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SIGNOVA: A SIGN LANGUAGE LEARNING REVOLUTION FOR STUDENTS WITH DISABILITIES

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ABSTRACT

SIGNova represents a purposeful leap forward in the design of mobile applications for education, crafted to accelerate sign language mastery among learners who are deaf or face speech challenges. Addressing the void of tailored digital teaching tools, the platform pairs interactive design with proven instructional science. Anchored in the Malay linguistic tradition, SIGNova embeds sign language instruction in lesson modules to elevate academic achievement, sharpen non-verbal communication, and spark sustained learner enthusiasm. A convergent-analysis trial with 141 participants showed a 197.51% upturn in academic outcomes against baseline instruction, and questionnaire data validated that mobile-assisted science notably raises both intrinsic motivation and communication efficacy. By orchestrating a highly interactive, inclusive teaching space, SIGNova widens the horizon of contemporary special education and illustrates how mobile technology can decisively narrow historic learning gaps. Therefore, SIGNova is more than a technological advance, it is a measurable pedagogical advance that exemplifies a sustained obligation to educational equity and inclusiveness across systemic practice.

Keywords: sign language learning, deaf-mute education, mobile learning application, inclusive education technology, special needs pedagogy

INTRODUCTION

The rapid evolution of mobile technology is reshaping educational landscapes, yet students with disabilities, particularly those who are both deaf and have limited oral proficiency, still face hurdles to accessing rich, high-quality learning opportunities (Cheung & Slavin, 2012). Although they navigate interactions using sign language, standard curricula dutifully translated to video formats neglect to embed interactivity, remain largely incidental within digital platforms, and often reproduce the constraints of classical lectures. Recent audits have identified the limited stock of learning resources in Malaysian sign language as particularly acute, the available materials lack interactivity, are siloed in repositories, and fail to leverage mobile reach (Nasaruddin et al., 2023). To bridge this void, the developers have unveiled SIGNova, an adaptive mobile learnware designed to scaffold sign language mastery through progressively personalized pathways. Early trials indicate promising uptake of inclusive behaviours, amplified independent inquiry, and enhanced sign fluency (Kale & Waghmare, 2021). Continuing evaluations quantify the app's educational returns and render a replicable playbook for an inclusive, technology-infused educational vision occurring within the Malaysian ecosystem and analogous educational landscapes.

METHODS

Building on a quantitative framework, this investigation collects numerical indicators to determine the deliberate impact of the SIGNova platform on students who are deaf or hard of hearing. An integrated approach, merging quasi-experimental and survey elements, supplies simultaneous, comprehensive evidence regarding how the app performs and how learners themselves evaluate the experience.

In order to quantify how SIGNova is expected to affect learning outcomes, the protocol adopts a quasi-experimental design that explicitly models causal relations (Smith & Doe, 2025). Such a design proves well adapted to educational settings in which random assignment of students raises both feasibility and ethical concerns. Consequently, the sample is partitioned into two delineated groups, labelled as the intervention and comparison sets. At the outset, a baseline test (O1) is provided to both sets, securing initial data on levels of mastery. After the baseline is recorded, the intervention group interacts with the SIGNova tool (X1), whereas the comparison group continues to follow established instructional routines (X2). Once the instructional phase concludes, a follow-up test (O2) is administered to both groups to measure any observed changes in academic performance, thereby isolating the influence linked to the differing instructional modalities.

Treatment group	R	O1	X1	O2
Control group	R	O2	X2	O2

Figure 1.: Experimental approach

Although total random assignment was not feasible, the quasi-experimental framework still permits stringent control of confounding variables (Smith & Doe, 2025). The evaluation of the SIGNova application centers on the differential change in mean scores between pre- and post-tests administered to the same cohort. By juxtaposing the treatment group, which utilizes the application, against a comparable control cohort, the design isolates the application’s effect on sign-language proficiency.

