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PROGRAMME DESCRIPTION

MEDTOPUS: An inclusive pharmacist-led health education innovation programme to improve medication knowledge and self-reported satisfaction among visually impaired persons

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Abstract

Background: Visually impaired individuals face significant barriers in understanding and safely managing medications. Educational efforts to promote quality use of medicines (QUM) often exclude this population. MEDTOPUS is a pharmacist-led educational programme tailored to visually impaired individuals, developed to improve their understanding of the 5B principles: right patient, right medicine, right dose, right route, and right time. **Methods:** It involved interactive educational talks and a tactile group game using materials in Braille and Roman scripts. The programme was delivered in four community-based settings for visually impaired individuals. Knowledge level improvement was assessed using pre- and post-tests, and participant satisfaction was evaluated using a structured feedback questionnaire. **Results:** Among 21 participants, 90.5% of participants either improved or maintained their knowledge scores. Nearly all participants reported satisfaction with the programme and expressed a willingness to apply and share the knowledge gained. **Conclusion:** The intervention demonstrates the effectiveness of inclusive, community-based education in pharmacy practice.

Introduction

The quality use of medicines (QUM) is an essential component of pharmacy education and public health policy. It ensures that medicines are used safely, effectively, and rationally, minimising harm and maximising therapeutic outcomes. In Malaysia, the Quality Use of Medicines – Consumer (QUMC) programme, such as Know Your Medicine (KYM), was introduced to promote public awareness and education on medication use (Ting *et al.,* 2019). Despite these national efforts, vulnerable groups such as individuals with visual impairments have largely been excluded from structured educational interventions. Visually impaired individuals often experience substantial challenges related to medication use, including difficulties reading labels, identifying medications, interpreting instructions, and managing medication storage and disposal.

International evidence supports this concern. In South Korea, pharmacists often counselled caregivers rather than the visually impaired patients themselves, resulting in limited direct engagement with the actual medicine users (Lee & Lee, 2019). In South Africa, studies highlighted a lack of knowledge among visually impaired patients, who frequently relied on informal or unsafe practices and had minimal access to educational support (Poka *et al.,* 2022). Meanwhile, Belgian

pharmacists reported difficulties in communicating effectively with visually impaired patients and emphasised the need for better training and resources to support them (Merenda *et al.,* 2024).

A Malaysian study conducted by Universiti Kebangsaan Malaysia (UKM) found that the majority of visually impaired individuals surveyed had never received proper education on medication use, leading to widespread unsafe practices such as incorrect storage and disposal (Zhi-Han *et al.,* 2017). These issues place them at greater risk of medication-related errors and adverse outcomes.

Despite the recognition of these gaps, most interventions to date have focused on accessibility features—such as Braille or audio labels—rather than direct educational strategies. While such technologies are helpful, they do not substitute for structured learning about fundamental QUM concepts. There remains a critical gap in inclusive health education that actively engages visually impaired populations in understanding medication safety, efficacy, and responsible use.

In response to this unmet need, the Kuala Selangor District Health Office, in collaboration with the Faculty of Pharmacy, Universiti Teknologi MARA (UiTM), developed and implemented MEDTOPUS. It is a pharmacist-led community education initiative designed to deliver medication literacy through interactive, inclusive, and culturally relevant teaching tools. The programme focuses on the 5R framework—right patient, right medicine, right dose, right route, and right time—as a foundation for promoting safe and effective medicine use.

This article presents the full development, implementation, and outcomes of the MEDTOPUS programme, highlighting its role as a replicable model for inclusive pharmacy education.

Education framework and programme philosophy

The design of MEDTOPUS is grounded in the principles of inclusive health education and experiential learning theory, particularly Kolb's experiential cycle (1984). This model emphasises learning through active involvement, reflection, conceptualisation, and application—elements fully embedded in the programme's flow (Reynolds et al., 2020). Participants engage in tactile, verbal, and socially interactive sessions that create opportunities to reflect on real-life medication experiences and reinforce key safety principles.

Additionally, MEDTOPUS aligns with the broader constructivist learning philosophy, which holds that learners construct knowledge through meaningful engagement in context. The programme's format—comprising peer-supported discussion, practical scenarios, and multi-sensory tools—encourages ownership of learning and contextual understanding of QUM principles.

