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Article

Remedial Teachers' Needs for Developing New Basic Numeracy Teaching Aids: A Needs Analysis

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Abstract: Appropriate teaching aids can assist remedial pupils in mastering basic numeracy skills effectively. However, issues persist of remedial pupils struggling to grasp basic numeracy skills, potentially due to the lack of suitable teaching aids tailored for Malaysia's Special Remedial Programme. Thus, this quantitative study aimed to identify remedial teachers' needs for developing new basic numeracy teaching aids in the Special Remedial Programme. This study adapted McKillip's Discrepancy Model to guide the needs analysis. A quantitative survey methodology was used with 143 remedial teachers respondents in Melaka state, Malaysia. A validated questionnaire measured the levels and discrepancies in remedial teachers' utilisation, perceptions, constraints, and skills regarding proposed basic numeracy teaching aids by the Ministry of Education Malaysia. Descriptive statistics were calculated. Findings showed moderate utilisation, high positive perception, moderate constraints, and high skills levels in using existing basic numeracy teaching aids. Discrepancies were identified in each construct, indicating the need for improvements tailored for better remedial learning. The results suggest modifying and developing new basic numeracy teaching aids that meet remedial pupils' learning characteristics, fostering their creative thinking, facilitating self-directed learning activities, improving time efficiency in teaching and learning mathematics, providing various customisable teaching aid templates that are easy to reproduce with affordable everyday materials, and developing user-friendly technology teaching aids. Addressing these needs can enhance remedial teaching practices and pupils' numeracy achievement. This study provides an important initial evidence base for designing and developing appropriate basic numeracy teaching aids based on remedial teachers' current needs.

Keywords: Basic numeracy; mathematics; needs analysis; remedial teachers; teaching aids

Introduction

A key goal in Malaysian primary mathematics education is developing pupils' strong foundation in basic numeracy skills (Ministry of Education [MoE] Malaysia, 2013). However, many pupils face challenges in acquiring numeracy competencies. National assessments and international testing show a large portion of Malaysian pupils do not meet minimum proficiency benchmarks in mathematics subject (Department of Statistics Malaysia, 2020; MoE Malaysia, 2019). Pupils struggling with numeracy may require remedial intervention. In Malaysia's context, the Ministry of Education implements a Special Remedial Programme to support learning for pupils with difficulties in foundational academic skills, including literacy and numeracy (Special Education Division, 2019). In alignment with Sustainable Development Goal 4 and the Malaysia Education Blueprint 2013-2025, the Special Remedial Programme aims to provide quality education for all learners.

Although there is the Special Remedial Programme to assist pupils, issues persist with pupils not mastering basic numeracy skills. Bird (2017) reports an approximation 4% to 6% of the pupil population is identified with dyscalculia, a learning disability affecting mathematical abilities. However, Malaysian national indicators show around 11% of additional pupils do not reach minimum mathematics benchmarks, indicating more prevalent issues (Department of Statistics Malaysia, 2020; MoE Malaysia, 2019). The COVID-19 pandemic and periods of home-based learning also exacerbated declines in foundational skills (MoE Malaysia, 2021). This insufficient progress in building pupils' basic numeracy proficiency warrants attention. Current mathematics teaching aids may require improvements to help remedial pupils master basic numeracy skills successfully.

Among teaching factors, a lack of appropriate mathematics teaching aids may contribute to pupils' struggles in numeracy. Appropriate teaching aids can support pupils' active learning and skills development effectively (Wong & Osman, 2018). Nevertheless, Malaysia lacks teaching resources and materials compared to other developed countries (the Organization for Economic Cooperation and Development [OECD], 2019). Within Malaysian remedial education contexts, pupils were reported to become bored and disinterested towards mathematics when using the provided teaching aids (Ahamad & Abdul Mutalib, 2015). Most remedial teachers built their teaching aids to support their instruction, even though they lack sufficient time and expertise to develop appropriate teaching aids (Kasran et al., 2012; Mohd Yasin et al., 2007). Besides, mainstream mathematics courses are biased towards remedial pupils' needs (Zientek et al., 2020). The standard teaching aids may be inappropriate to address remedial pupils' different learning difficulties effectively. Consequently, developing new mathematics teaching aids, which are tailored to remedial teachers' and pupils' needs could enhance their teaching and learning outcomes.

