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DEVELOPMENT APPLICATION EDUCATION NUMERATION WITH VISUAL-INTERACTIVE FEATURES FOR THE ALPHA GENERATION: SYSTEMATIC LITERATURE REVIEW

Murni Setiawati, Ratna Sari, Rosianty Amelia, Sumayyah
Indraprasta PGRI University, Indonesia
E-mail: justmurnie@gmail.com, rtnasari5@gmail.com, rosiamelia94@gmail.com, nkim050598@gmail.com.

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Abstract

Indonesian students' numeracy skills remain concerned, with a PISA 2022 mathematics score of only 366 points, significantly below the OECD average of 472. Meanwhile, 83.39% of Indonesian internet users access the internet via smartphones, creating substantial opportunities to leverage mobile-based education games for improving numeracy. However, the design of visual-interactive features in numeracy educational games and their alignment with Generation Alpha's learning characteristics have not been systematically examined. This study aims to folder the visual-interactive features of smartphone-based numeracy educational games and evaluate their alignment with Generation Alpha's learning characteristics. A systematic literature review (SLR) following PRISMA guidelines was conducted across four databases (Google Scholar, Semantic Scholar, OpenAlex, and ERIC) for the period 2015–2025. Of 79 identified articles, 38 met the inclusion criteria (30 for RQ1 and 8 for RQ2). The findings reveal that visual-interactive features in numeracy educational games are dominated by basic elements: 2D illustrations (93%), tap interactions (93%), scores (90%), and levels (83%). on the contrary, immersive features such US 3D representation (10%), augmented reality (0%), multitouch (3%), and badges (0%) are rarely implemented. The alignment analysis shows that none of Generation Alpha's seven learning characteristics are fully addressed, with the largest gaps in personalization and collaboration. These findings indicate the need to develop numeracy educational games that integrate more immersive visual features, richer touch interaction variations, deeper game mechanics, and personalization and collaborative features better suited to Generation Alpha's learning characteristics.

INTRODUCTION

Numeracy is activity Which every day There is in all aspect life. In Market, In schools, government offices, and even on the stock exchange. Numeracy isn't just calculations on a blackboard or in a textbook. Unfortunately, the reality for our children isn't good. The OECD's 2022 Programme for International Student Assessment (PISA) results put Indonesian students at 366 points in mathematics. This is a significant 106 points below the OECD average of 472 (OECD, 2023). Our ranking? 70th out of 81 participating countries. Only 18% of Indonesian students were able to reach Level 2, while the OECD average is 69%. In the top performer category (Levels 5 and 6), almost no Indonesian students reached that level. The 2022 score even dropped compared to the 2018 PISA score of 379 points, and, unfortunately, it was the lowest mathematics achievement since Indonesia participated in PISA in 2001 (Wijaya et al., 2024). The authors interpret the figure of 82% of students not reaching minimum competency not as a per-child issue, but as a signal that something is amiss in the larger framework.

The root of the problem of low numeracy, according to the authors, lies in the classroom. Many schools still rely on lectures and exercises from textbooks, two approaches that are, arguably, outdated. Students sit passively, get bored, and then begin to hate mathematics, which they see as an abstract and torturous subject (Pramuditya et al., 2018; Watulingas & Samara, 2020). The lack of fun and interactive learning media exacerbates the situation, decreasing interest. As interest in mathematics declines, understanding also disintegrates. At this point, the author feels teachers need to be encouraged to step out of their comfort zones and seek alternative methods that are more enjoyable, more colorful, and more understandable for Generation Alpha students.

Meanwhile, mobile technology is experiencing rapid growth. Data from the Indonesian Internet Service Providers Association (APJII) in 2025 recorded 229.4 million internet users. in land water, with penetration touch 80.66% from total resident. And try Guess the main entry point? Smartphones, at 83.39% (APJII, 2025). Interestingly and surprisingly, Generation Alpha (born 2013 and later) already accounts for 23.19% of total users, ranking third after Gen Z and Millennials. Data from the Central Statistics Agency (BPS) in 2024 adds context: 39.71% of Indonesian children already own a mobile phone, and by the age of 5–6, the figure jumps to 58.25%. In fact, 98.70% of children aged 5 and above who surfing the internet do it via cell phone. It means, cell phone clever No Again just gadgets. Mobile phone Already become media Study Which, if filled with content Which Correct, can accessible anytime and anywhere.

