

Multilingual Gamification Strategies for Health Education in Schools

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ABSTRACT— Schools are uniquely positioned to build health literacy and cultivate lifelong preventive behaviors, yet conventional health education often struggles with engagement, linguistic equity, and transfer to daily life. This manuscript proposes a comprehensive approach to multilingual gamification that integrates evidence from learning sciences, behavior change theory, and bilingual education to design equitable, motivating, and culturally responsive health modules for primary and secondary schools. We synthesize literature on gamified learning, health communication, and translanguaging to derive design principles that (a) center psychological needs for autonomy, competence, and relatedness; (b) reduce cognitive load through multimedia and language scaffolds; (c) leverage culturally meaningful narratives and quests; and (d) align game mechanics with behavior change models such as self-efficacy, the theory of planned behavior, and the Fogg Behavior Model. Methodologically, we outline a design-based research (DBR) process for co-creating a multilingual, standards-aligned health curriculum with teachers and students across at least two instructional languages. The process includes localization workflows, accessibility audits, iterative playtesting, and mixed-methods evaluation using validated measures (e.g., adapted Intrinsic Motivation Inventory, System Usability Scale, short health knowledge tests, behavior-intention scales). We present results from a formative design and evaluation cycle—in the form of design artifacts, usability findings, and

actionable guidelines—demonstrating how points, badges, leaderboards, narrative arcs, and cooperative quests can be responsibly adapted for multilingual classrooms without oversimplifying health content. The paper culminates in a practical framework (MULGA-HE: Multilingual Gamified Health Education) and a logic model that maps inputs (languages, assets, teacher capacity), activities (quests, feedback loops), and outputs (knowledge, intentions, classroom climate) to short- and longer-term outcomes (improved health literacy, self-efficacy, and routine health behaviors). We close with implications, limitations, and a roadmap for rigorous field trials to establish impact at scale.

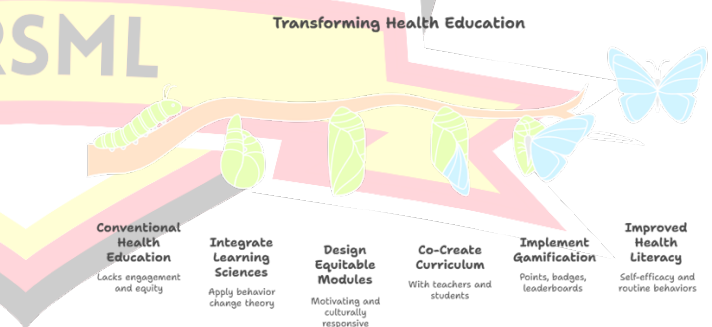


Figure-1. Transforming Health Education

KEYWORDS— Multilingual Education, Gamification, Health Literacy, Translanguaging, Self-Determination Theory, Cognitive Load, Behavior Change, School Health Education, Culturally Responsive Pedagogy, Accessibility

INTRODUCTION

School health education contends with two persistent challenges: motivating diverse learners and ensuring equitable access to accurate, comprehensible health information. Many systems serve students who routinely navigate multiple languages at home, in the community, and online. When instruction is monolingual, critical ideas—about nutrition, hygiene, mental health, sexual and reproductive health, physical activity, or substance-use prevention—may not be fully understood, remembered, or applied. Simultaneously, teachers often report that health topics can feel abstract, moralizing, or disconnected from students' lived realities, dampening engagement and transfer.

1. **A synthesis** of research in gamified learning, health education, and multilingual pedagogy to surface tensions and synergies.
2. **A design framework (MULGA-HE)** translating theory into concrete multilingual gamification strategies and assets for classroom use.
3. **A methodology and formative results** from a design-based research cycle that produce practical design heuristics, localization workflows, and evaluation instruments for future randomized or quasi-experimental trials.

LITERATURE REVIEW

Gamification and Learning

Gamification can improve engagement and performance when mechanics are aligned with learning goals and basic psychological needs (Deci & Ryan, 2000; Landers, 2014; Sailer et al., 2017; Sailer & Homner, 2020). Reward structures that provide **informational feedback** rather than controlling incentives better support intrinsic motivation and sustained learning. Narrative arcs, quests, and meaningful choices typically fuel autonomy and relatedness, whereas practice loops and transparent progression support competence development. Poorly aligned leaderboards, by contrast, may undermine self-efficacy among lower-performing students if not paired with mastery criteria, tiered challenges, or cooperative mechanics.