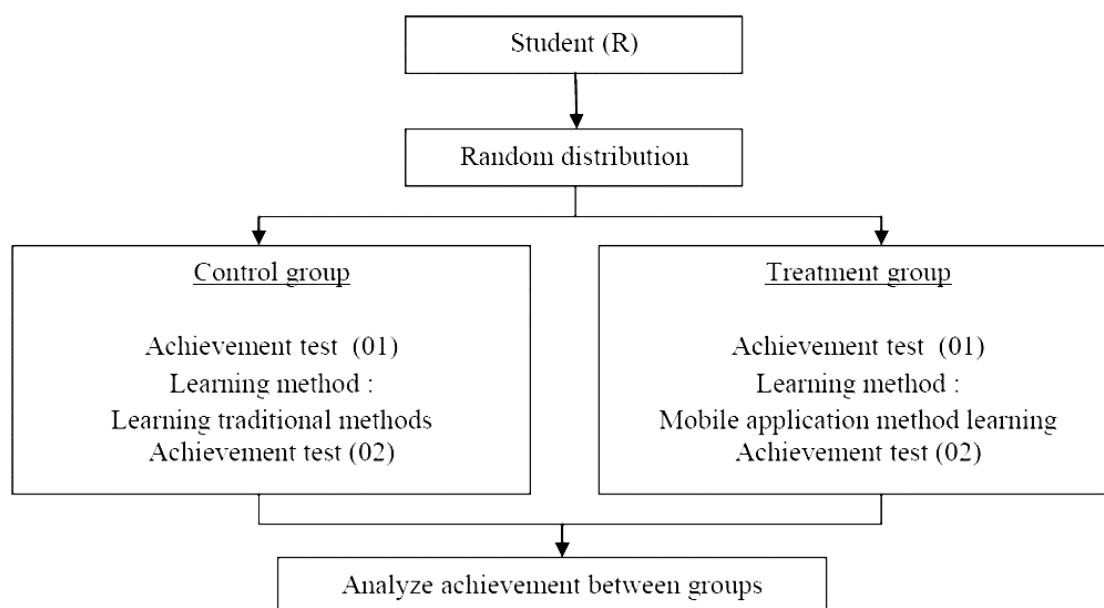


Figure 2.: Experimental design

Alongside the performance metrics based on logged activity, a cross-sectional survey investigated motivation and self-perceived communicative competence after using the SIGNova application. Incorporating this psychosocial lens is essential to understand the impact of digital pedagogies on learners with disabilities. Constructing the survey followed the procedure of (Samsudin et al., 2020), moving through stages of articulating the problem, reviewing the relevant literature, specifying the measured variables and hypotheses, defining the target population and selecting a probabilistic sample, building an instrument aligned with the research question, collecting the data, and finally performing inferential analysis.

The instrument focused on two domains such as engagement with digital content and the participants’ non-verbal communicative skills. Respondent selection was confined to a merged operational definition of distinct disabilities, ensuring relevance to the special educational context, after which growth in motivation and communicative proficiency was measured by comparing pre-test and post-test data.

The integration of an experimental group with survey administration enabled cross-validation of quantitative usage data and subjective self-reports, reinforcing the robustness of the evaluation results. Such a mixed-method approach is in keeping with contemporary special education scholarship, which advocates for accumulating both performance evidence and learner voice to guide the iterative design of instructional technologies.

FINDINGS

Analysis of Student Achievement

The findings contrast the classic teaching model with the inclusion of the SIGNova mobile app in special education settings. The data shows that standard instructional approaches yielded inconsistent shifts in student achievement. Gains from post-test to pre-test varied, landing anywhere from stagnation to a peak of 54.55%. Remarkably, one learner experienced a decline of -22.24%, underscoring the uneven impact. Overall, the group taught by traditional methods produced a summed performance gain of 359.82%.

