) exceeded recommended thresholds, identifying them as misfitting items. These items may need rewording or further clarification in future use. High-performing items included Item_8, Item_16, and Item_17, with outfit MNSQ values close to 1.0, reflecting strong alignment with the model's expectations.

Rating-Scale Category Functioning. The rating-scale diagnostics showed that the four-category scale was used unevenly. No respondent selected Category 1 (Strongly Disagree), Category 2 (Disagree) appeared only three times (0.9%), Category 3 (Agree) appeared 288 times (84.2%), and Category 4 (Strongly Agree) appeared 51 times (14.9%). This pattern indicates a strongly positive perception of the system among the pilot respondents, but it also shows that the lower categories were underutilised. Therefore, the category structure should be retained only provisionally and re-examined

with a larger and more heterogeneous sample. If sparse use of Categories 1 and 2 persists, future studies may consider collapsing categories or revising item wording to improve category discrimination.

Table 2. Observed rating-scale category frequencies in the pilot Rasch analysis.

Category	Response label	Observed count	Percentage	Interpretation
1	Strongly Disagree	0	0.0%	Not observed in this pilot sample
2	Disagree	3	0.9%	Very sparse use; thresholds cannot be interpreted robustly
3	Agree	288	84.2%	Dominant category; indicates broad endorsement
4	Strongly Agree	51	14.9%	Used meaningfully for stronger endorsement
Total		342	100.0%	19 respondents x 18 items

The absence of Category 1 responses and the very low use of Category 2 also explain the limited interpretability of full threshold-based category diagnostics in the present dataset. This result is reported as a limitation of the pilot instrument rather than as evidence that the scale is fully optimised.

ITEM STATISTICS: MISFIT ORDER

ENTRY NUMBER	TOTAL SCORE	TOTAL COUNT	MEASURE	MODEL S.E.	INFIT MNSQ	INFIT ZSTD	OUTFIT MNSQ	OUTFIT ZSTD	PT-MEASURE CORR.	PT-MEASURE EXP.	EXACT MATCH OBS%	EXACT MATCH EXP%	ITEM
15	60	19	-.27	.63	2.21	2.4	2.70	2.2	A .51	.26	63.2	83.3	Item_15
18	61	19	-.63	.58	1.25	.8	2.24	2.0	B -.24	.29	78.9	78.3	Item_18
12	59	19	.18	.72	1.64	1.2	1.59	1.0	C .61	.24	78.9	87.9	Item_12
11	62	19	-.95	.55	1.11	.5	1.13	.4	D .17	.31	78.9	73.7	Item_11
13	60	19	-.27	.63	1.08	.3	1.06	.3	E .10	.26	84.2	83.3	Item_13
5	61	19	-.63	.58	1.03	.2	.92	.0	F .24	.29	78.9	78.3	Item_5
2	60	19	-.27	.63	.98	.1	.97	.1	G .19	.26	84.2	83.3	Item_2
4	58	19	.78	.84	.74	-.2	.97	.2	H -.01	.22	94.7	91.9	Item_4
6	59	19	.18	.72	.94	.1	.91	.1	I .13	.24	89.5	87.9	Item_6
14	59	19	.18	.72	.94	.1	.91	.1	i .13	.24	89.5	87.9	Item_14
10	60	19	-.27	.63	.83	-.3	.71	-.4	h .36	.26	84.2	83.3	Item_10
1	61	19	-.63	.58	.83	-.5	.69	-.5	g .43	.29	78.9	78.3	Item_1
9	62	19	-.95	.55	.79	-.8	.62	-.9	f .52	.31	68.4	73.7	Item_9
7	61	19	-.63	.58	.78	-.6	.66	-.6	e .47	.29	78.9	78.3	Item_7
3	59	19	.18	.72	.75	-.4	.46	-.8	d .39	.24	89.5	87.9	Item_3
17	58	19	.78	.84	.66	-.3	.51	-.5	c .19	.22	94.7	91.9	Item_17
8	57	19	1.61	.95	.07	-1.8	.04	-1.8	b .00	.24	100.0	93.8	Item_8
16	57	19	1.61	.95	.07	-1.8	.04	-1.8	a .00	.24	100.0	93.8	Item_16
MEAN	59.7	19.0	.00	.69	.93	-.1	.95	.0			84.2	84.3	
S.D.	1.5	.0	.75	.13	.47	1.0	.65	1.0			9.6	6.3	

Fig. 1. Item Fit Statistics.

The Wright Map visualizes both item difficulty and person ability on the same logit scale. The map reveals that most respondents (e.g., R05, R12, R16) were positioned above the midline, indicating high agreement with the statements and overall positive perceptions of the system.

