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PAPER

Spatial Acumen in the Digital Age: The Transformative Power of STEM-Enriched Mobile Textbooks in Geography

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ABSTRACT

Integrating technology into learning has become a pivotal necessity in the digital age. This underscores the imperative for educators, serving as facilitators, to organize and implement digital technology within instructional processes adeptly. Central to this application is educators' perceptions of the utilization of mobile digital textbooks. Crucially, this study, rooted in a qualitative research design, sought to elucidate teachers' perceptions regarding the employment of the Mobile Digital Textbook, integrated with a STEM approach, to enhance students' spatial thinking and Higher-Order Thinking Skills (HOTS). Data collection was meticulously executed through semi-structured interviews involving fifteen geography educators from eight East Java, Indonesia, secondary institutions. With the aid of NVIVO software, the data were systematically organized and categorized based on pre-established criteria. The findings revealed a predominantly positive perception among the fifteen participants towards using the Mobile Digital Textbook with the STEM approach in fostering students' spatial thinking and HOTS. The implications of this research underscore the significance of continuous training and support for educators in assimilating digital technology, particularly mobile digital textbooks, to elevate instructional quality and cultivate students' advanced cognitive abilities.

KEYWORDS

mobile digital textbook, STEM approach, spatial thinking, HOTS

1 INTRODUCTION

The advent of education grounded in digital technology heralds an epochal transformation in the pedagogical landscape of geography. The dexterity with which an educator integrates learner-centric needs with instructional activities can significantly amplify student engagement and intrinsic motivation [1], [2]. This pedagogical model necessitates ensuring that learners enjoy unrestrained access to a compendium of learning assets [3], interactive multimedia [4], and digitized pedagogical content [5]. Amidst this digital renaissance, geography pedagogues are endowed with the capacity

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to meticulously customize instruction, resonating with learner prerequisites [6], and proffering immersive pedagogical journeys via STEM-infused mobile digital textbooks.

The mobile digital textbook, undergirded by the STEM paradigm—comprising Science, Technology, Engineering, and Mathematics—materializes as an invaluable instrument for sophisticated geography pedagogy. Geography, as a discipline, is inherently imbued with the integration of scientific tenets, technological infrastructures, engineering insights, and mathematical lucidity [7]. Within these textbooks, content sculpted through the STEM lens endeavors to enhance student interactivity, refine pedagogical experiences, and seamlessly fuse instructional mechanisms with avant-garde technological innovations [8]. Such a pedagogical trajectory not only empowers students to refine their competencies [9] but also to delve deeper into the realms of Spatial Cognition and Higher Order Thinking Skills (HOTS).

Spatial Cognition and HOTS epitomize the crux of geographical education. Geographical scholars wield spatial cognition to unravel inquiries associated with spatial interrelationships, territorial demarcations [10], and ecological complexities [11]. Concurrently, HOTS emerges as an indispensable cognitive benchmark within the geography syllabus [12]. Digital textbooks, championed by the STEM methodology, proffer unmatched advantages in nurturing Spatial Cognition and HOTS.

The amalgamation of STEM tenets with mobile digital textbooks engenders a distinctive synergy, exponentially amplifying students' spatial cognitive prowess. Textbooks, deeply rooted in the STEM ethos, wield profound influence over students' cognitive evolution in spatial reasoning [13]. Leveraging the comprehensive ambit of STEM, these pedagogical tools foster an intricate comprehension of spatial paradigms, adroit employment of technological apparatuses for spatial delineation, and the formulation of spatial hypotheses anchored in mathematical and logical underpinnings [14], [15]. Such a confluence expedites the maturation of students' HOTS, ensuring that the digitized content, bolstered by online adjuncts, resonates at the zenith of cognitive harmony [16].

Acknowledging the profound significance of interweaving STEM principles within digital pedagogical tools is of paramount importance. A seminal study conducted by Farmer EC, Catalano AJ, Halpern AJ [17], underscores that learners exposed to digital materials enriched with STEM principles witnessed an augmentation of approximately 20% in their spatial reasoning capabilities, in contrast to their peers who utilized traditional materials. As the global educational arena experiences an accelerated trajectory towards digitization, with pronounced momentum in nascent economies such as Indonesia, the integration of cutting-edge pedagogical methodologies becomes indispensable to ensure optimal learning outcomes [18].