MEDTOPUS supports and advances several key national and global policy frameworks. It aligns closely with the Malaysian National Medicines Policy (DUNas), particularly Pillar 4, which focuses on the promotion of quality use of medicines at the community level (Pharmaceutical Services Division, 2012). Pillar 4 calls for structured, evidence-based educational activities that engage the public in understanding their medicines, making informed decisions, and using medicines safely and effectively. MEDTOPUS directly contributes to this objective by addressing a specific underserved community—individuals with visual impairments—who have traditionally been excluded from mainstream medicine education campaigns.

On a global scale, MEDTOPUS contributes to the achievement of the United Nations Sustainable Development Goals (SDGs), particularly SDG 3: Good Health and Well-being and SDG 10: Reduced Inequalities, by promoting health literacy and inclusivity in public health education (United Nations, 2015). By integrating Braille-printed learning cards, tactile gameplay, and verbal facilitation, MEDTOPUS exemplifies health equity in action. It strengthens the role of pharmacists not only as medication experts, but also as health educators committed to addressing the needs of marginalised communities through inclusive pedagogy.

Description of innovation

Programme design and objectives

The MEDTOPUS programme was developed as a community-based educational initiative aimed at enhancing medication literacy and promoting the safe use of medicines among individuals with visual impairments. In designing the educational content, the programme adopted the 5R principles—right patient, right medicine, right dose, right route, and right time—established by Malaysia's Pharmaceutical Services Programme under the Ministry of Health. These principles form the foundation of the national Know Your Medicines campaign and were selected for their clarity, relevance to everyday medicine use, and alignment with public health education goals in Malaysia (MOH Pharmaceutical Services Programme, 2013).

Rather than delivering these messages in a conventional didactic format, MEDTOPUS translated them into

accessible learning experiences. Using tactile tools, verbal guidance, and interactive group activities, participants were introduced to the 5R concepts in ways that encouraged engagement and practical application. This approach was particularly effective for visually impaired individuals, who often face challenges in accessing standard medicine-use instructions and counselling.

The programme aimed to achieve three core objectives: first, to improve participants' knowledge of safe medicine practices through inclusive and interactive strategies; second, to measure the effectiveness of the intervention via structured pre- and post-assessments; and third, to evaluate participants' satisfaction and perceptions of the programme's usefulness. The entire structure was informed by experiential learning theory (Kolb, 1984), which emphasises learning through concrete experience, reflective observation, and active experimentation—principles that were embedded into every stage of the programme delivery.

Development of learning materials

The learning materials used in the MEDTOPUS programme were meticulously developed to ensure accessibility and inclusion, with contributions from experienced pharmacists and educators who possessed familiarity with best practices in teaching individuals with visual impairments. These materials were crafted to support multi-sensory engagement and promote independent participation among the target population (Figure 1). Assessment tools included pre- and post-tests delivered via Google Forms, which were optimised for compatibility with smartphone accessibility features, including screen readers. Participants accessed the tests through QR codes and completed them either independently or with the assistance of facilitators, depending on their level of digital literacy and vision capabilities.

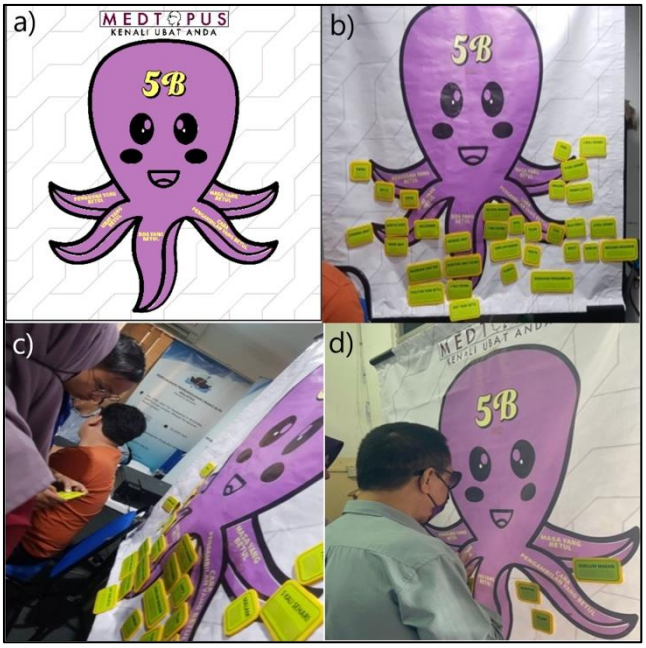

Figure 1: (a) MEDTOPUS gameboard design. (b) The MEDTOPUS gameboard with complete stickers of Braille for visually impaired participants. (c) and (d) MEDTOPUS game activity with participants.