While past research has examined aspects of remedial teaching aids, some limitations exist. Previous studies used relatively small samples localised to a few schools in Malaysia (Ungang, 2008), or focused broadly on teaching aids usage regardless of the specific mathematics topics and skills (Mohd Yasin et al., 2007). Some are outdated based on the previous Special Remedial Programme's guidebook (Hamdan et al., 2006). Others included only mainstream mathematics teachers as participants, whose perspectives may not generalise to remedial learning context (Omar et al., 2017; Rusiman et al., 2017). There is limited research specifically investigating remedial teachers' use of basic numeracy teaching aids aligned with the current Special Remedial Programme's guidebook. Examining remedial teachers' practices and perspectives in using current basic numeracy teaching aids can help to inform the development of new basic numeracy teaching aids tailored to remedial contexts. This study also meets the research suggestion by Sani (2014) to develop appropriate teaching aids for remedial pupils.

Thus, this study aimed to provide an updated needs analysis focused on basic numeracy teaching aids usage from the perspective of remedial teachers. The results were used to suggest the development of new basic numeracy teaching aids for Malaysia's Special Remedial Programme. It addressed these research questions below:

i. What are the levels of remedial teachers' utilisations, perceptions, constraints, and skills regarding current basic numeracy teaching aids proposed by the Special Remedial Programme's guidebook?
ii. What are the discrepancies in remedial teachers' utilisations, perceptions, constraints, and skills regarding current basic numeracy teaching aids proposed by the Special Remedial Programme's guidebook?
iii. What are remedial teachers' needs for developing new basic numeracy teaching aids tailored for Malaysia's Special Remedial Programme?

Literature Review

This section examines four core constructs related to mathematics teaching aid usage, namely utilisation, perceptions, constraints, and skills. It also reviews the needs analysis model used in this study.

1. Teaching Aid Usage Utilisation

Teaching aid usage utilisation provides insight into how often teachers employ teaching aids in their instructional practices. Past studies on mainstream mathematics teachers in Malaysia found relatively high levels of overall teaching aid usage utilisation (Omar et al., 2017; Rusiman et al., 2017). However, these studies examined general mathematics teaching aids covering all topics in the local textbook, not specifically focused on basic numeracy skills teaching aids. The basic numeracy teaching aids proposed in the current Special Remedial Programme's guidebook may show different usage utilisation by remedial teachers. Limited research has investigated this context. Additionally, remedial and mainstream teachers varied in terms of the pupils' profiles and needs, thus preventing generalisations of findings between these groups. This present study addressed this gap by analysing remedial teachers' usage utilisations and discrepancies related to the current basic numeracy teaching aids. It can provide insight into teaching aids that may require modifications or replacements to enhance remedial teaching and learning.

2. Teaching Aid Usage Perceptions

Teachers' perceptions of teaching aids reflect their views on the teaching aids' merits and limitations. Past studies on both mainstream and remedial contexts found positive perceptions towards the use of teaching aids (Omar et al., 2017; Rusiman et al., 2017; Ungang, 2008). However, Ungang's (2008) study of remedial teacher perceptions had a relatively small sample size limited to five schools, impacting its generalisability to a broader context. Mainstream mathematics teachers' perceptions may also not apply directly to remedial contexts, given the differences in pupils' characteristics and needs (Omar et al., 2017; Rusiman et al., 2017). This present study updated data regarding remedial teachers' perceptions of the current basic numeracy teaching aids proposed in the Special Remedial Programme's guidebook. It identified any potential discrepancies in remedial teachers' perception that reveal limitations of the existing teaching aids, which required any enhancement or new teaching aids development.

3. Teaching Aid Usage Constraints

Teachers' constraints on using teaching aids can reveal problems or difficulties that hinder their utilisation in the classroom. Past studies on remedial contexts showed various constraints faced in using teaching aids. These included insufficient materials, limited preparation time, and perceptions of ineffective training programmes on how to build and utilise appropriate teaching aids (Hamdan et al., 2006; Mohd Yasin et al., 2007; Ungang, 2008). However, these studies were becoming outdated and examined constraints generally rather than focusing specifically on basic numeracy teaching aids context as defined in the current Special Remedial Programme's guidebook. Research on mainstream mathematics teachers also showed high workload constraints (Omar et al., 2017), contrasting with Hamdan et al.'s (2006) finding of moderate remedial teachers' workload. There is a need to re-examine the constraints specifically impacting remedial teachers' usage of defined basic numeracy teaching aids within the context of Malaysia's Special Remedial Programme. Addressing the identified constraints can inform how enhanced teaching aids could be designed to minimise challenges and facilitate more effective classroom integration by remedial teachers.