Within the Indonesian pedagogical framework, foundational components of geography encapsulate pivotal themes such as fertility, mortality, migration, and demographic forecasting. This content holds significant weight within the secondary education matrix, especially within the realm of social sciences [19]. Given the intricate nexus between demographic dynamics and spatial parameters, there emerges a compelling imperative [20] for an enriched spatial intellect to adeptly navigate demography-centric dilemmas [21], [22]. In light of the cross-disciplinary essence of demographic studies, the onus squarely rests on instructional resources to embody a holistic scientific perspective [23].

The inexorable global transition towards a digital pedagogical paradigm amplifies the relevance of the present research endeavor. Forecast data from the World Education Forum envisage that an overwhelming 60% of global academic institutions will transition to digital textbooks by the culmination of 2030. In the wake of such epochal transformations, acquiring a deep-seated mastery over STEM-infused

resources is an imperative [24]. The emerging pedagogical zeitgeist accentuates the multifarious dimensions of learner engagement [25], [26]. The confluence of avant-garde technological innovations undeniably escalates the cognitive expectations levied upon learners. Consequently, the insights gleaned from educators serve as a linchpin, illuminating technology's potential in amplifying learners' spatial cognition and HOTS. This research endeavor, thus, emerges as a pivotal compass, steering both pedagogues and policymakers towards the astute integration of STEM-enriched digital platforms, ensuring the intellectual evolution of subsequent generations.

2 LITERATURE REVIEW

2.1 Mobile digital textbook with STEM approach

Textbooks have long been fundamental in shaping educational landscapes, deeply impacting pedagogical directions and augmenting the scholastic endeavor. With the relentless evolution of science and technology, academia witnesses an unmistakable shift towards avant-garde textbook paradigms, tailored to cater to the burgeoning digital requisites and challenges [27]. Digital textbooks have evolved into four distinct categories, namely: native, web-based, hybrid applications, and mobile [28]. Of these, mobile digital textbooks have increasingly established their prominence [29].

The emergence of mobile digital textbooks marks a significant milestone in the repository of pedagogical tools. They empower educators to deploy textbooks as instructional assets through versatile digital mobile interfaces, thus refining the academic experience for learners [30]. Furthermore, these digital mediums amplify students' propensity to immerse themselves in digital ecosystems [31]. The assimilation of internet-driven resources remains instrumental in elevating both the efficacy and efficiency of the instructional paradigm [32]. In contemporary educational discourse, the integration of the STEM (Science, Technology, Engineering, and Mathematics) paradigm within mobile digital textbooks has captured the spotlight. This framework melds scientific tenets with technological nuances, fostering profound comprehension and equipping students with essential skills befitting the 21st century. Consequently, this synergy positions STEM integration as a cardinal subject within mobile digital textbook research. Complementing this paradigm is the study of connectivity theory, now inextricably woven into this digital innovation. Connectivity theory underscores the salience of intricate networks and synergistic liaisons in pedagogy. It advocates an environment where learners seamlessly intertwine and coalesce with a plethora of resources and peers, thus enriching their scholastic journey in this digital epoch.

2.2 Spatial thinking skill

The field of geography, as an intellectual endeavor, boasts unique characteristics central to spatial analysis. Pedagogically, geography accentuates a plethora of concepts deeply intertwined with spatial cognition [33]. Within this scholarly framework, students demonstrate an enhanced aptitude in deciphering spatial constructs embedded in geography [34], most notably, the dimension of spatial reasoning. Spatial reasoning embodies a student's adeptness to interpret and integrate multifarious information underpinned by spatial tenets. This cognitive prowess functions as an orchestrated instrument, streamlining the acquisition of information anchored in

spatial domains [35]. Moreover, spatial reasoning embraces a comprehensive comprehension of geographical entities, drawing inspiration from conceptual doctrines, symbolic delineations, and the formulation of pioneering premises [36].

The ascendency of spatial thinking, particularly for geography aficionados, gains momentum with the relentless progression of information technology. The competency to amalgamate geographic information systems, spatial data visualization techniques, and geolocation-centric problem resolution emerges as quintessential. Geographic information systems empower learners to engage in profound exploration, comprehension, and analysis of geographical phenomena. Meanwhile, spatial data visualization acts as a catalyst in the lucid interpretation and dissemination of geographical insights. Parallelly, geolocation-driven problem-solving bolsters students' prowess in transposing geographical scholarship into tangible real-world applications.