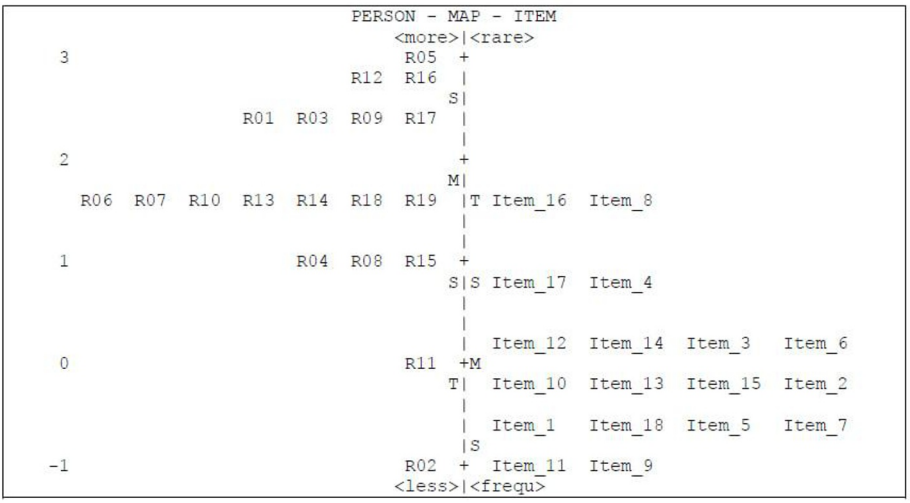


Fig. 2. Wright Map

The easiest item to agree with, "I am no longer burdened by repeated queries from parents," highlighted the system's strong impact on communication efficiency. The most difficult item, "Parents provide positive feedback about this system," indicated a gap in visibility of stakeholder satisfaction—suggesting a future opportunity to integrate parental feedback features. Items were well distributed across the measurement continuum, with a few (e.g., Item_16 and Item_8) located at the top of the scale, suggesting these were more difficult to endorse—possibly due to their abstract or challenging nature (e.g., long-term impact, professional transparency). In contrast, frequently agreed-upon items like Item_11 and Item_9 appeared at the lower end of the scale, reflecting their ease of agreement (e.g., "this system saves time"). This alignment indicates that item difficulty matched respondent ability well, suggesting that the instrument was appropriately targeted for the intended population.

Person fit assesses whether respondents answered consistently and in line with the model. Overall, the results indicate high internal consistency among respondents. The mean person ability score was 1.71 logits, with a standard deviation of 0.97. Most respondents demonstrated good fit values. However, Respondent R02 exhibited an outfit MNSQ of 3.31, suggesting erratic or inconsistent responses. This may be due to misunderstanding certain items or fatigue. Respondents R05, R12, and R16 scored among the highest, reflecting strong confidence and agreement with the system's benefits. The exact match percentage averaged 84.2%, suggesting a high level of response predictability in the data set.

PERSON STATISTICS: MISFIT ORDER

ENTRY NUMBER	TOTAL SCORE	TOTAL COUNT	MEASURE	MODEL S.E.	INFIT MNSQ	INFIT ZSTD	OUTFIT MNSQ	OUTFIT ZSTD	PT-MEASURE CORR.	PT-MEASURE EXP.	EXACT MATCH OBS%	EXACT MATCH EXP%	PERSON
2	53	18	-.95	.91	2.45	1.6	3.31	1.9	A .10	.22	83.3	92.5	R02
1	58	18	2.49	.58	1.58	1.7	1.39	.9	B .28	.25	66.7	77.4	R01
18	56	18	1.66	.73	.95	.1	1.26	.6	C .04	.19	88.9	87.9	R18
9	58	18	2.49	.58	1.05	.3	1.17	.5	D .11	.25	77.8	77.4	R09
13	56	18	1.66	.73	1.01	.2	1.08	.3	E .02	.19	88.9	87.9	R13
16	59	18	2.80	.54	1.02	.1	.90	-.1	F .27	.27	72.2	72.0	R16
3	58	18	2.49	.58	1.01	.1	.96	.1	G .22	.25	77.8	77.4	R03
7	56	18	1.66	.73	.96	.1	.87	.0	H .13	.19	88.9	87.9	R07
19	56	18	1.66	.73	.96	.1	.87	.0	I .13	.19	88.9	87.9	R19
14	56	18	1.66	.73	.96	.1	.96	.2	J .11	.19	88.9	87.9	R14
12	59	18	2.80	.54	.92	-.3	.82	-.4	i .38	.27	72.2	72.0	R12
17	58	18	2.49	.58	.91	-.2	.81	-.3	h .35	.25	77.8	77.4	R17
5	60	18	3.08	.52	.87	-.6	.76	-.7	g .47	.29	66.7	67.4	R05
6	56	18	1.66	.73	.86	-.1	.64	-.4	f .30	.19	88.9	87.9	R06
10	56	18	1.66	.73	.81	-.2	.56	-.5	e .37	.19	88.9	87.9	R10
15	55	18	1.02	.89	.76	-.1	.74	.0	d .09	.16	94.4	92.5	R15
8	55	18	1.02	.89	.72	-.1	.55	-.3	c .20	.16	94.4	92.5	R08
4	55	18	1.02	.89	.66	-.2	.42	-.6	b .31	.16	94.4	92.5	R04
11	54	18	.04	1.05	.03	-1.8	.02	-1.8	a .00	.16	100.0	94.8	R11
MEAN	56.5	18.0	1.71	.72	.97	.0	.95	.0			84.2	84.3	
S.D.	1.8	.0	.97	.15	.44	.7	.63	.7			9.6	8.1	