4. Teaching Aid Usage Skills

Teachers' skills in using teaching aids reflect their capabilities to effectively apply them within their instruction. Past research focused on pre-service teachers regarding teaching aids skills (Ahmad Zanzali & Daud, 2010), with a limited investigation of trained and in-service remedial teachers. Remedial teachers were noted to lack expertise in preparing and utilising appropriate teaching aids in their context (Mohd Yasin et al., 2007; Ungang, 2008). However, there remains limited specific data on remedial teachers' skills with the defined basic numeracy teaching aids prescribed in the current Special Remedial Programme's guidebook. Thus, examining the levels and discrepancies related to skills can address the areas where remedial teachers may require additional training or support to maximise the usage of teaching aids. Enhanced skills can contribute to more effective classroom integration.

5. Needs Analysis

A needs analysis is a process to identify gaps that can guide productive enhancements, changes, and innovations in practices or programmes (McKillip, 1987). This study adapted McKillip's Discrepancy Model (1987) to conduct a needs analysis focused on remedial teachers' use of current basic numeracy teaching aids. This model involves three processes, namely determining the product goal, measuring performance, and identifying discrepancies, as shown in Figure 1. The levels and discrepancies in using current basic numeracy teaching aids highlight specific needs and areas for improvement.

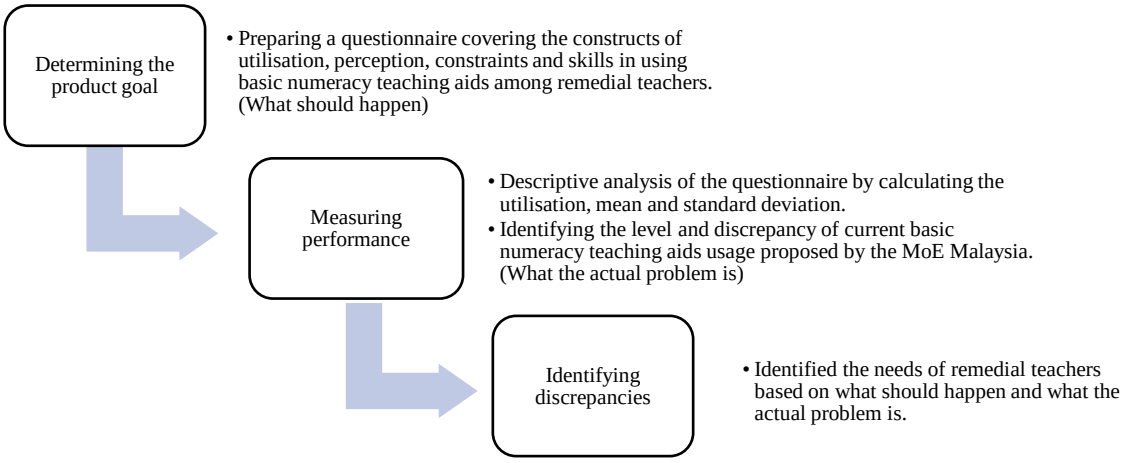

Figure 1. Three Processes of McKillip's Discrepancy Model Needs Analysis
Source: Adapted from McKillip's Discrepancy Model (1987)

In this study, a questionnaire was used to support the needs analysis process. It evaluated remedial teachers' usage of current basic numeracy teaching aids proposed in the Special Remedial Programme's guidebook across four constructs of utilisations, perceptions, constraints and skills. Initially, this questionnaire listed the product goal where every item describes the ideal state of the teaching aid usage. The survey then measured remedial teachers' actual performance on these constructs. Descriptive statistical analysis identified levels and discrepancies where the reality diverges from the ideal. Lastly, these findings revealed remedial teachers' needs and suggested how developing new basic numeracy teaching aids could address the identified discrepancies effectively.

In summary, research gaps persisted around remedial teachers' use of basic numeracy teaching aids outlined in the latest Special Remedial Programme's guidebook. Past studies either focused on general mathematical teaching aids, mainstream teachers, small, localised samples, or works of literature are becoming outdated. Thus, there is a need for research specifically surveying remedial teachers' usage utilisations, perceptions, constraints, and skills regarding proposed basic numeracy teaching aids in the latest guidebook. The identified levels and discrepancies can inform the development of new basic numeracy teaching aids tailored to remedial learning needs. This study was vigorous in providing an initial needs analysis as a foundation for enhancing basic numeracy teaching aids for Malaysia's Special Remedial Programme.