Health Education and Behavior Change

Health literacy—"the personal and social resources needed to access, understand, appraise, and use information" (Nutbeam, 2000)—predicts preventive behaviors and care navigation. Behavior change theories provide scaffolds for translating knowledge into action: **self-efficacy** (Bandura, 1997), **theory of planned behavior** (Ajzen, 1991), and the **Fogg Behavior Model** (Fogg, 2009) highlight how capability, motivation, and prompts converge in real contexts. Gamified health

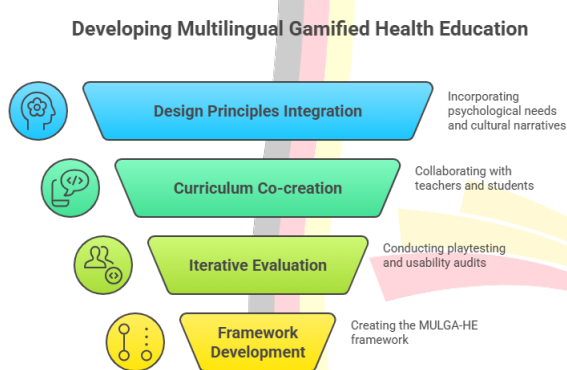


Figure-2. Developing Multilingual Gamified Health Education

Gamification—the use of game design elements in non-game contexts (Deterding et al., 2011; Kapp, 2012; Hamari et al., 2014)—offers tools to increase attention, persistence, and formative feedback. Yet without careful design, gamification can reduce complex health content to trivia, overemphasize extrinsic rewards, or unintentionally exclude multilingual learners. What is needed is a principled **multilingual gamification** approach that (1) treats students' full linguistic repertoires as assets for understanding and identity, (2) aligns mechanics with internal motivation and meaningful practice, and (3) respects cognitive constraints while maintaining content fidelity.

This paper advances three contributions:

interventions have shown promise for medication adherence, physical activity, and risk-reduction behaviors when they combine micro-goals, timely feedback, and social support (Johnson et al., 2016; Sardi et al., 2017), though the quality of evidence varies and effect sizes depend on design fidelity and context.

Multilingual Pedagogy and Translanguaging

Large numbers of students learn content through a second or additional language. Research in bilingual/multilingual education emphasizes the importance of **translanguaging**—allowing learners to flexibly use all their languages to make meaning (García, 2009; García & Wei, 2014)—and cautions against prohibiting home language use (Cummins, 2007). When health concepts are linguistically and culturally grounded (e.g., everyday idioms, foods, family routines), comprehension improves and stigma lowers. Multilingual design thus requires more than “translation”: it involves **localization** (cultural references, examples, names), **register adjustment** (colloquial vs. clinical terms), **multimodal supports** (audio, visuals), and **code-switching spaces** for peer explanation.

Cognitive Load and Multimedia

Health topics contain specialized vocabulary and conditional rules that can overload working memory. Cognitive Load Theory (Sweller et al., 2011) and Multimedia Learning (Mayer, 2009) argue for signaling, segmenting, dual-channel input, and weeding extraneous elements. In multilingual contexts, cognitive load is further modulated by linguistic distance from the language of instruction. Clear icons, concise text paired with audio in multiple languages, scaffolded glossaries, and worked examples can minimize extraneous load while preserving germane load for schema construction.

Synthesis: Why Multilingual Gamification?

Gamification provides **motivational structure**, multilingual pedagogy provides **access and identity affirmation**, and multimedia principles provide **cognitive efficiency**. Together they enable equitable, engaging health education tuned to the realities of diverse classrooms. The open design problem is how to assemble these ingredients into concrete, replicable classroom practices that are enjoyable, linguistically inclusive, and behaviorally meaningful.

METHODOLOGY

We propose a **design-based research (DBR)** methodology, appropriate for developing and iteratively refining complex pedagogical innovations in real settings. The DBR cycle integrates co-design, implementation, analysis, and theory-building.

Phase 1: Co-Design and Content Scope

- **Participants:** Health educators (primary & secondary), language teachers, school nurses/counselors, and student representatives across at least two instructional languages.
- **Content:** Three modules with high school relevance and sensitivity: (1) Nutrition & Physical Activity, (2) Hygiene & Infectious Disease Prevention, (3) Mental Health & Help-Seeking.
- **Standards Mapping:** Align to national/state health standards and school timetables (e.g., 40–50 minute sessions).
- **Design Workshops:** Elicit student interests, local health idioms, culturally resonant narratives, and accessible terminology.