In addition to assessments, two structured educational talks formed the foundation of the instructional content. The first, titled "*Know Your Medicine*", focused on key competencies such as interpreting medication labels, identifying different dosage forms, and understanding correct usage instructions. The second talk, "*Proper Medicine Storage*", addressed common misconceptions around household medicine storage, emphasising the importance of maintaining appropriate storage conditions, monitoring expiry dates, and separating medications to avoid misuse.

To reinforce these concepts through active learning, the programme introduced the MEDTOPUS Gameboard—a uniquely designed, squid-shaped tactile tool. As shown in Figure 1, each of its "*tentacles*" symbolised one of the five key principles of safe medicine use. Game cards, produced in both Braille and Roman script, featured real-life medication scenarios such as incorrect timing or

dosage. Participants were encouraged to discuss and physically match each card to its corresponding tentacle, allowing them to consolidate their understanding through tactile feedback and peer interaction.

All materials were reviewed and validated by pharmacy academicians and a Braille educator. MEDTOPUS was also pilot tested at KL Braille Resources, a centre that supports the blind and visually impaired community. Based on the feedback received during this pilot phase, modifications were made to enhance the clarity of instructions, the comfort and usability of the tactile components, and the overall educational impact of the sessions.

Recruitment and participants

Participants were recruited through collaborations with organisations serving visually impaired individuals, including KL Braille Resources, Development Organisation for the Blind Malaysia (DOBM), and a special education primary school for students with visual impairment in Selangor. Eligible participants were visually impaired individuals who voluntarily agreed to participate in the programme. A total of 21 visually impaired participants were recruited across the three implementation sites and at the Kuala Selangor Health clinic facility.

Facilitators and training

The programme was delivered by a multidisciplinary team comprising six pharmacists and one pharmacy assistant from the Kuala Selangor District Health Office, together with one academic researcher from the Faculty of Pharmacy, Universiti Teknologi MARA. Prior to implementation, facilitators were briefed on the intervention objectives, use of the MEDTOPUS materials, and appropriate communication strategies when engaging with visually impaired participants.

Cost and resource considerations

MEDTOPUS was designed as a low-cost, reusable educational intervention. Materials were developed for repeated use, and the group-based delivery model minimised resource and personnel requirements. Participation was provided at no cost to participants.

Ethical considerations

MEDTOPUS was implemented as part of a routine pharmacist-led public health education programme under the Quality Use of Medicines–Consumer (QUMC) initiative. Formal ethics committee approval was not required, as the activity constituted programme delivery with routine educational evaluation rather than research involving experimental intervention. Participation was voluntary, and verbal consent was obtained prior to participation. Pre- and post-test assessments and satisfaction surveys were administered anonymously, with no collection of personally identifiable information. All data were used solely for programme evaluation and service improvement purposes.

Evaluation

Pre and post tests

To evaluate the educational impact of the MEDTOPUS programme, participants completed structured pre- and post-tests consisting of 12 multiple-choice questions related to safe medication practices based on the 5R principles. These tests were administered using Google Forms, accessed via QR codes and optimised for screen reader accessibility. Participants answered independently or with assistance from trained facilitators. Out of 21 participants, 5 (23.8%) required facilitator assistance during completion of the pre- and post-tests due to limitations in digital literacy or familiarity with assistive technologies. Assistance involved reading questions verbatim and recording participants' stated responses without interpretation or feedback. Identical questions were used for both tests to enable direct comparison of knowledge improvement.

Each score was converted into a percentage and categorised into three knowledge levels using fixed thresholds: low (0 – 49%), moderate (50 – 79%), and high (80 – 100%). These thresholds were applied consistently for both pre- and post-tests to ensure comparability. Changes in category levels are presented descriptively, while the primary analysis focused on continuous score differences.