Methodology

1. Research Design

This study employed a quantitative survey methodology. Surveys allow for collecting data about phenomena that cannot be directly observed, such as remedial teachers' teaching aids usage (Idris, 2011). Aligned with McKillip's Discrepancy Model (1987) for needs analysis, this survey evaluated remedial teachers' levels and discrepancies in using defined basic numeracy teaching aids across four constructs of utilisations, perceptions, constraints and skills. Analysing levels and discrepancies in each construct identified needs for improvements through developing tailored teaching aids and training that can enhance remedial instruction and learning.

2. Respondents and Location

The study respondents comprised 143 remedial teachers from primary schools across Melaka state in Malaysia. The homogeneous condition of the Malaysian education system enabled the focus on a single state location for this study. Based on Melaka Education Department statistics in 2021, 1104 third-grade remedial pupils in Melaka continued struggling to master basic numeracy skills, highlighting the need for research in this area. In addition, geographical circumstances between states may lead to different needs for the development of new teaching aids. Thus, limiting the sample to Melaka helps control for potential confounds. However, the findings may serve as an initial model that could be replicated in future studies across other Malaysian states.

Melaka has 200 primary schools implementing the Special Remedial Programme. Every school is assigned one remedial teacher to deliver the programme, apart from low-enrolment schools. This study used a simple random sampling method to avoid sampling bias (Idris, 2011). Krejcie and Morgan's (1970) sample size determination table indicated a required minimum of 132 respondents from this population of remedial teachers. Thus, the achieved sample of 143 respondents in this study was deemed sufficient.

3. Research Instrument

A validated questionnaire with 46 items measured the core constructs. It adapted components from similar instruments used in past Malaysian teaching aids studies while customising to the specific remedial context of teaching and learning basic numeracy skills (Omar et al., 2017; Rusiman et al., 2017). In addition, this questionnaire was improvised to cover more teaching aid goals, as required in the first process of the McKillip Discrepancy Model (1987). It applied a 5-point Likert scale to generate reliable individual difference scales (Creswell, 2009). This questionnaire was in Malay language, as local teachers were fluent. Section A collected respondent demographic data, while sections B to E addressed utilisation, perception, constraints, and skills related to basic numeracy teaching aids usage defined in the Special Remedial Programme's guidebook. All items are in positive statements, except the constraints construct in negative statements.

Extensive validation processes were undertaken based on guidelines from the methodological literature. To establish content validity, three remedial education experts reviewed the questionnaire items. Items that obtained a Content Validity Index below 1.0 were omitted from this questionnaire (Polit et al., 2007). Pilot testing with 20 remedial teachers in Melaka established strong face validity, with items deemed clear and understandable by the respondents (DeVellis, 2016). Respondents took approximately 5 minutes to complete the entire questionnaire. Construct validity was verified through item-total correlation analysis, with non-significant items eliminated from this questionnaire (Pallant, 2010).

Reliability refers to the consistency of the measurements produced by a measuring instrument (Kamis et al., 2012). Based on Chua (2006), test-retest with the pilot sample showed a significant correlation between the first and second surveys ($p<.05$), showing positive external reliability. Besides, the final questionnaire achieved Cronbach's Alpha value of more than .80 for all constructs, meeting accepted thresholds for internal reliability (Pallant, 2010). Overall, this questionnaire demonstrated the required validity and reliability of the study.

This questionnaire was distributed through online Google Forms. Digital survey forms such as Google Forms aided administration and data collection efficiency (Mohamed Yahya, 2002). Questionnaires were distributed to all remedial teachers in Melaka through the Melaka Education Department's officer. All remedial teachers in Melaka were invited to complete the questionnaire within two weeks, excluding the 20 respondents who had taken part in the pilot test.

4. Data Analysis

Descriptive statistics were calculated using Statistical Package for Social Sciences (SPSS) version 20. Frequencies and percentages described respondent demographics. Research question one regarding teaching aids usage levels was addressed by calculating means and standard deviations for each construct. Interpretation used the rubric shown in Table 1.

Table 1. Interpretive rubric for mean values

Mean Score	Level
1.00 – 2.33	Low
2.34 – 3.67	Moderate
3.68 – 5.00	High

Source: Adapted from Abd Samad et al. (2018)

To address research question two, discrepancies were identified from the descriptive results. Items with lower frequencies in the construct of utilisation, perceptions, and skills highlighted that the current teaching aids need improvement. For negative statement items in the constraints construct, items with higher frequencies highlighted the need to be improved. These discrepancies highlighted the current basic numeracy teaching aids limitations and areas for enhancement. Finally, integrating the level and discrepancy findings enabled researchers to identify the needs and recommendations for developing enhanced basic numeracy teaching aids tailored for the Special Remedial Programme, addressing research question three.