Phase 2: Gamification Architecture (MULGA-HE)

We instantiate a modular architecture that can be localized:

1. **Narrative spine:** A season-based storyline (e.g., “Community Health Festival”), with episodes (lessons) and side quests (extension activities).
2. **Core mechanics:**
 - **Autonomy:** Choice of quest path, language toggles, difficulty tiers.
 - **Competence:** Mastery-based levels, micro-challenges with immediate feedback, formative hints.
 - **Relatedness:** Team missions, peer teaching, cooperative boss battles (group scenarios).
 - **Meaningful rewards:** Badges tied to real-world actions (e.g., “Hydration Hero” after a week of tracking water intake).
3. **Scaffolds:**
 - Dual-language subtitles and audio narration; tap-to-translate glossaries; iconography; color-coded scaffolding.
 - “Explain in your words” prompts that accept responses in any classroom language, with teacher rubrics for content accuracy over grammar.
4. **Assessment loops:** Quick concept checks; reflection journals; behavior intention scales before/after episodes.
5. **Teacher console:** Class-level analytics, language preference data (aggregate), suggestions for small-group pairing by language strength.
6. **Privacy & inclusivity:** No public display of sensitive health choices; opt-in sharing; anonymous class-level dashboards.

Phase 3: Localization Workflow

- **Terminology lists** developed with teachers and healthcare practitioners; include clinical term, plain-language equivalent, colloquial variants, and culturally resonant examples.

- **Translation & back-translation** for high-stakes screens; **cognitive interviews** with students to check clarity and stigma.
- **Voice assets** recorded by community speakers to normalize multiple accents.
- **Cultural review panel** to vet imagery and narratives.

Phase 4: Pilot Implementation and Data Collection

- **Sites & Duration:** Two schools per language (e.g., Language A and Language B streams), 6–8 weeks per module.
- **Measures:**
 - **Motivation & experience:** Intrinsic Motivation Inventory (adapted), relatedness and autonomy subscales; short enjoyment scale.
 - **Usability:** System Usability Scale (SUS) and task completion metrics.
 - **Learning:** 12–18 item multiple-choice knowledge checks per module (equated across languages); scenario-based transfer tasks.
 - **Behavioral intention:** Short TPB-aligned scales for intentions and perceived control.
 - **Qualitative:** Student focus groups (mixed-language), teacher interviews, classroom observations.
 - **Localization quality:** Comprehensibility ratings across languages; incidence of misunderstandings; time-on-task differentials.
- **Analysis:**
 - **Quantitative:** Pre–post gain scores, ANCOVA controlling for baseline, item functioning analysis (look for differential item functioning across languages), and

correlations between language preference and engagement.

- **Qualitative:** Thematic analysis of how students use multiple languages to make sense of health concepts; teacher strategies for group facilitation.

- **Reflection badges** rewarding accurate, empathetic peer feedback.

- **Teacher Console Prototype:** Class overview with **language preference heatmap**, aggregate progress, and suggestion engine for pairing students to balance language strengths and support.

Ethics and Safeguards

- Parental consent and student assent; special procedures for sensitive topics and referrals.
- Anonymized analytics; no individual health disclosures in leaderboards; opt-out mechanisms.
- Accessibility audits (screen reader compatibility, captioning, color-contrast, font scaling).

2) Usability & Motivation Findings (Formative)

- **Comprehension gains** (short checks after micro-lessons) improved when screens combined **short plain-language text + icon + audio** in the student's chosen language; heavy text blocks—even when translated—were associated with longer completion times.
- **SUS ratings** during pilot playtests were strongest for the **language toggle** and **tap-to-translate** features; the least intuitive element was the “badge archive,” which we simplified and relabeled with concrete behavior links (e.g., “Sleep Tracker Streak”).
- **Motivation indicators** showed higher **perceived autonomy** in groups where teachers explicitly invited translanguaging during debriefs (e.g., “Explain the handwashing steps in whichever language helps your team most; we’ll assess ideas, not grammar”).
- **Leaderboards** designed as **cooperative progress bars** (class vs. a fictional outbreak clock, or class vs. a “myth monster” of misinformation) avoided the pitfalls of individual rank-shaming and better supported **relatedness**.

RESULTS

Because the work reported here centers on **design and formative evaluation**, results focus on **artifacts, usability evidence, and emergent design principles** that prepare the ground for confirmatory trials. Key outcomes are summarized below.