Game-based learning (GBL) So conversation Which increasingly crowded later This. Studies systematic consistent show GBL hoist motivation, involvement, at a time students' mathematics learning outcomes. Hui and Mahmud (2023) reviewed 28 studies and found positive impacts on both cognitive and affective aspects. Hussein et al. (2022) confirmed the effectiveness of *digital game-based learning* at the K-12 level. Papanastasiou et al. (2024) conducted a meta-analysis show the effect is at on range currently until big for cognitive output, social, And emotional on education child age early. Superiority GBL located on a mix of entertaining experiences, tiered challenges, and instant feedback that keeps students' brains curious.

But content just No Enough. Success A games education very depends on design visual And their interactions. Mayer (2024) past *Cognitive Theory of Multimedia Learning* (CTML) explains that our brains have two processing pathways, verbal and visual, each with limited capacity. Meaningful learning, he says, requires the active activity of selecting, organizing, and linking information. Mayer's meta-analysis of 92 studies concluded alloy text-and-diagram give effect big Which consistent, temporary Games and simulations are even more

powerful in boosting inferential skills and knowledge transfer (Clark & Mayer, 2024). CTML principles such as *coherence, signaling, segmenting,* and *spatial contiguity* ultimately serve as a compass for game designers: guiding them so that visual-interactive features aren't just busy, but actually facilitate the learning process.

Today's elementary and middle school students are considered Generation Alpha, the first generation to be exposed to screens from birth (McCrindle & Fell, 2020). Their learning characteristics are qualitatively different from those of previous generations. They are purely visual learners, hungry for image-rich content, and have short attention spans due to their constant media bombardment. digital, used to interact past touch finger, And demand personalization plus feedback lightning (Fernando & Premadasa, 2024; Cimene et al., 2024). Research Also implies Games with strong narratives, memorable characters, and realistic visual styles hold a special place in their hearts, even if their attention quickly shifts (Exploring Design Factors, 2024). These unique characteristics, according to the authors, cannot be served by legacy designs from previous generations.

Even though topic This crowded reviewed, study question games education mathematics based Mobile games still leave gaping holes. First, most studies stop at developing and testing effectiveness using pre-tests/post-tests. Details of visual and interactive features are rarely explored. Second, systematic studies specifically mapping the visual-interactive features of smartphone-based numeracy games are still rare. This also leaves gaps. gap, Not yet Lots study Which with firm evaluate how much suitable those features with character Study Generation Alpha. Fernando And Premadasa (2024) in His *thematic literature review* explicitly called for further research on Generation Alpha learning preferences, fresh game element design, and adaptive gamification strategies. Springer (2024) reviewed 83 studies and noted that the term "Generation Alpha" is frequently mentioned, but empirical evidence on how these children actually learn is still thin.

Building on these research gaps, this study conducted a literature review to answer two questions. First, what visual-interactive features are used in smartphone-based numeracy educational games according to the literature? Second, to what extent do these features align with the learning styles of Generation Alpha? It is hoped that this research will produce a comprehensive feature map and design recommendations that better align with the needs of digital-age students. Ultimately, and this is what the author hopes, the research results will serve as a reference that can be directly utilized by educational app developers, educators, and policymakers when designing numeracy games that are not merely trendy but relevant.

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Numeracy And Mathematical Literacy

Numeracy is the ability to think using mathematical concepts, procedures, facts, and tools to solve everyday problems in a variety of contexts relevant to individuals (Kemdikbudristek, 2022). Within the AKM framework, numeracy content covers four domains: Number, Geometry and Measurement, Data and Uncertainty, and Algebra, with three cognitive levels: understanding, application, and reasoning (Pusat Penilaian Pendidikan, 2022).