All statistical analyses of pre- and post-tests were conducted using IBM SPSS Statistics version 28. Descriptive statistics (mean, standard deviation, frequencies) were used to summarise participants' scores and knowledge level categories. A paired-sample t-test was applied to compare pre- and post-test mean scores. Relationships between pre-test scores and improvement were explored using Pearson correlation and simple linear regression. A p-value of less than 0.05 was considered statistically significant.

Evaluation findings and educational significance

Descriptive analysis showed that the mean pre-test score was 59.19% (SD = 14.83), increasing to 79.71% (SD = 13.64) at post-test. The mean difference between

post- and pre-test scores was 20.52 percentage points (95% CI: [14.1, 26.9]). A paired-sample t-test confirmed this improvement was statistically significant (t(20) = 6.514, $p < 0.001$), with a large effect size (Cohen's d = 1.421) (Table I).

Table I: Comparison of pre-test and post-test scores (paired sample t-test)

Test	Mean (%)	SD	t (df=20), *p*-value
Pre-test	59.19	14.83	t = 6.514, $p < 0.001$
Post-test	79.71	13.64	

Categorical analysis based on knowledge levels showed that most of participants either improved or maintained their knowledge level following intervention. Among those initially classified in the low category, 77.8% moved to moderate and 22.2% advanced to high. The full distribution of changes is shown in crosstabulation in Table II.

Table II: Shift in knowledge levels from pre-test and post-test

Pre-test levels	Post-test level		
	Low	Moderate	High
Low	0%	77.8%	22.2%
Moderate	0%	20.0%	80.0%
High	0%	0%	100%

Figure 2 presents the relationship between pre-test scores and improvement scores, indicating greater score increases among participants with lower baseline knowledge. Simple linear regression confirmed that pre-test scores significantly predicted improvement (β = −0.566, $p = 0.007$), accounting for 32.1% of the variance (Table III).

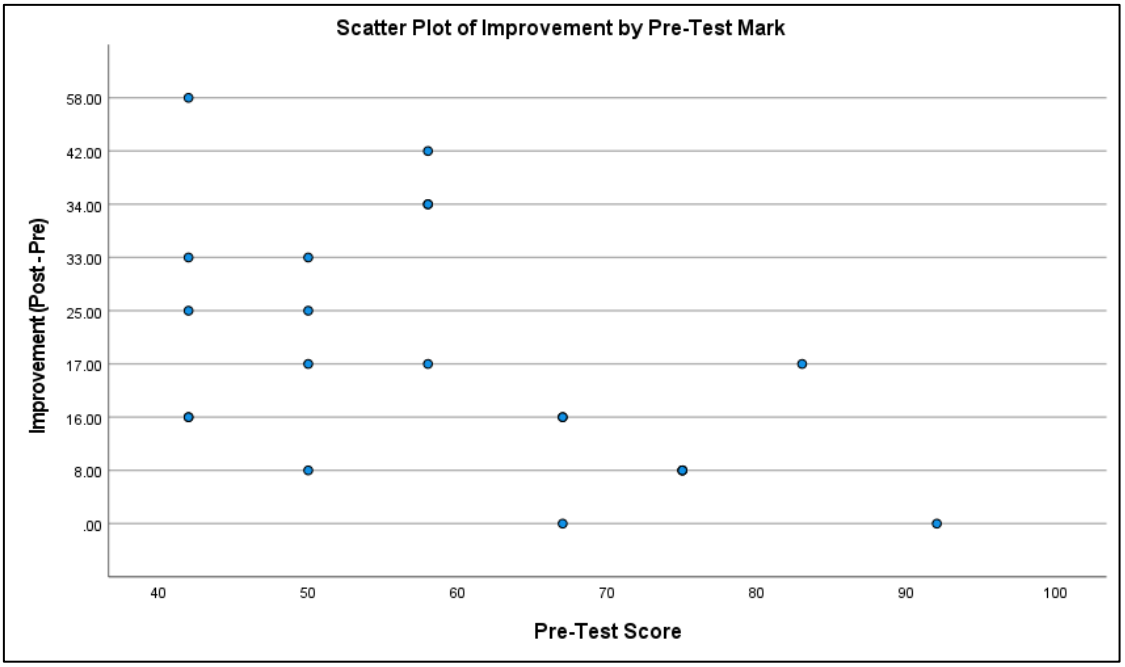

Figure 2: Scatterplot showing the relationship between pre-test scores and knowledge Improvement. Each point represents an individual participant. A clear negative correlation is visible, indicating that those with lower initial knowledge tended to show greater learning gains following the MEDTOPUS intervention.