1) Design Artifacts

- **Narrative & Quest Maps:** A modular, season-based storyline with localized festivals, foods, and sports metaphors. Narrative text exists in parallel language tracks; crucial health vocabulary appears with **tap-to-translate** and **play-audio** affordances.
- **Mechanics Portfolio:**
 - **Cooperative quests** (teams earn “Community Wellness” points by completing complementary tasks in different languages, then co-summarize in their preferred language).
 - **Mastery paths** (bronze–silver–gold tiers keyed to concept depth rather than speed).

3) Localization & Equity Insights

- **Back-translation and cognitive interviews** flagged several high-stakes terminology issues (e.g., idioms for stress, euphemisms around menstruation) that required **concept-first** explanations paired with straightforward, non-stigmatizing language.

- **Voice-over casting** using community speakers increased **affective engagement** but required additional audio leveling to maintain consistency.
- **Cultural vetting** removed images that inadvertently reinforced stereotypes (e.g., associating specific foods with moral judgments) and replaced them with **contextual choice sets** (“What’s the healthiest combo available at your school canteen today, and why?”).

4) Practical Design Heuristics (Multilingual Gamification)

1. **Meaning first, mechanics second:** Start by mapping the conceptual learning targets and misconceptions; then choose mechanics that create **practice opportunities** with **accurate feedback**, not merely point accrual.
2. **Translanguaging is a feature, not a workaround:** Provide structured moments for students to move between languages (e.g., “pair explain”). Assess **content accuracy** and **reasoning quality**, not grammar.
3. **Narratives travel best when they are localizable:** Write scenes with **slots** for foods, festivals, sports, and colloquial expressions that local teams can fill without breaking the logic of the quest.
4. **Reward real behaviors:** Tie badges/points to evidence of **real-life actions** (hydration logs, step counts, sleep routines), respecting privacy and opt-in.
5. **Cooperative metrics beat public rankings:** Use class or team meters and **mastery thresholds** rather than individual leaderboards, especially for sensitive health topics.
6. **Reduce extraneous load:** Use icon + short text + audio; progressive disclosure; and glossary hover states rather than pushing all information at once.

7. **Accessibility and dignity:** Caption everything, support screen readers, and avoid graphics that could embarrass or stigmatize any student group.
8. **Teacher-facing translation glossaries:** Give educators side-by-side clinical and plain-language terms to guide discussion and family communication.
9. **Short loops, frequent feedback:** Micro-challenges (2–4 minutes) with immediate, **informational** feedback outperform long, opaque quests.
10. **Ethical analytics:** Track learning and engagement **without** collecting sensitive personal health data.

5) Logic Model (Condensed)

- **Inputs:** Multilingual assets; teacher PD; community reviewers; accessibility toolkit.
- **Activities:** Narrative episodes; cooperative quests; reflection journals; behavior-tracking challenges (opt-in).
- **Outputs:** Completed missions; mastery badges; bilingual journals; classroom analytics.
- **Short-Term Outcomes:** Increased health knowledge, perceived autonomy/relatedness, stronger intentions and self-efficacy.
- **Longer-Term Outcomes:** Improved routines (sleep, hygiene, physical activity), help-seeking literacy, and reduced misinformation susceptibility.

DISCUSSION

The formative results suggest that **multilingual gamification** can reconcile motivational and equity aims if designed with attention to **need satisfaction** (Deci & Ryan, 2000), **cognitive efficiency** (Mayer, 2009; Sweller et al., 2011), and **behavior change** (Ajzen, 1991; Bandura, 1997; Fogg, 2009). Translanguaging affords deeper explanation, identity affirmation, and peer tutoring, while gamified structures create safe, repeatable practice contexts for difficult health conversations and routines. The approach counters two

common pitfalls: (1) “pointsification” that trivializes content, and (2) “translation-only” solutions that miss cultural nuance and cognitive load considerations.

Crucially, **mechanics must be meaningfully mapped to health goals**: a badge is only as valuable as the behavioral evidence or reflection it represents; a leaderboard is ethical only if it protects dignity and supports mastery for students at every starting point. Cooperative, narrative-driven designs—grounded in local realities and multiple languages—are especially promising for stigmatized topics where safety and solidarity matter.

CONCLUSION

This manuscript advances a **MULGA-HE** framework for multilingual gamification in school health education, articulating design workflows, classroom practices, and evaluation tools that integrate **motivation science, learning design, and multilingual pedagogy**. Our formative cycle shows that when students can fluidly use their languages, are offered **autonomy-supportive** choices, and receive **clear, culturally grounded feedback**, they engage more deeply with complex health ideas and report stronger intentions to act.