Game-Based Learning in Education Mathematics

Game-based learning (GBL) is a learning approach that utilizes games as the main medium. (Prensky, 2001). It is important to distinguish GBL from gamification; GBL uses a complete game as a learning context, while gamification refers to the use of game design elements in non-game contexts (Deterding et al., 2011). The effectiveness of GBL can be explained through Ryan and Deci's (2000) *Self-Determination Theory* (SDT), which states that intrinsic motivation is driven by autonomy, competence, and relatedness.

Feature Visual-Interactive on Game Education

Feature visual covers animation, illustration, character, scheme color, typography, 3D representation, and *augmented reality.* Interactive features include *drag-and-drop, tap, swipe,* answer input, *real-time feedback, pace control,* and *multitouch.* These two dimensions are bridged by mechanics game like score, level, *badges, leaderboard,* And *storyline.* Outhwaite et al. (2023) identified *active ingredients* that contribute to effectiveness, while Gocheva et al. (2020) classified 13 types of mobile games for elementary mathematics.

Cognitive Theory of Multimedia Learning

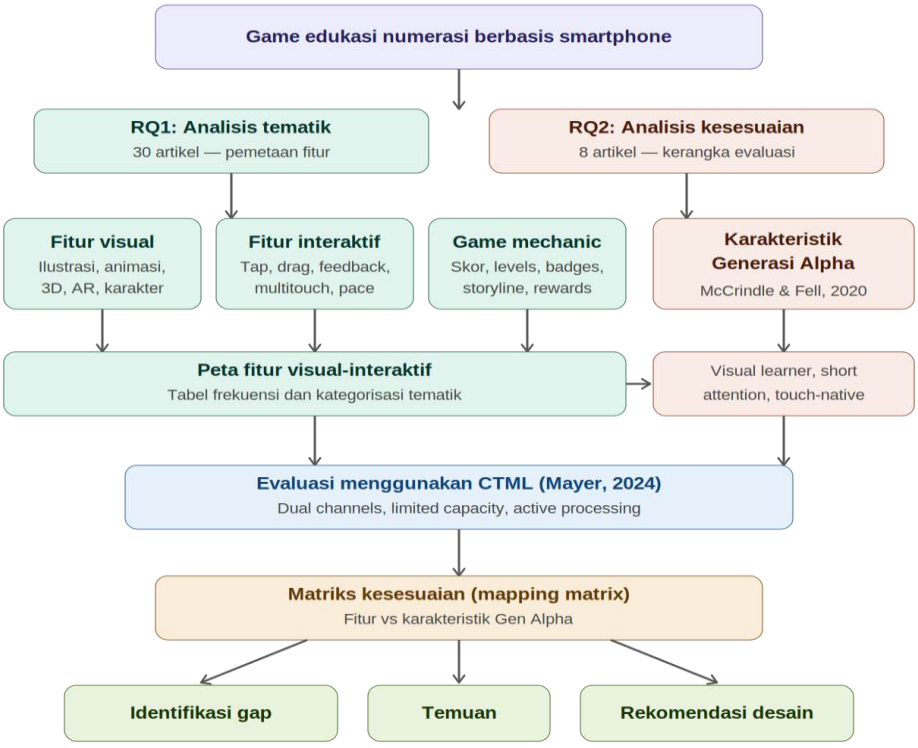
CTML Mayer (2024) built on three assumptions: *dual channels* (channel separated verbal and visual), *limited capacity* (capacity processing limited), And *active processing* (*selecting, organizing, integrating*). Relevant design principles include *multimedia, coherence, signaling, segmenting,* and *spatial contiguity.* A meta-analysis of 92 articles showed that *games* and simulations produced greater effects on *transfer outcomes* (Clark & Mayer, 2024).

Characteristics Study Generation Alpha

Generation Alpha (born 2010–2025) is the first generation to grow up entirely in the digital age (McCrindle & Fell, 2020). Fernando and Premadasa (2024) identified key characteristics: *shorter attention span,* tendency to be *visual learners,* as well as preference to experience interactive And gamified. Cimene et al. (2024) found that *visual learners* demonstrated the highest learning engagement. However, a review of 83 studies found that empirical evidence is still limited (Springer, 2024).