Fig. 3. Person Fit Statistics

The scalogram analysis provides a visual representation of the consistency of item responses across respondents.

GUTTMAN SCALOGRAM OF RESPONSES:

```
PERSON |ITEM
       | 1   1 111  11 1 1
       |91157820353624478 6
       |------------------
     5 +3443443443333333  R05
    12 +4343433334433333  R12
    16 +3334433434433333  R16
     1 +4344333342334333  R01
     3 +4333343333334433  R03
     9 +4333343333343334  R09
    17 +4433333334334333  R17
     6 +3334333333333333  R06
     7 +3333333443333333  R07
    10 +3434333333333333  R10
    13 +3333334333343333  R13
    14 +3334333333333433  R14
    18 +3433333333333433  R18
    19 +3333334343333333  R19
     4 +3433333333333333  R04
     8 +3333343333333333  R08
    15 +3333333343333333  R15
    11 +3333333333333333  R11
     2 +3333343332332333  R02
       |------------------
       | 1   1 111  11 1 1
       |91157820353624478 6
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Fig. 4. Scalogram

8 Discussion

This study examined the effectiveness of SMARTSERVE-PPKI as a digitally automated solution for managing applications and placements within the Special Education Integration Programme (PPKI), combining operational performance

indicators with Rasch-validated user perception data. The findings provide convergent evidence that low-cost, no-code automation can meaningfully improve administrative efficiency, communication quality, and professional practice in special education services.

8.1 Alignment with Digital Transformation and Administrative Efficiency Theory

The substantial reduction in communication turnaround time (≤1 working day) and the high success rate of automated notifications (85%) support existing theories of digital transformation in public service delivery, which posit that automation enhances efficiency by reducing manual intervention and process fragmentation [1,6]. These outcomes align with prior studies demonstrating that structured digital workflows minimise human error, improve information timeliness, and enable more responsive administrative practices in education settings [2–4].

Importantly, the findings extend this body of work into the domain of special education administration, where timely communication and accurate placement decisions are particularly critical. Consistent with Sullivan and McDonough [13], the reduction in repetitive parent inquiries reflects the role of automation in alleviating cognitive and communicative load among administrators, allowing officers to redirect effort towards higher-order professional tasks. This supports the view that digital tools function not merely as efficiency enhancers but as enablers of professional role redefinition in education services.

8.2 Rasch Measurement Evidence and Interpretation of User Perceptions

The Rasch analysis provides preliminary psychometric support for the evaluation instrument, with most items functioning within the expected fit range and with a coherent item hierarchy on the Wright Map. The unidimensional interpretation is justified by the instrument-development logic: the five dimensions were not designed to produce separate domain scores, but to ensure adequate content coverage of one overall construct, namely officers' positive perception of SMARTSERVE-PPKI. The Wright Map and scalogram suggest that items related to efficiency, workload reduction and professionalism operated as facets of a common perception continuum.

At the same time, the rating-scale statistics indicate that respondents mainly used the agreement categories. This pattern is consistent with the pilot context, where respondents were direct users of a system designed to solve an immediate administrative problem. However, the underuse of disagreement categories limits the precision of threshold interpretation and supports the need for larger-scale validation. The two misfitting items should be reviewed substantively to determine whether wording ambiguity, limited stakeholder visibility or extreme endorsement patterns contributed to the misfit.

The hierarchical ordering of items offers substantive insight into system impact. The easiest item to endorse—relief from repeated parent queries—reflects an immediate and tangible benefit of automation, consistent with earlier findings on digital communication systems in education [2,6]. In contrast, the most difficult item to endorse—positive parental feedback—highlights a limitation not in system functionality, but in feedback visibility. This distinction underscores the strength of Rasch analysis in identifying not only system strengths but also latent gaps that may not be apparent through descriptive statistics alone.

8.3 Practitioner-Led Innovation and No-Code System Design

From a design-based research perspective, SMARTSERVE-PPKI exemplifies the effectiveness of practitioner-led digital innovation grounded in contextual needs [9]. The use of no-code platforms and lightweight scripting aligns with research emphasizing accessibility, sustainability, and scalability of digital solutions in public sector environments [8]. Unlike proprietary systems requiring substantial financial and technical resources, SMARTSERVE-PPKI demonstrates that frontline officers can develop, maintain, and refine functional systems that deliver measurable impact.

The strong user agreement observed in this study further supports theories of technology acceptance, which suggest that perceived usefulness and ease of use are critical determinants of sustained adoption. The Rasch-validated findings indicate that officers not only accepted the system but also internalized its benefits as part of their professional workflow, strengthening the case for grassroots digital transformation in education administration.