The Findings

This study used descriptive analysis to describe the findings.

1. Respondents' Demographics

Overall, 143 remedial teachers provided valid survey responses that met the minimum required sample size. The respondents reflected Malaysia's predominantly female, Malay ethnicity remedial teacher workforce, with bachelor's qualifications and varied remedial teaching experience. Most respondents were aged between 31 to 50 years and served in national primary schools. This aligns with population characteristics, suggesting a representative sample. Table 2 summarises the key respondents' demographic.

Table 2. Remedial teacher demographic profile (N=143)

Demographic	Frequency	Percentage (%)
Gender		
Male	30	21.0
Female	113	79.0
Age		
21 - 30 years	28	19.6
31 - 40 years	63	44.0
41 - 50 years	40	28.0
> 50 years	12	8.4
Ethnicity		
Malay	101	70.6
Chinese	37	25.9
Indian	5	3.5
School Type		
National School (SK)	98	68.5

Chinese National-Type School (SJKC)	37	25.9
Tamil National-Type School (SJKT)	5	3.5
Arab Jaim Primary School (SRA)	3	2.1
Education Level		
Diploma in Education	10	7.0
Teaching Certificate	25	17.5
Bachelor's Degree	101	70.6
Master's Degree	7	4.9
Remedial Teaching Experience		
0 to 5 years	22	15.4
6 to 10 years	42	29.4
11 to 15 years	46	32.2
16 to 20 years	26	18.2
21 to 25 years	7	4.9

2. Basic Numeracy Teaching Aids Usage Levels

The overall mean of 2.89 (SD=.360) indicated a moderate level of utilisation for the proposed basic numeracy teaching aids in the latest Special Remedial Programme's guidebook. Remedial teachers' overall perceptions of the use of basic numeracy teaching aids were high (M=4.08, SD=.338). Most of the items received agreement. In addition, the overall mean for constraints was moderate (M=2.96, SD=.476). Lastly, remedial teachers' overall skill level was high (M=4.02, SD=.308). In conclusion, the findings of this study showed moderate utilisation, high positive perception, moderate constraints, and high skills levels in using existing basic numeracy teaching aids from the perspective of remedial teachers in Melaka. Table 3 summarises the overall basic numeracy teaching aids usage across the four constructs.

Table 3. Overall basic numeracy teaching aids usage construct levels

Constructs of Using Basic Numeracy Teaching Aids	**Mean**	**Standard Deviation**	**Level**
Utilisation	2.89	.360	Moderate
Perception	4.08	.338	High
Constraint	2.96	.476	Moderate
Skill	4.02	.308	High

3. Basic Numeracy Teaching Aids Usage Discrepancies

Findings above on overall levels provided a useful overview, while examining discrepancies within each construct could offer deeper insight into issues and needs.

Utilisations Discrepancies

Table 4 illustrates utilisations construct findings of using basic numeracy teaching aids in Special Remedial Programme among remedial teachers.

Table 4. Utilisations of using basic numeracy teaching aids in Special Remedial Programme (N=143)

No.	Item	Never (1)	Rarely (2)	Sometimes (3)	Often (4)	Very Often (5)
1	Dienes blocks	16	27	47	44	9
2	Counters	0	0	7	69	67
3	Place value chart	1	6	22	71	43
4	Decimal squares	31	21	47	37	7
5	Number line	8	21	40	53	21
6	Hundred chart	6	16	47	58	16
7	Number cards	109	30	3	1	0
8	Dot cards	92	44	6	1	0
9	Multiplication table	1	0	1	52	89
10	Abacus	70	44	23	6	0
11	Calculator	55	81	5	2	0

The findings showed basic numeracy teaching aids such as counters, place value charts, and multiplication tables were utilised most often among remedial teachers. However, abacus, calculators, dot cards, and number cards showed low usage. This discrepancy highlighted that some teaching aids required modifications and the need to develop new teaching aids that could meet the remedial pupils' learning characteristics.

Perceptions Discrepancies

Table 5 illustrates perceptions construct findings of using basic numeracy teaching aids in Special Remedial Programme among remedial teachers.