Table III: Simple linear regression analysis predicting improvement based on pre-test score

Predictor	Unstandardised β	Standardised β	*p*-value
Pre-test score	-0.514	-0.566	0.007

Figure 3 illustrates the distribution of scores from the pre-test and post-test assessments, highlighting a significantly higher median score for the post-test and a reduction in score variability.

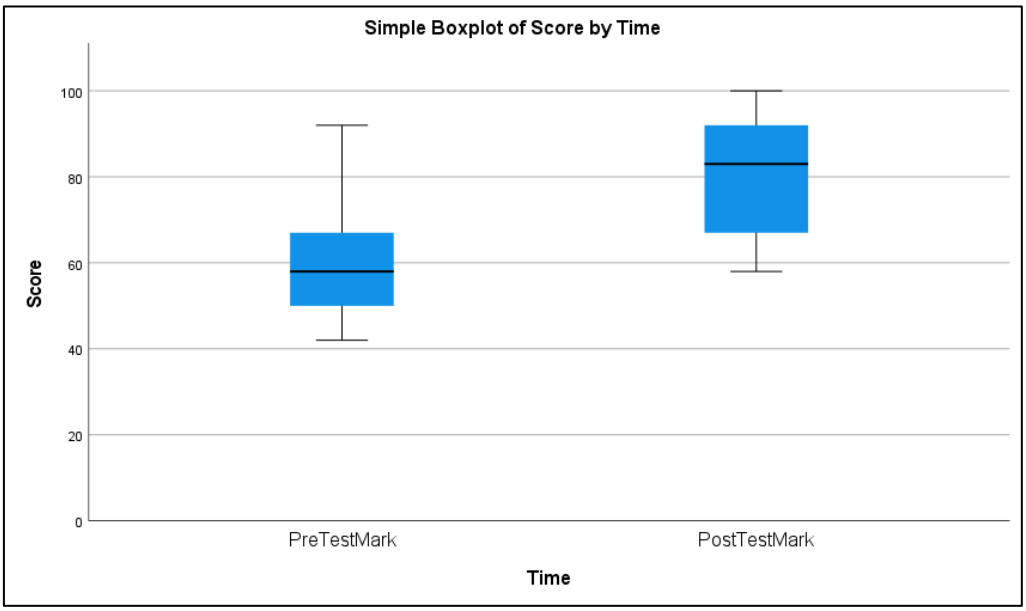

Figure 3: Boxplot comparing pre-test and post-test score distributions. The boxplot illustrates the shift in score distributions before and after the intervention. The post-test group demonstrated higher median scores and reduced interquartile range, supporting the overall effectiveness of the programme.

To assess the potential influence of assisted assessment completion, a sensitivity analysis was conducted, excluding participants who required facilitator assistance (n = 5). Among participants who completed assessments independently (n = 16), post-test scores remained higher than pre-test scores, with a comparable direction and magnitude of improvement, indicating that the observed knowledge gains were not solely attributable to assisted completion.

Participant satisfaction

Participant satisfaction was assessed using an 8-item self-reported questionnaire covering four domains: content quality, delivery effectiveness, accessibility, and behavioural intent (Table IV). The questionnaire was administered immediately after programme completion using Google Forms accessed via QR codes and optimised for screen reader compatibility. Participants completed the survey independently, where possible; facilitator assistance was provided verbally when required, without prompting or interpretation of responses.

Table IV: Participants satisfaction survey domains and sample items

Domain	Code	Item	Agree/Strongly Agree percentage (%)
Content quality	S1	Content was clear and understandable	98
	S2	Improved medication knowledge	100
Delivery effectiveness	S3	Presenter's delivery was clear	97
	S4	Materials supported learning	96
Accessibility	S5	Activity accommodated visual impairment	100
Behavioral intent	S6	Would participate again	99
	S7	Would recommend to peers	100
	S8	Overall satisfaction	100

Overall, satisfaction responses were high across all survey items, with agreement rates exceeding 95% for each item (Table IV). All participants agreed that the programme improved their understanding of medication-related information (S2), was accessible for visually impaired individuals (S5), and was suitable for recommendation to peers (S7). Given the near-ceiling distribution of responses, satisfaction findings are presented descriptively and interpreted as indicators of programme acceptability rather than as measures of intervention effectiveness.