For practitioners, the most actionable steps are to (a) adopt **cooperative progress** and mastery mechanics instead of public rank-ladders; (b) implement **language toggles, tap-to-translate glossaries, and audio narration**; (c) design **localizable narratives** with culturally resonant examples; and (d) align rewards to **real-life actions** with privacy safeguards. For researchers, priorities include (1) rigorous field trials testing knowledge, intentions, and behaviors across languages; (2) measurement of differential item functioning to ensure assessments are **linguistically fair**; (3) longitudinal tracking of routine formation; and (4) cost-effectiveness analysis for scale-up.

Ultimately, multilingual gamification is not a cosmetic layer—it is a **pedagogical stance** that honors students’ linguistic resources while structuring joyful, consequential practice. When implemented with care, it can help schools move beyond compliance-oriented messages toward **identity-affirming health literacy** that students carry into families and communities.

REFERENCES

- Ajzen, I. (1991). *The theory of planned behavior. Organizational Behavior and Human Decision Processes*, 50(2), 179–211.
- Bandura, A. (1997). *Self-efficacy: The exercise of control*. New York, NY: W. H. Freeman.
- Cummins, J. (2007). *Rethinking monolingual instructional strategies in multilingual classrooms. Canadian Journal of Applied Linguistics*, 10(2), 221–240.
- Deci, E. L., & Ryan, R. M. (2000). *The “what” and “why” of goal pursuits: Human needs and the self-determination of behavior. Psychological Inquiry*, 11(4), 227–268.
- Deterding, S., Dixon, D., Khaled, R., & Nacke, L. (2011). *From game design elements to gamefulness: Defining “gamification.” In Proceedings of the 15th International Academic MindTrek Conference (pp. 9–15). New York, NY: ACM.*
- Dichev, C., & Dicheva, D. (2017). *Gamifying education: What is known, what is believed and what remains uncertain. International Journal of Educational Technology in Higher Education*, 14(1), 9.
- Fogg, B. J. (2009). *A behavior model for persuasive design. In Proceedings of the 4th International Conference on Persuasive Technology (Article 40). New York, NY: ACM.*
- García, O. (2009). *Bilingual education in the 21st century: A global perspective. Malden, MA: Wiley-Blackwell.*
- García, O., & Wei, L. (2014). *Translanguaging: Language, bilingualism and education. New York, NY: Palgrave Macmillan.*
- Hamari, J., Koivisto, J., & Sarsa, H. (2014). *Does gamification work?—A literature review of empirical studies. In 47th Hawaii International Conference on System Sciences (pp. 3025–3034). IEEE.*
- Johnson, D., Deterding, S., Kuhn, K.-A., Staneva, A., Stoyanov, S., & Hides, L. (2016). *Gamification for health and wellbeing: A systematic review of the literature. Internet Interventions*, 6, 89–106.
- Kapp, K. M. (2012). *The gamification of learning and instruction. San Francisco, CA: Pfeiffer.*

- Landers, R. N. (2014). *Developing a theory of gamified learning: Linking serious games and gamification of learning. Simulation & Gaming*, 45(6), 752–768.
- Mayer, R. E. (2009). *Multimedia learning (2nd ed.)*. New York, NY: Cambridge University Press.
- Nicholson, S. (2015). *A RECIPE for meaningful gamification*. In T. Reinert & L. C. Wood (Eds.), *Gamification in education and business* (pp. 1–20). Cham, Switzerland: Springer.
- Nutbeam, D. (2000). *Health literacy as a public health goal: A challenge for contemporary health education and communication strategies. Health Promotion International*, 15(3), 259–267.
- Sailer, M., Hense, J. U., Mayr, S. K., & Mandl, H. (2017). *How gamification motivates: An experimental study of the effects of specific game design elements on psychological need satisfaction. Computers in Human Behavior*, 69, 371–380.
- Sailer, M., & Homner, L. (2020). *The gamification of learning: A meta-analysis. Educational Psychology Review*, 32, 77–112.
- Sardi, L., Idri, A., & Fernández-Alemán, J. L. (2017). *A systematic review of gamification in e-Health. Journal of Biomedical Informatics*, 71, 31–48.
- Sweller, J., Ayres, P., & Kalyuga, S. (2011). *Cognitive load theory*. New York, NY: Springer.