Framework Conceptual

The conceptual framework of this research integrates three components: visual-interactive features (RQ1), characteristics Generation Alpha (RQ2), And principles CTML as Evaluation lens. Analysis flow: feature mapping through thematic analysis, suitability evaluation through matrix *mapping, resulting in gap* identification, findings, and design recommendations. This conceptual framework is presented in Figure 1.



Picture 1. Framework Conceptual Study

RESEARCH METHODS

Research Design

This study uses a *Systematic Literature Review* (SLR) approach based on the PRISMA guidelines (Moher et al., 2009). We chose this approach because SLR allows we identify, measuring, And unite evidence Which scattered in a way orderly And translucent view (Kitchenham, 2004). Method This felt fit For facing our two research questions which are both exploratory and analytical in nature.

Question Study

Research This worked on For answer two question:

1. Question Study 1 (RQ1): Feature visual-interactive What just Which used in smartphone-based numeracy educational games according to available literature?
2. Research Question 2 (RQ2): How well do these features support Generation Alpha's learning styles?

RQ1 is descriptive in nature, its aim is to capture and group visual and interactive features. Which appear in games numeracy. RQ2 its nature analytical; we intend to considering the suitability of these features to the learning styles of Generation Alpha as mapped in the literature (McCrindle & Fell, 2020; Fernando & Premadasa, 2024).

Strategy Search Literature

A structured literature search was conducted across four academic databases: Google Scholar, Semantic Scholar, OpenAlex, and ERIC. We chose these four platforms because they offer a broad reach, encompassing both international and nationally accredited journals. Search ongoing throughout March–April 2026, with window publication 2015–2025.

Say key we arrange in two Language, Then connected with operator Boolean. For English: (*"educational game" OR "game-based learning"*) AND (*"numeracy" OR "mathematics"*) AND (*"mobile" OR "smartphone"*). For Indonesian: (*"educational game" OR "game" educational*) AND (*"numeration" OR "mathematics"*) AND *"smartphone"*. We conducted additional manual searches to filter articles about Generation Alpha characters. with say key *"Generation Alpha" learning characteristics* And *"Generation Alpha" game-based learning,* plus multimedia learning theory literature from Mayer (2024). So that the results relevant, we Also use *snowball search* —search list library from articles that are considered most relevant.

Criteria Inclusion And Exclusion

The articles obtained were screened using inclusion and exclusion criteria that we established well in advance of the search. Details are presented in Table 1.