Amidst the digital zeitgeist of our age, the endorsement of Mobile Digital Textbooks crystallizes as an indispensable pedagogical asset, bolstering the inculcation of spatial thinking. These digitized compendiums proffer students the privilege of instantaneous access, tactile engagement, and discernment of geographical datasets, thus orchestrating a more symbiotic and immersive scholastic journey. Enhanced accessibility paired with the dynamism of visualizing geographical paradigms ensures that Mobile Digital Textbooks augment students' grasp on spatial thinking. They also capacitate learners to transpose these insights into real-life frameworks. As such, the infusion of Mobile Digital Textbooks in geographical pedagogy not only elevates the academic experience but also readies students to navigate the intricacies of the information-driven epoch.

2.3 Higher order thinking skills

Within the realm of geography, a discipline inherently interweaving the physical, societal, and technological dimensions, the transition to digital textbooks marks a significant pedagogical metamorphosis. At its core, geography grapples with a diverse array of frequently evolving data necessitating rigorous spatial analysis. This dynamism underscores the growing imperative for educational resources that transcend traditional static text and imagery, evolving in tandem with real-time changes [37], [38].

The incorporation of digital textbooks in geographical instruction heralds the ushering in of more nuanced, context-sensitive, and data-centric pedagogical strategies. Such textbooks, for instance, can seamlessly embed hyperlinks connecting to contemporary data repositories, Geographic Information Systems (GIS), or scholarly debate platforms, thereby infusing an enriched layer of depth and context [39]. Additionally, the integration of interactive assessments and simulations expedites the practical application of geographical tenets within tangible scenarios. This dynamic approach amplifies students' comprehension of the broader ramifications and practicalities linked with their academic pursuits [40].

Consonant with the development of Higher Order Thinking Skills (HOTS), the eclectic range of resources and instructional modalities facilitated by digital textbooks plays a pivotal role in nurturing capabilities like critical appraisal, evaluative judgment, and data synthesis. From this vantage point, students transcend the traditional role of passive information recipients, metamorphosing into discerning analysts and evaluators—competencies that stand central to the essence of geography [41].

Nevertheless, the path towards unfettered digital integration in geography pedagogy is not devoid of challenges. The specter of accessibility concerns and the digital

divide looms large, potentially impinging on the degree to which all students can harness these digital assets optimally [42]. Consequently, pedagogical strategies must conscientiously champion principles of sustainability and inclusivity when intertwining technology with geographical instruction.

3 METHOD

3.1 Research design

Grounded in a qualitative research design, this study adopts a descriptive analytical approach. Its primary objective is to delve into the perspectives of geography educators concerning the incorporation of mobile digital textbooks within secondary education contexts. Given its inherent reliance on diverse datasets and spatial analytic instruments, geography stands out as a quintessential discipline ripe for the infusion of educational technological innovations, such as digital textbooks [43].

Prevailing academic literature underscores the potency of qualitative research in illuminating and decoding the individualistic and subjective interpretations or stances toward a specified subject or phenomenon. Within the confines of this investigation, the qualitative framework offers a profound medium to discerningly assess the reactions and adjustments of geography educators vis-à-vis the assimilation and operationalization of mobile digital textbooks within their pedagogical repertoires [44].

The study harnesses the descriptive analytical technique to collate exhaustive and intricate data. This strategy affords a granular comprehension of the manner in which mobile digital textbooks are embraced, engaged with, and appraised by geography educators. Moreover, it paves the way for a context-sensitive analysis, shedding light on how these educators' perceptions might shape the efficacy and longevity of this technological tool within geographical instruction [45].

Anchored in this methodological construct, this research endeavors to bridge a discernible lacuna in the existing geographical academic canon. It seeks to proffer empirical insights elucidating the perceptions of secondary education geography educators regarding the efficacy and role of mobile digital textbooks. The anticipated outcomes of this investigation are poised to inform and refine more adept educational methodologies and policy frameworks, driving the seamless melding of technology within geographical syllabi and instructional strategies [46].

3.2 Participant

This research is anchored within the educational milieu of Senior High Schools in East Java, Indonesia, thereby delineating a geographically specific purview for the inquiry. The participant ensemble comprises 15 veteran educators' adepts in geography pedagogy, drawn from a diverse spectrum of institutions, notably including Senior High School 1 Purwosari, Senior High School 1 Kepanjen, and an assortment of state-subsidized Senior High Schools in Batu, Kediri, and Malang.

Demographically, the educators adhere to precise criteria: each participant falls within the age bracket of 54 to 59 years and has secured, at a minimum, a Bachelor's degree anchored in geography education. Furthermore, these educators have garnered an extensive pedagogical repertoire, with their teaching tenure in geography ranging from 24 to 30 years.