Implementation

MEDTOPUS programme was implemented at four locations: Sekolah Kebangsaan Jeram Batu 20, the Malaysian Association for the Blind (PPOBM), Kuala Selangor Health Clinic and KL Braille Resources. From there, a convenience sample of 21 visually impaired individuals was successfully selected and participated in this programme. According to Figure 4, each session followed a structured and consistent flow, designed to facilitate both learning and assessment in an inclusive environment. The session began with a pre-test, where participants were asked to scan a QR code using their smartphones to access a 12-item multiple-choice quiz (MCQ) via Google Forms. Participants who were familiar with screen reader technology completed the test independently, while others received guided assistance from trained facilitators who supported them in navigating the form and recording their responses verbally if necessary.

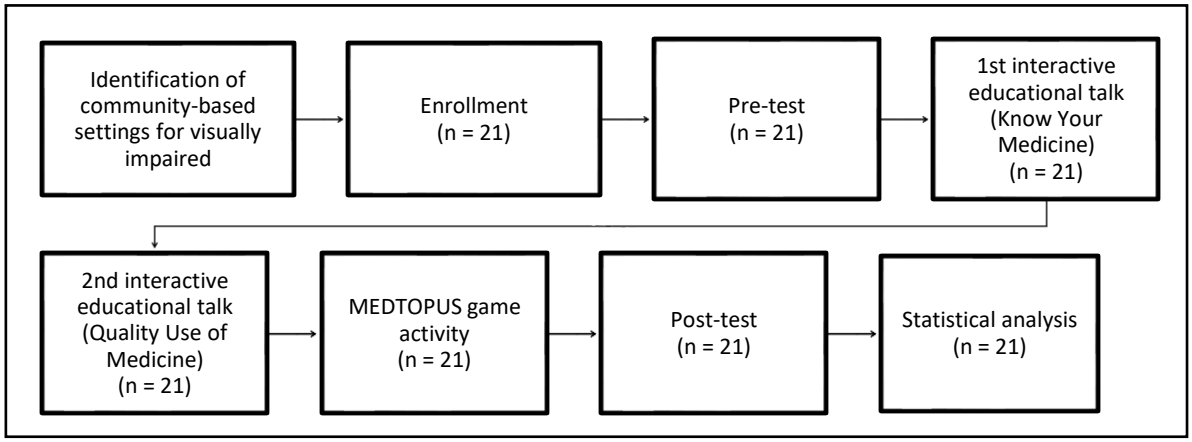

Figure 4: Flowchart of learning activities

Following the assessment, participants attended two educational talks delivered orally by pharmacists using simplified slides and relatable real-life examples. These sessions covered fundamental topics, including the safe and effective use of medicines, how to interpret medicine labels, understanding dosage instructions, and the principles of proper medicine storage. The talks were intentionally designed to be clear, interactive, and aligned with the lived experiences of visually impaired individuals.

After the lecture component, participants engaged in the MEDTOPUS game activity, conducted in small groups to foster collaboration and peer discussion. Using the tactile MEDTOPUS board, participants were presented with medicine-related scenarios and asked to classify each one according to the appropriate medication-use principle. This activity provided an opportunity for hands-on learning while reinforcing the 5R concepts through tactile cues and verbal interaction.

To conclude the session, a post-test was administered using the same method as the pre-test. This allowed the facilitators to measure knowledge improvement while ensuring consistency in the testing format and accessibility approach.

Discussion

The findings of this study indicate that the MEDTOPUS programme was associated with a meaningful improvement in medication-related knowledge among visually impaired participants. The statistically significant increase in post-test scores, together with the large effect size observed, suggests that participants demonstrated substantial short-term knowledge gains following the intervention (Table I). Similar outcomes have been reported in pharmacist-led

educational initiatives, where structured community-based programmes contributed to improved medication knowledge and safer medication practices (Almukainzi *et al.,* 2020; Jaam *et al.,* 2021).