Table 5. Perceptions of using basic numeracy teaching aids in Special Remedial Programme (N=143)

No.	Item	Strongly Disagree (1)	Disagree (2)	Slightly Agree (3)	Agree (4)	Strongly Agree (5)
1	Improve conceptual understanding	0	0	1	71	71
2	Concretely portray concepts	0	0	1	64	78
3	Help remember knowledge	0	1	17	68	57
4	Enable independent learning activities	6	27	92	13	5
5	Save learning time	0	6	55	65	17
6	Guide creative thinking	4	42	78	16	3
7	Attract attention	0	0	7	94	42
8	Foster interest	0	1	9	76	57
9	Lead to positive attitudes	0	1	18	84	40
10	A fun way to introduce skills	0	0	4	48	91
11	Easy way to introduce skills	0	0	6	91	46
12	Link real situations and symbols	0	0	9	86	48
13	Improve performance	0	0	5	87	51
14	Facilitate teaching and learning	0	0	10	92	41
15	Create conducive environment	0	0	11	91	41

The findings showed most of the items received agreement. This indicated remedial teachers had a positive perception of current basic numeracy teaching aids. Nevertheless, three discrepancies were detected in this construct through high frequency in "Strongly Disagree", "Disagree", and "Slightly Agree". The respondents disagreed that the current teaching aids were effective at enabling independent learning activities, saving learning time, or guiding creative thinking for remedial pupils. It indicated areas for enhancements.

Constraints Discrepancies

Table 6 illustrates constraints construct findings of using basic numeracy teaching aids in Special Remedial Programme among remedial teachers.

Table 6. Constraints of using basic numeracy teaching aids in Special Remedial Programme (N=143)

No.	Item	Strongly Disagree (1)	Disagree (2)	Slightly Agree (3)	Agree (4)	Strongly Agree (5)
1	Ineffective teacher training on teaching aid usage	70	52	6	13	2
2	Lack of experience/expertise in using teaching aids	40	70	15	16	2
3	Limited time to test new teaching aids	14	85	23	18	3
4	Insufficient preparation time	2	30	22	68	21
5	Packed syllabus limits usage	5	75	39	22	2
6	Administration pressure on syllabus limits usage	7	69	45	18	4
7	Heavy teacher workload	3	14	20	83	23
8	High cost of preparing new teaching aids	7	78	39	16	3
9	Insufficient teaching aids	0	7	30	90	16
10	Insufficient teaching aid usage guidelines	7	38	67	28	3
11	Limited teaching aid variations	0	7	35	92	9
12	Insufficient class sets of teaching aids	0	8	30	84	21

The items in this construct were negatively worded. Therefore, discrepancies in this construct were identified through the items that achieve high frequency in "Agree" and "Strongly Agree". This study discovered five constraints faced by remedial teachers. The five highest frequency constraint items were heavy teacher workload, insufficient preparation time, insufficient class sets of teaching aids, insufficient teaching aids, and limited teaching aid variations. Innovation in creating appropriate teaching aids could help minimize these constraints.

Skills Discrepancies

Table 7 illustrates skills construct findings of using basic numeracy teaching aids in Special Remedial Programme among remedial teachers.

Table 7. Skills of using basic numeracy teaching aids in Special Remedial Programme (N=143)

No.	Item	Strongly Disagree (1)	Disagree (2)	Slightly Agree (3)	Agree (4)	Strongly Agree (5)
1	Help pupils understand concepts	0	0	2	104	37
2	Select teaching aids based on learning objectives	0	0	8	94	41
3	Plan lessons with teaching aids	0	0	7	82	54
4	Explain mathematics concepts with teaching aids	0	0	10	102	31
5	Use teaching aids to reduce memorisation without understanding	0	1	22	91	29
6	Adapt teaching aids to pupils' level	0	0	14	100	29
7	Use electronic teaching aids	2	28	73	36	4
8	Correct misconceptions with teaching aids	0	1	14	112	16

As shown in Table 7, remedial teachers were skilful in using prescribed teaching aids throughout their instruction. However, a discrepancy emerged regarding lower skills in using electronic teaching aids. Developing and enhancing user-friendly electronic teaching aids could build remedial teachers' competency in this area.

4. Remedial Teachers' Needs for New Basic Numeracy Teaching Aids

Integrating the levels and discrepancies in using basic numeracy teaching aids allowed researchers to identify remedial teachers' needs and recommendations for developing new teaching aids tailored for remedial contexts. Table 8 summarises remedial teachers' needs based on the constructs.

Table 8. Needs analysis outcomes

Constructs	Level	Key Discrepancies	Remedial Teachers' Needs
Utilisation	Moderate	Rare use of abacus, calculator, dot cards, and number cards	Modify and develop new teaching aids that meet the remedial pupils' learning characteristics to increase utilisation level.
Perception	High	Teaching aids lack encourage remedial pupils' creative thinking, limited support for independent activities, and less time efficiency	Enhanced teaching aids to foster remedial pupils' creative thinking, support self-directed learning, and improve time efficiency.
Constraint	Moderate	Teacher heavy workload, insufficient preparation time, lack of teaching aids, insufficient class sets, and limited variations.	Various customisable teaching aid templates that are easy to reproduce with affordable everyday materials.
Skill	High	Lower with electronic-type teaching aids	Developing user-friendly technology teaching aids.