Table 1. Criteria Inclusion And Exclusion

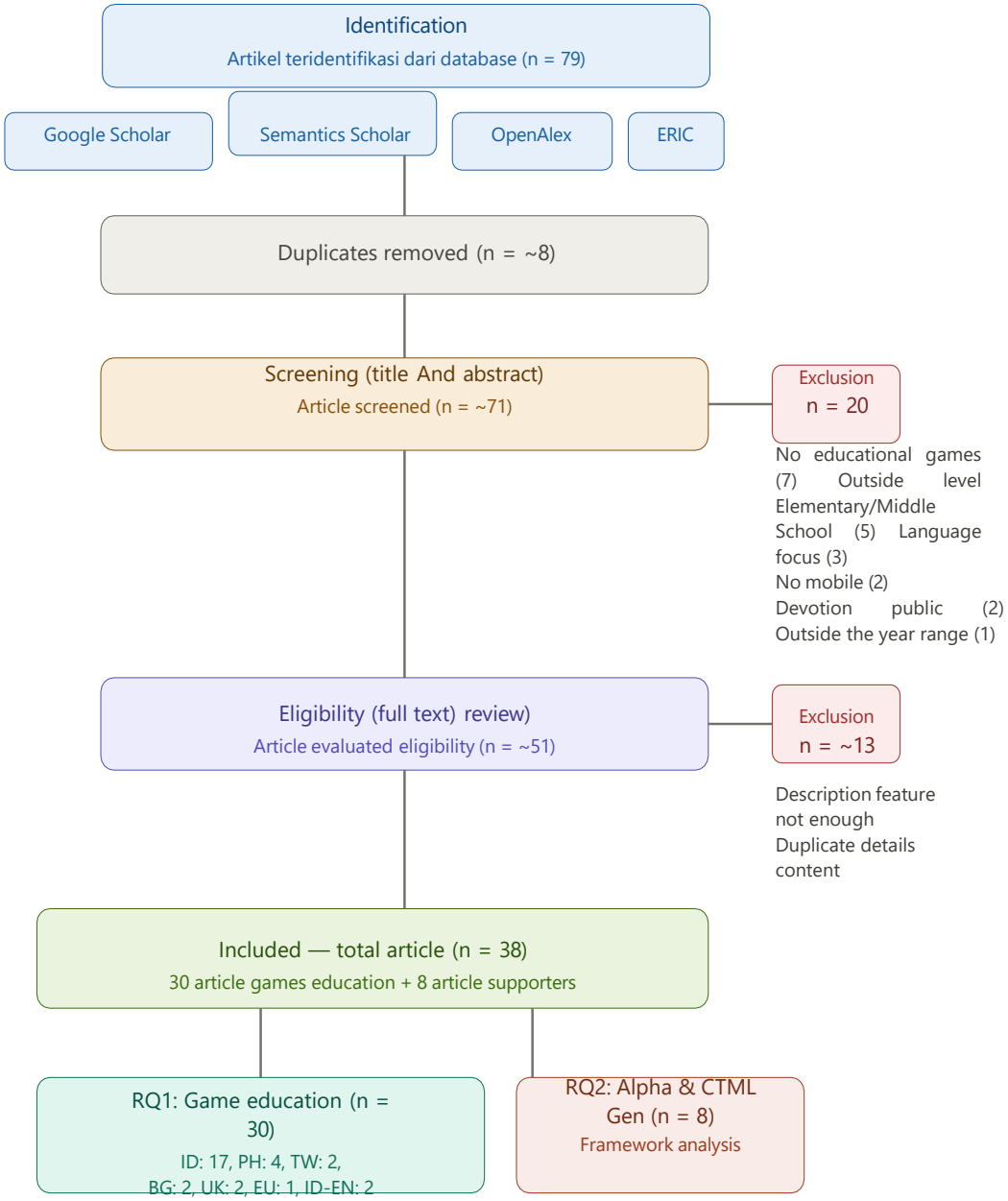
Criteria Inclusion	Criteria Exclusion
Article journal peer-reviewed or reputable conference proceedings	Article without access full text
Published in range year 2015– 2025	Book review, editorial, or abstract just
Discuss games education For numeracy or mathematics	Game Which No intended For level Elementary School or junior high school
Based mobile (smartphone or tablet)	Game based desktop/PC without version mobile

Own description feature games Which Enough details	Article duplicate on database Which different
Speaking English or Language Indonesia	Article devotion public without research components

Process Article Selection

We carry out our selection process in four stages, according to PRISMA. The first stage is *identification,* which involves recruiting... article from four base data. The total 79 article, results combination search automatic and manual. The second stage, *screening,* removes duplicates through similar titles. The remaining articles Then filtered based on title And abstract; we set aside 20 article with reasons vary: not discussing educational games (n=7), focusing on language instead of numeracy (n=3), educational levels outside of elementary/middle school (n=5), not mobile-based (n=2), outside the year range (n=1), and community service articles (n=2).

On stage *eligibility,* article Which pass *screening* we read full For ensure compatibility with criteria inclusion. Article Which not give description feature Which adequate, or which turns out to be duplicates, we exclude in this round. On stage *included,* the final article that passed all over filter enter to pocket analysis. The result: 30 article For RQ1 And 8 supporting articles For RQ2 (characteristics Generation Alpha And theory multimedia learning). There are 38 articles in total. The PRISMA flowchart is shown in Figure 2.



Picture 2. Diagram PRISMA Flow

Extraction Data

From each article, researchers extracted data and compiled it into a pre-designed extraction table. Data for RQ1 included: author, year, country, journal, student level, technology platform, numeracy materials, visual features, interactive features, *game mechanics,* research methods, key findings, and limitations. Data for RQ2 included: the learning characteristics of Generation Alpha discussed, their relationship to visual-interactive features, and recommendations for game and learning design. The complete extraction variables are presented in Table 2.