In addition to improvements in continuous knowledge scores, descriptive analysis of knowledge level categories provides further insight into individual learning trajectories. When consistent thresholds were applied across pre- and post-tests, most participants either improved or maintained their knowledge levels (Table II). This pattern suggests that participants were able to consolidate core concepts related to the quality use of medicines rather than demonstrating superficial recall. Comparable findings have been reported in community pharmacy education programmes employing interactive and experiential approaches, which have been shown to enhance comprehension and retention of health information (Chang *et al.,* 2024; Kore & Begum, 2022).

An important observation was the significant negative association between baseline knowledge scores and subsequent improvement (Figure 2), indicating that participants with lower initial knowledge tended to achieve greater gains. This finding is consistent with previous studies highlighting the benefits of tailored educational approaches for individuals with disabilities, who may face additional barriers when accessing conventional health education resources (López Flores & González Lara, 2023; Nguyen, 2024). The results suggest that inclusive programme design may be particularly valuable for addressing foundational knowledge gaps in underserved populations.

From an educational perspective, the structure of MEDTOPUS reflects principles of experiential learning. Kolb's (1984) framework, which emphasises learning through concrete experience, reflection, and active engagement, is reflected in the tactile game-based activities and facilitated group discussions incorporated into the programme. This approach aligns with national educational priorities that promote community-centred and inclusive learning environments (MOHE, 2015), as well as with broader developments in pharmacy education that emphasise public health engagement and responsiveness to diverse community needs (Sawalha *et al.,* 2023).

While the findings support the potential value of MEDTOPUS as an inclusive educational intervention, several limitations should be considered. The development of Braille-based materials and the preparation of facilitators required considerable time and expertise, which may present challenges for large-scale implementation without sustained institutional support. Additionally, although the use of Google Forms facilitated accessible data collection, some participants required facilitator assistance during assessment completion, underscoring the need for simpler and more universally accessible digital interfaces. The relatively small sample size (n = 21), with limited representation of individuals with severe or profound visual impairment, may also limit generalisability and suggest that accessibility needs could be underestimated.

Overall, the MEDTOPUS programme demonstrates that visually impaired individuals can actively engage in medication-related education when appropriate adaptations are incorporated. Through the use of tactile materials, verbal instruction, and group-based learning, the programme supported meaningful participation and understanding of quality use of medicines (QUM). These findings highlight the importance of inclusive health education strategies and reinforce the expanding role of pharmacists as educators and advocates within the community, extending beyond traditional dispensing-focused responsibilities.

Limitations

Several limitations should be considered when interpreting the findings of this study. First, the study involved a relatively small convenience sample (n = 21) recruited from selected community-based settings, which may limit the generalisability of the findings to the wider visually impaired population. In particular, individuals with severe or profound visual impairment may have distinct accessibility needs that were underrepresented in the present sample.

Second, knowledge outcomes were assessed using pre- and post-tests administered via a digital platform. Although most participants completed the assessments independently, a subset required facilitator assistance due to limitations in digital literacy or familiarity with assistive technologies. Assistance was standardised and limited to reading questions verbatim and recording participants' stated responses without coaching. While sensitivity analysis excluding assisted participants demonstrated a comparable direction and magnitude of improvement, assisted completion may still have influenced individual test performance. Future studies may benefit from alternative assessment formats that further minimise the need for facilitator involvement.

Third, participant satisfaction outcomes were self-reported and collected immediately following programme completion in a group-based setting. The near-ceiling distribution of satisfaction responses may reflect social desirability or acquiescence bias,

particularly where facilitator assistance was required. Accordingly, satisfaction findings should be interpreted as indicators of programme acceptability rather than definitive measures of educational effectiveness.

Finally, this study focused on short-term knowledge outcomes and participant perceptions. Behavioural outcomes related to actual medication use, as well as longer-term knowledge retention, were not assessed. Future research should incorporate longitudinal follow-up and behavioural endpoints to better evaluate the sustained impact of inclusive pharmacist-led education programmes.

Conclusion

MEDTOPUS exemplifies how pharmacists can lead inclusive, impactful public health education. It demonstrated measurable improvements in knowledge and satisfaction among visually impaired participants, using affordable, replicable tools and accessible delivery methods. As Malaysia strives toward equitable health outcomes, programmes like MEDTOPUS will play a vital role in bridging gaps and empowering all individuals to use medicines safely and effectively.

Conflict of interest

The authors declare no conflict of interest.

Source of funding

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