Applying McKillip's Discrepancy Model (1987), discrepancies between desired and actual levels of the teaching aids usage constructs suggested the need to develop improved basic numeracy teaching aids in the Special Remedial Programme. Based on Table 8, less utilised teaching aids such as abacus, calculator, dot cards, and number cards required modifications to be more usable. Besides, this study also suggested the development of new basic numeracy teaching aids that were tailored to meet remedial pupils' learning characteristics. Addressing these discrepancies could boost the utilisation level of teaching aids usage among remedial teachers. The development of new basic numeracy teaching aids should also be able to foster remedial pupils' creative thinking, support self-directed learning, and improve time efficiency. Constraints faced by remedial teachers could be addressed through various customisable teaching aid templates that are easy to reproduce with affordable everyday materials. Addressing these problems could decrease the constraint level in using teaching aids among remedial teachers. Finally, developing electronic teaching aids with user-friendly designs could build remedial teachers' technology skills. This aligned with remedial teachers' needs to enhance better technology integration skills for delivering quality instruction.

Overall, addressing these gaps through the development of appropriate new basic numeracy teaching aids can significantly enhance remedial instruction and pupils' numeracy learning. This needs analysis provided important evidence to inform tailored teaching aids design and training focused on remedial contexts.

Discussion

This study provides an updated perspective on remedial teachers' usage of basic numeracy teaching aids prescribed in the latest Special Remedial Programme's guidebook. Applying appropriate teaching aids can enhance remedial pupils' mathematics learning outcomes (Chen & Wu, 2020; Ong & Amir, 2019; Wong & Osman, 2018). Thus, the findings offer vital evidence regarding the need for developing new basic numeracy teaching aids that can better support remedial pupils in acquiring basic numeracy skills effectively.

The moderate utilisation level among remedial teachers contrasts with past studies showing a high utilisation level among mainstream mathematics teachers (Omar et al., 2017; Rusiman et al., 2017). This supports the literature indicating mainstream mathematics courses are potentially biased against remedial learners (Zientek et al., 2020). Standard teaching aids may be inappropriate to cater to remedial pupils' needs. This study identifies abacus, calculators, number cards, and dot cards may present cognitive challenges for pupils struggling with numeracy foundations. Although the abacus can increase pupils' cognitive capacity (Chen et al., 2011), it is less appropriate to use with remedial pupils who are weak in number sense and working memory (Yoong & Ahmad, 2021). Adaptations and development of new basic numeracy teaching aids that can build number sense and strengthen their working memory may promote greater teaching aid utilisation among remedial teachers. Tailoring these teaching aids to remedial pupils' learning characteristics can improve their engagement, skills, motivation, and mathematics performance effectively (Mazeyanti et al., 2018).

The overall high positive perceptions align with previous research (Rusiman et al., 2017; Ungang, 2008). Teachers believe teaching aids can enhance remedial pupils' learning effectively (Chen & Wu, 2020).

However, discrepancies around fostering creative thinking reflect findings that pupils with weaker mathematics skills have underdeveloped number sense (Yoong & Ahmad, 2021). Moving through a concrete-representational-abstract approach may be beneficial to guide their creative thinking phase by phase (Flores et al., 2020), rather than focusing solely on procedural fluency exercises (Somasundram et al., 2018). Perceptions that teaching aids do not promote self-directed learning also reflect remedial pupils' dependence on teachers' guidance (Special Education Curriculum Development Centre, 2008). Integrating and developing a digital math game that incorporates feedback mechanisms, can increase remedial pupils' engagement and motivate autonomous practice in their learning process effectively (Avdiu et al., 2022; Chu et al., 2021; Mustafa et al., 2023). In addition, perceptions that teaching aids are less efficient reflect remedial pupils need more time to solve a mathematical problem. Using teaching aids like counters is less efficient in solving a large number through strategy counting one by one. Thus, new teaching aids should be able to build both conceptual understanding and procedural fluency simultaneously, and support pupils to generalise these skills without any concrete teaching aids at the end of the lesson (Zulnaidi & Syed Zamri, 2017).