Table 2. Variables Extraction Data

Variables	Category	Information
Feature Visual	Animation, images/illustrations, videos, colors/themes, character, 3D, augmented reality	Element visual Which can seen by users
Feature Interactive	Drag-and-drop, tap/swipe, input answers, feedback real-time, pace control, multitouch	Element interaction Which can be done by the user
Game Mechanic	Points, levels, badges, leaderboard, timer, lives, storyline, quests, rewards, progression	Element mechanics implemented games
Characteristics Gen Alpha	Visual learner, short attention span, touch-native, instant feedback, personalization, collaborative	Characteristics Study Generation Alpha of literature

Analysis Data

Our analysis is divided into two waves, following two research questions. answer RQ1, we go through analysis thematic on data feature visual, feature interactive features, and game mechanics from 30 articles. We categorized the features, grouped them thematically, and then calculated their frequency of occurrence to identify the dominant features. The results are presented in a frequency table and visualization diagram.

For RQ2, we used a suitability analysis (*mapping*). The learning characteristics of Generation Alpha Which we take from literature supporters become framework; each character we mapped to the features that emerged in RQ1, forming a suitability matrix. This matrix serves as a mirror that shows how far the existing features have accommodated the characteristics of Generation Alpha while also uncovering untouched gaps. We rely on Mayer's (2024) CTML principles, including *dual channels, limited capacity,* and *active processing.* as a framework additional theory when assessing design feature visual-interactive and how Generation Alpha processes multimedia information.

RESULTS AND DISCUSSION

Results Analysis RQ1: Feature Visual-Interactive in Game Education Numeracy

Analysis thematic on 30 article Which pass filter show that feature visual-interactive on games education numeracy based smartphone split become three pillar main: features visual, feature interactive, And mechanics game. Frequency emergence each feature lined up in Table 3, Table 4, and Table 5.

Table 3. Amount feature visual on games education numeration (n=30)

Feature Visual	Frequency	Percentage
Illustration/picture 2D	28	93%
Color bright/theme visual	25	83%
Character games (avatar, (NPC)	12	40%
Animation (movement, transition)	10	33%
Environment/background thematic	8	27%
Representation 3D	3	10%
Visual novels/comics style	1	3%
Augmented Reality (AR)	0	0%

Table 3 reveals that illustrations and 2D images form the visual backbone, appearing in 93% of articles. Bright colors and visual themes are also frequent, appearing in 83%. Conversely, more sophisticated visual features, such as 3D representations, appear in only 10% of articles (Firdaus et al., 2024; Chao et al., 2018). *Augmented reality* (AR) is absent entirely. The conclusion? Majority games education numeracy Still play safe in level basic visuals and have not yet touched the potential of more immersive visual technologies.

Table 4. Frequency Feature Interactive on Game Education Numeracy (n=30)

Feature Interactive	Frequency	Percentage
Tap For choose answer	28	93%
Feedback direct (true/false)	25	83%
Navigation menu/level	22	73%
Input answer (type number)	5	17%
Drag-and- drop	4	13%
Control character (move/jump)	4	13%
Pace control (speed control)	3	10%
Manipulation object 3D (rotate/zoom)	2	7%
Branching narrative (choice decision)	1	3%
Multitouch gesture	1	3%
Multiplayer	1	3%

Table 4 shows the dominance of tap-to-select, which reached 93%, accompanied by direct correct/incorrect feedback at 83%. In contrast, more layered interactive features such as *drag-and-drop* (13%), 3D object manipulation (7%), *branching narrative* (3%), *multitouch gestures* (3%), and multiplayer (3%) are still very rare. This pattern tells a story: interactions in numeracy educational games are one-way and simple, where students... choose answer Then accept bait come back, without given door going to variety richer and more immersive

interactions.