8.4 Implications for Special Education Policy and Measurement Practice

At the policy level, the findings support the objectives of Malaysia's Digital Education Policy by demonstrating that digitalization initiatives can be implemented effectively at the district level using existing infrastructure and competencies. The study also contributes methodologically by illustrating how Rasch measurement can be applied to validate administrative evaluation instruments, moving beyond anecdotal or satisfaction-based assessments.

By integrating operational metrics with Rasch-based psychometric evidence, this study provides a more rigorous framework for evaluating digital innovations in special education services. This dual-evidence approach strengthens confidence in the reported outcomes and offers a replicable evaluation model for similar initiatives across districts and education systems.

8.5 Limitations

Several limitations should be acknowledged. The most important limitation is the small purposive sample of 19 education officers. This sample was appropriate for an internal pilot evaluation because the respondents were the officers directly involved in PPKI application and placement management in the Northern Zone of Sarawak. However, it is not sufficient for broad population generalization, stable multidimensional modelling or definitive instrument calibration. The findings should therefore be interpreted as preliminary pilot evidence of item functioning and user acceptance rather than as conclusive psychometric validation.

The small sample also affected rating-scale diagnostics. Category 1 was not used and Category 2 was used only minimally, which limits the interpretation of category thresholds. Future studies should include larger and more heterogeneous samples involving officers from additional districts, school administrators and parents so that the full range of response categories can be tested more robustly.

Second, although the instrument was constructed using five content dimensions, the present study applied a unidimensional Rasch model because the dimensions were conceptualised as facets of one integrated construct and because the sample size was too small for stable multidimensional estimation. Future research with a larger sample should examine whether the five-dimensional blueprint is empirically supported and whether separate domain scores are meaningful.

Third, the study focused primarily on officers' perceptions and operational performance indicators. Direct parental satisfaction and school-level user experience were not measured using Rasch-validated instruments. Finally, the pilot implementation was conducted over one month, limiting conclusions about long-term sustainability, adoption behaviour and organisational impact.

9 Conclusion

This study demonstrates that the SMARTSERVE-PPKI system has the potential to serve as a catalyst for digital transformation in the management of special education placement applications at the district level. By implementing an automation system developed using freely available platforms such as Google Forms, Google Sheets, WhatsApp, and Google Apps Script, education officers were able to deliver information to parents more quickly, systematically, and transparently. This innovation not only reduced reliance on time-consuming manual processes that are prone to delays and omissions but also enhanced professionalism and promoted a data-driven work culture within the education sector.

The pilot implementation showed clear positive impacts in terms of time efficiency, reduced workload, and increased user confidence. Rasch model analysis confirmed that the perception instrument was valid and reliable in capturing users' views on system

effectiveness. The Wright Map and scalogram analysis reflected a logical and unidimensional item hierarchy, while person fit statistics indicated strong internal consistency among respondents.

Overall, SMARTSERVE-PPKI is not merely a technological solution but represents an innovative approach that can be replicated in other districts to support the implementation of Malaysia's Digital Education Policy. With its low cost, minimal training requirements, and significant impact, this innovation offers a practical example of how locally developed digital systems can enhance the efficiency of public services, particularly in special education. The study recommends that future system enhancements focus on strengthening two-way communication with parents and expanding functionalities to include schools and state education departments.

Future research should extend the evaluation of SMARTSERVE-PPKI through larger-scale and multi-site implementations involving diverse district education offices to enhance generalizability. Longitudinal studies are recommended to examine system sustainability, user adoption over time, and organizational change resulting from sustained automation. To strengthen stakeholder-centered evaluation, subsequent studies should incorporate Rasch-validated instruments measuring parental satisfaction and school-level user experiences, enabling multi-perspective analysis of service effectiveness. Further refinement of the perception instrument, particularly items related to stakeholder feedback, could improve item targeting and separation, thereby enhancing measurement precision. Future work may also explore integration with state-level education management systems and assess the impact of automation on policy compliance, data governance, and decision-making in special education services

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