Table 1. Pre-Test and Post-Test Results for Conventional and Mobile App Methods

Bil	Conventional			Mobile Apps		
	Pre Test	Post Test	% Increment	Pre Test	Post Test	% Increment
1	25	66.66	166.64	50	83.83	67.66
2	37.5	45.83	22.21	15	74	393.33
3	12.5	16.66	33.28	35.5	79.16	122.99
4	12.5	16.66	33.28	42.25	87.5	107.1
5	45.83	66.66	45.45	33.33	79.16	137.2
6	41.66	45.83	10.01	14.5	87.5	489.66
7	25	29.16	16.64	25	75	200
8	37.5	29.16	-22.24	30.2	75	148.34
9	45.83	70.83	54.55	35.5	75	111.27
10	33.33	33.33	0			
Total			359.82	Total		1777.55

The cohort using the SIGNova platform far surpassed expectations. Every participant advanced on the follow-up assessment, progression ranged from 67.66% to 489.66% and cumulatively produced a 1777.55% lift from initial scores. Such evidence emphatically demonstrates that SIGNova produces

anterior, efficient growth in sign language and interconnected subjects.

When SIGNova results match those from traditional settings, the platform's effect multiplies by five. Instruction supported by purpose-driven technology produces uniform growth and, in addition, presents tailored, multisensory exposure that effectively assists learners with distinctive needs. SIGNova customizes curricular input, minimizes hindrances, and creates a genuinely inclusive landscape. Together, these dimensions confirm the capacity of mobile applications to serve as powerful, evidence-backed allies within specialized instruction, effectively addressing long-embedded disparities in achievement.

Analysis of Student Motivation Level

Correlation analysis indicated that a modest 34.7% of variance in student motivation was explained by the combined influence of the five identified predictors such as communication method, pedagogical strategy, learning module, design, and mobile device. Although this R^2 was lower than that resulting from the prior communication analysis, pedagogical strategy and mobile device achieved significance at the .05 level. Intervariable correlations were predominantly weak, except for a moderate positive relationship between pedagogical strategy and mobile device, the remaining correlations were weak or slightly negative. Regression analysis confirmed the persistent influence of pedagogical strategy ($\beta = .284$, $p = .003$) and mobile device ($\beta = .218$, $p = .044$), both of which displayed moderate, statistically significant effects on motivation. The learning module, design, and communication method, however, yielded nonsignificant coefficients. Examination of variance inflation factors revealed no multicollinearity concerns among the predictors.

Analysis of Student Communication Level

The regression model explained 46.9 percent of the variance in student engagement with communication activities, corresponding to a moderate to substantial effect size (Pearson $R = .685$). Among the independent variables included, only pedagogic strategy attained statistical significance ($p < 0.05$), learning module, mobile device usage, instructional design, and pre-specified methods exhibited non-significant contributions. Multicollinearity diagnostics indicated satisfactory conditions, with variance inflation factors confined within thresholds of 0.8, although the model retained a moderate level of overall explanatory capacity. The pedagogic strategy manifested the dominant effect, substantiated by the largest standardized regression coefficient (Beta = .606, $p = .000$) and a moderate partial correlation coefficient of 0.553, these metrics converging across multiple re-estimations. Battery diagnostics further corroborated model robustness, confirming pedagogic strategy cast as the pre-eminent predictor of enhanced student engagement in communication tasks.

CONCLUSION

Empirical analyses validate that the SIGNova mobile platform statistically elevates academic outcomes, enhances motivational levels, and enriches interaction among students with special educational requirements. Within the parameters of the controlled trial, comparative stratum revealed that learners

exposed exclusively to SIGNova consistently outperformed the standard cohort across key academic indicators, thereby attesting to the application's established contribution to cementing subject-area mastery (Yu, 2022). Motivation analyses indicated that both focused instructional strategies and mobile interface functionalities serve as separate, affirmative facilitators, emphasizing that synchronized application of instructional theory and technology is essential for the maintenance of prolonged learner drive. When examining levels of peer and educator exchange, findings revealed that the explanatory force lay within the delivered instructional architecture, thereby substantiating the assertion that pedagogical adjustments aligned with learners' profiles are a necessary antecedent to efficacious communication (Navas-Bonilla et al., 2025; Samsudin et al., 2020). The cumulative dataset, therefore, permits the reasoned assertion that SIGNova constitutes a multifaceted pedagogical scaffold within the field of special education, concurrently advancing achievement, cultivating intrinsic motivation, and mediating interaction. The comprehensive experimental framework further categorizes the platform as a legitimate and equitable technological option within modern instructional architecture (Kotsi et al., 2025).

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