Such judiciously defined demographic and academic contours bestow the research with a nuanced contextual backdrop. The educators' enduring pedagogical trajectories, juxtaposed against their varied institutional engagements, not only amplify the research's internal validity but also elevate its external applicability. Consequently, this participant matrix bolsters the depth of interpretation and underscores the credibility of the forthcoming insights pertaining to the assimilation and potency of mobile digital textbooks within the ambit of secondary geography pedagogy in Indonesia.

3.3 Data collection

For the data collection in this qualitative research, semi-structured interviews were employed. Such interviews were selected due to their inherent flexibility, allowing for dynamic and adaptive discussions during the research process [44]. This method is instrumental in discerning teacher perceptions concerning the adoption of mobile digital textbooks to bolster spatial thinking and Higher Order Thinking Skills (HOTS).

Complementarily, observational data were harnessed to further substantiate the research findings. These observations serve as empirical testimonies of the efficacy of mobile digital textbooks integrated with the STEM approach in enhancing students' spatial thinking capabilities and HOTS. Data from these observations were meticulously documented on specified observation sheets during the learning interactions.

3.4 Data analysis

For this investigation, sophisticated qualitative data analysis methodologies were employed, notably utilizing the NVIVO software. This platform is renowned for its prowess in orchestrating, categorizing, and decoding qualitative data, discerning patterns across an array of designated categories and benchmarks [45]. To bolster the robustness and integrity of the research undertaking, the interview tool was subjected to an exhaustive pilot testing regimen. This rigorous procedure was geared towards validating its authenticity and reliability.

In the realm of primary data collection, a sequenced methodology was instituted for the collation and taxonomy of interview transcripts. As a commencement step, the researcher embarked on a rigorous data examination and earmarking exercise, harnessing the intricate coding capabilities intrinsic to the NVIVO platform. This coding paradigm was meticulously crafted to elucidate educators' perceptions about the ramifications of mobile digital textbooks on students' spatial cognition and Higher-Order Thinking Skills (HOTS). In the ensuing phase, the data gleaned through this coding trajectory were assiduously aggregated, each set aligned with distinct markers pertinent to students' spatial cognitive competencies and HOTS.

4 RESULT

From the data analysis, leveraging the query wizard and subsequently creating a word cloud to elucidate word frequency, as depicted in Figure 1, specific findings emerge. The data reveals a prominent recurrence of terms such as "student", "thinking", "skills", "digital", "spatial", "high", "orderly", "improving", among others. This underscores the inference that educators perceive the employment of mobile digital textbooks as beneficial, particularly in enhancing students' spatial thinking and higher-order thinking skills.

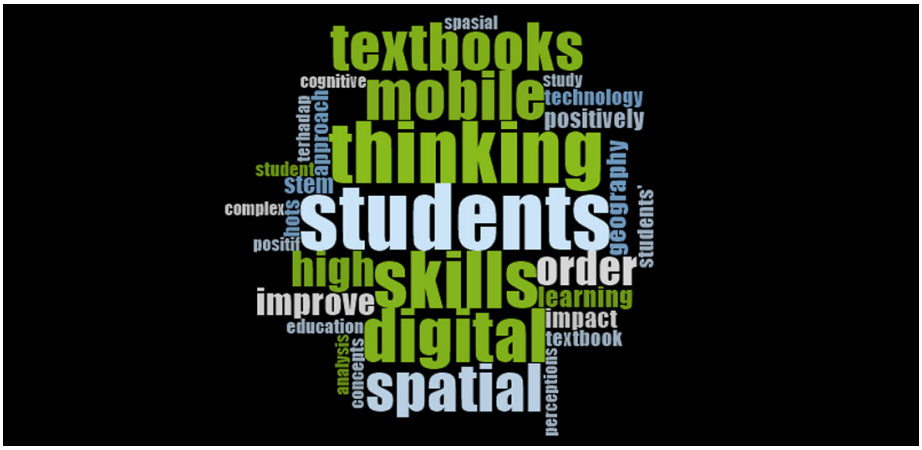

Fig. 1. Word cloud as a word frequency query from interviews

Referring to the project map extrapolated from NVIVO, as illustrated in Figure 2, salient points surface regarding educators' perspectives on the implementation of mobile digital textbooks predicated on the STEM approach, targeting students' spatial thinking prowess and HOTS. Within the ambit of spatial thinking, pivotal insights associated with the deployment of mobile digital textbooks encompass: (1) spatial concepts, (2) spatial representation, and (3) reasoning grounded in spatial constructs. Concurrently, in relation to the HOTS spectrum, educators' perceptions accentuate the facets of (1) conceptual knowledge, (2) procedural knowledge, and (3) meta-cognitive knowledge, each intertwined with cognitive undertakings such as analysis, evaluation, and creation.