Moderate constraint levels corroborate past studies identifying hindrances such as insufficient teaching aids, limited variations, and inadequate preparation time (Hamdan et al., 2006; Mohd Yasin et al., 2007; Ungang, 2008). The updated syllabus also adds workload pressures that limit remedial teachers to integrate teaching aids in class (Special Education Department, 2012). These constraints can be linked to the moderate utilisation level of teaching aids usage in this study. Insufficient teaching aids limit their utilisation in class. This is also in line with the OECD report (2019), which noted that Malaysia lacks teaching materials compared to other developed countries. To address this, developing various customisable teaching aid templates that can easily to reproduce with affordable everyday materials can provide diverse options without overburdening remedial teachers. It also allows remedial teachers to build adequate teaching aids at any time and any place. Besides, customisable templates enable teachers to modify the teaching aids' design and content. Tailoring these teaching aids to cater to different remedial pupils' needs can maximise their learning outcomes.

Finally, high skill levels are expected with the respondents' training and experience in this study. However, one discrepancy is detected. Remedial teachers have limited skills in using electronic teaching aids. It is in line with remedial teachers' moderate level in integrating 21st-century learning in Malaysia (Mohd Yasin & Atin, 2021). This can be explained by the limited electronic teaching aids suggested in the current Special Remedial Programme's guidebook and local mathematics textbooks. To address this, developing user-friendly electronic teaching aids can build teachers' competency in this area. The development of mathematical smartphone applications can promote playful and engaging math practice for pupils to enhance their mathematics performance at their level of understanding (Chang & Yang, 2016). Besides, the development of instructional videos for self-directed learning allows remedial pupils to increase their acceptance rate towards the course (Sugiman et al., 2021). Lastly, the development of immersive technologies, such as Augmented Reality and Virtual Reality can boost motivation, focus, and performance by experiencing a different learning environment between the virtual and real worlds (Ibrahim et al., 2022; Keller et al., 2018). Thus, many types of appropriate electronic teaching aids can be developed to enhance remedial pupils learning in Malaysia. However, they need to be user-friendly and easy to use.

In summary, key discrepancies across all constructs highlighted the important need for developing new basic numeracy teaching aids. This study on needs analysis provides a valuable foundation to guide future research on designing and developing appropriate basic numeracy teaching aids for the Special Remedial Programme. Implementing appropriate evidence-based teaching aids can enhance remedial instruction and reduce the issue of remedial pupils yet to master basic numeracy skills in Malaysia. As a conclusion, remedial teachers need:

i. Teaching aids that are specifically developed based on remedial pupils' learning characteristics to enhance their utilisation level in the classroom.
ii. Innovative teaching aids that can foster remedial pupils' creative thinking by utilising a concrete-representational-abstract approach to stimulate deeper understanding.
iii. Interactive digital math games that can support remedial pupils' self-directed learning to master basic numeracy skills.

iv. Teaching aids that can build conceptual understanding and procedural fluency simultaneously to improve time efficiency in teaching and learning mathematics.
v. Various customisable teaching aid templates that are easy to reproduce with affordable everyday materials to reduce remedial teachers' constraints level in using teaching aids.
vi. Innovative digital teaching aids such as mathematical smartphone applications, instructional videos, and immersive technologies to enhance remedial teachers' proficiency in using electronic teaching aids.

Conclusion

This study provides an important updated needs analysis focused on basic numeracy teaching aids prescribed in Malaysia's latest Special Remedial Programme's guidebook. The survey among remedial teachers yielded vigorous perspectives revealing levels, discrepancies and needs that can inform tailored teaching aid design. Findings suggest modifying and developing new basic numeracy teaching aids that meet remedial pupils' learning characteristics, fostering remedial pupils' creative thinking, facilitating self-directed learning activities, improving time efficiency, providing various customisable teaching aid templates that are easy to reproduce with affordable everyday materials, and developing user-friendly technology teaching aids. Meeting these needs can equip remedial teachers with more appropriate teaching aids aligned with their pupils' learning characteristics and difficulties.

Addressing these needs can enhance remedial teachers' instructional practices and pupils' mathematics learning outcomes effectively. This quantitative study offers a methodological foundation for empirical remedial education research in Malaysia. It provides an initial evidence base to guide purposeful innovations in basic numeracy teaching aids design and tailored remedial instruction. Further research should develop and evaluate new basic numeracy teaching aids and training that can address the needs identified in this study. Enhanced teaching aids can potentially promote mastery of basic numeracy skills among remedial pupils and strengthen the Special Remedial Programme's capacity to fulfil Malaysia's educational goals.

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