Table 5. Frequency Game Mechanic on Game Education Numeracy (n=30)

Game Mechanic	Frequency	Percentage
Score/Points	27	90%
Levels (level difficulty)	25	83%
Progression	18	60%
Quiz	10	33%
Quests/missions	3	10%
Timer/limit time	3	10%
Storyline/narrative	3	10%
Leaderboard	2	7%
Rewards/prizes	2	7%
Lives	2	7%
AI opponent	1	3%
Badges	0	0%

Table 5 confirm score/points (90%) And levels (83%) as pillar main game mechanics. Findings Fernando And Premadasa (2024) resonate with This they record points, badges, And leaderboard (PBL) as element gamification Which most often used in elementary education. However, the deeper mechanics and potential for involvement deep like *storyline* / narrative (10%), *leaderboard* (7%), especially *badges* (0%) is still limping. The absence of *badges* in any of the articles feels odd, even though they're listed as a core element of gamification recommended for Generation Alpha.

Results Analysis RQ2: Compliance Feature with Characteristics Generation Alpha

To answer RQ2, we mapped the learning characteristics of Generation Alpha, formulated from eight supporting articles, to the features identified in RQ1. The mapping results are presented in Table 6.

Table 6. Matrix Compliance Feature Visual-Interactive with Characteristics Generation Alpha

Characteristics Gen Alpha	Feature Which Already available	Status	Gap / Notes
Visual learner	Illustration 2D (93%), bright colors (83%), character (40%), animation (33%)	Partially fulfilled	3D and AR are not yet exploited; visual still predominantly static/decorative, not yet functioning as a visual literacy tool
Short attention span	Direct feedback (83%), levels gradually (83%), short quiz (33%)	Partially fulfilled	Segmenting (CTML principles) Already implemented through levels, but timer and pace control are still rare (10%)

Touch-native interaction	Tap (93%)	Minimum requirements met	Domination tap simple; drag-and-drop (13%), multitouch (3%), manipulation 3D (7%) very rare — not yet exploiting the potential of touch interaction
Instant feedback	Feedback true/false (83%)	Partially fulfilled	Feedback Still binary dominant (true/false); explanatory feedback and multimodal feedback (visual+audio+haptic) is still very rare
Personalization	Not found	Not yet fulfilled	No articles implement adaptive difficulty or personalized difficulty. learning path
Gamified experience	Score (90%), levels (83%), progression (60%)	Partially fulfilled	Limited on basic mechanics; storyline (10%), leaderboard (7%), badges (0%), rewards (7%) still very rare
Collaborative learning	Multiplayer (3%)	Not yet fulfilled	Only 1 from 30 article which has multiplayer features; collaboration features almost There isn't any

Table 6 confirms: of the seven identified learning characteristics of Generation Alpha, none of them are fully met by the existing numeracy educational game features. Four of the characteristics that is *visual learner, short attention span, instant feedback, gamified experience* which has a status of "partially met." The basic features are embedded, but not yet mature. One feature, *touch-native interaction,* only reaches a status of "minimally met." Although taps are available in almost all games, variation interaction touch Which more colored Still very thin. Two character others— *personalization* And *collaborative learning* — even classified as "not yet fulfilled"; almost no games have adaptive or collaborative features.

Discussion

The analysis results reveal a wide gap between the design of visual-interactive features in games. education numeracy And method Study Generation Alpha. Canyon That can we read past three points of view.

First, in terms of visual features, we're still stuck with basic elements like 2D illustrations and color play. More immersive visual technologies like 3D and AR are almost here. not touched. Whereas Generation Alpha grow in environment Which very visual (Journal of Visual Literacy, 2024) and requires richer stimulation. Mayer (2024) reminds us through the CTML *coherence principle* that each visual element must work, teach, not just be beautiful. We found many articles that didn't even explain whether feature the visuals designed in on foundation design multimedia Which scientific. Often what is prioritized is only aesthetics.

Second, in terms of interactive features, *tap-and-feedback models* (93% and 83%)

dominate the arena. This pattern reveals that most numeracy educational games still use simple, one-way interaction methods. Yet, Generation Alpha is accustomed to more complex touch —*multitouch, drag-and-drop, pinch-to-zoom, and rotate* (Cimene et al., 2024). Mayer's meta-analysis found that games and simulations produce more robust effects on inferential outcomes and transfer than other media. static (Clark & Mayer, 2024). This means that games with greater depth of interaction have a greater potential to improve the quality of numeracy learning.

Third, in the realm of game mechanics, there is an over-reliance on scores and levels. as bone back. Element gamification Which more in like case in point *storyline, badges, leaderboard,* adaptive features come at a very slow frequency. Fernando and Premadasa (2024) emphasize that gamification Which own surface Which solely Relying on *points, badges,* and *leaderboards* isn't enough for Generation Alpha. Generation Alpha, in their words, " *instantly get bored due to their constantly changing behavior.*" Thus, game mechanics demand a breakthrough: a compelling narrative, relatable characters. down to earth, And strategy gamification Which able adapt self with the abilities of each student.

The absence of personalization or adaptability features across the games we reviewed is noteworthy. Generation Alpha grew up surrounded by recommendation algorithms and personalized content in their daily lives (McCrindle & Fell, 2020); they were raised with the expectation of experiences tailored to their individual needs and abilities. The principles of segmentation and pre-training in CTML (Mayer, 2024) become foundation Which friendly for approach adaptive with Breaking down content into chunks that align with students' levels of understanding. Collaborative features too so silent: only 3% games load multiplayer. Gap This big, remember Generation Alpha is highly digitally connected but still needs a platform to interact and learn together.

One notes other Which felt important: Lots article Which we review No explain the features in a way details. Of the 30 articles, some are only mention the game they "interactive" and "engaging" without detailing what, how, and why certain features were selected or designed. This finding further reinforces the urgency of research that systematically maps and categorizes features, as we attempted to accomplish in this study.

CONCLUSION

This study aims to map the visual-interactive features of smartphone-based numeracy educational games and assess their suitability for Generation Alpha's learning styles. We systematically reviewed 38 articles, including 30 on numeracy educational games and 8 supporting articles on Generation Alpha and multimedia learning. Based on our analysis, we summarize the following points.

For RQ1, the visual and interactive features of smartphone-based numeracy educational games part big Still struggling in element base. Illustration 2D present on 93% case, bright color scheme 83%, tap interaction 93%, correct/incorrect feedback 83%, scoring mechanics 90%, and levels 83%. More features advanced and immersive—representation *3D* (10%), *AR* (0%), *multitouch* (3%), *branching narrative* (3%), and *badges* (0%)—are still rarely actually presented by developers.

Related RQ2, writer find not There is One even from seven character Study Generation Alpha is completely saturated with existing numeracy educational game features. The most significant gaps are concentrated in three areas. In terms of personalization, not a single numeracy educational game utilizes adaptive learning. In terms of collaboration, only 3% of games offer it. feature multiplayer. On variation interaction touch, games This Still depend on tap simple And Not yet invite multitouch, drag-and-drop, or manipulation object.

Two main contribution we offer through this research. First, the map A

comprehensive visual-interactive feature set that developers can use as a reference when developing numeracy educational games. Second, a suitability matrix that shows the gap between existing designs and the needs of Generation Alpha, a compass that can guide the development of more effective educational games in the future.

For developer games education, writer propose five step: (1) embed features visual Which truly functioning For process Study, No only patch aesthetics;
(2) enriching the variety of touch interactions that are in line with the habits of Generation Alpha; (3) exploring mechanics game Which more in, including narrative, badges, And leaderboard;
(4) building personalization and adaptability features that adjust content to each student's abilities; (5) designing collaborative features that encourage social interaction in numeracy learning.

Of course, this research is not without limitations. We only searched four academic databases, which means there's a chance important articles slipped through our net. We also... depend on abstract And description methodology For evaluate feature Because not all full text can we access. Categorization feature even we do in a way interpretive, so that the final results are not completely sterile from the researcher's point of view. Further research should ideally test in a way direct How feature visual-interactive influence ability numeracy of Generation Alpha students, or even raise a game prototype that embodies the design recommendations from this study.

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