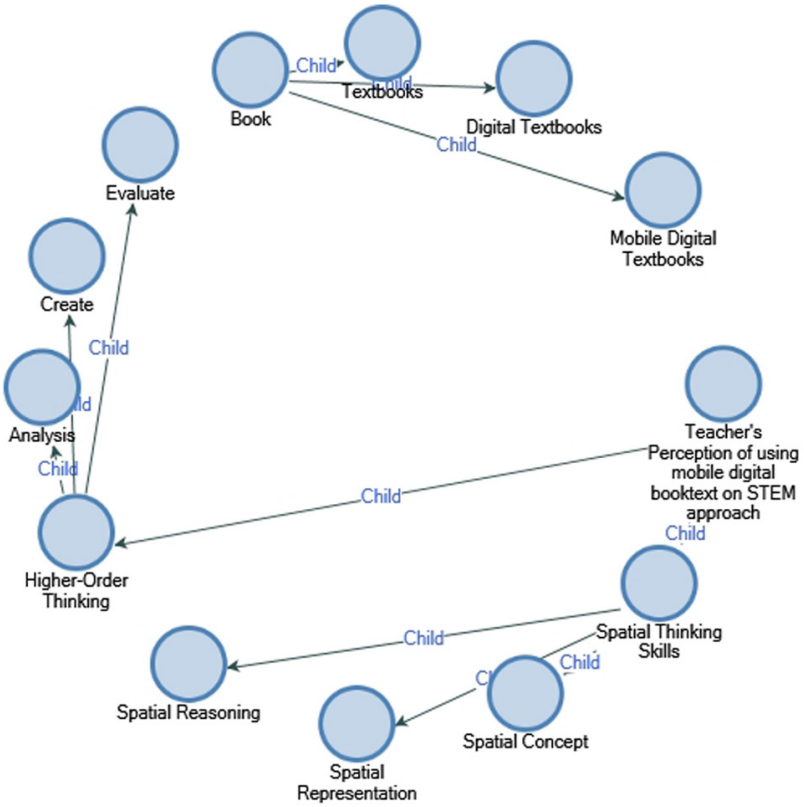

Fig. 2. Project map of teacher's perception of using mobile digital book text on STEM approach

4.1 Teacher's perception of the use of mobile digital textbooks with STEM approach to student's spatial thinking ability

The analytical outcomes underscore that the incorporation of mobile digital textbooks rooted in the STEM paradigm, targeting spatial cognition, accentuates three cardinal dimensions: (1) Spatial Concepts, bifurcated into simple and intricate spatial indicators, (2) Spatial Representation, and (3) Spatial Reasoning, encompassing stages of Input, Processing, and Output. Concurrently, the indicators for Higher-Order Thinking Skills (HOTS) encapsulate: (1) Analysis, (2) Evaluation, and (3) Creation.

1. ***Spatial Concept***

a) *Simple Spatial*

Participants' feedback underscores that STEM-oriented mobile digital textbooks fortify students' foundational spatial understanding. Muhammad Ali's perspective substantiates this notion: "The STEM-integrated mobile digital textbook, by emphasizing technologically advanced tools, streamlines the learning trajectory. Predominantly, the unbridled access to a myriad of geographical resources paves the way for students to internalize rudimentary spatial constructs." This foundational spatial concept emerges prominently in subtopics such as Population Migration, delineating movement, transition, and distance. Such textbooks simplify students' endeavors to discern and delve deeper into geographical topics.

b) *Complex Spatial*

The STEM-infused mobile digital textbook amplifies students' advanced spatial cognition. Lukman Huri observes, "In the current pedagogical climate, there's an exigency for digitally-augmented instructional resources. Given students' affinity for mobile interfaces, it's imperative for educators to harmonize their pedagogical tactics with these platforms. Mobile digital textbooks facilitate students' adept navigation and application of geospatial data." Such insights suggest that these textbooks enhance students' spatial constructs by unveiling multifaceted information, thereby refining their comprehension of spatial patterns, relationships, and clusters in their academic explorations.

2. ***Spatial Representation***

a) *Spatial Representation*

Contrary to mere textual content, mobile digital textbooks offer an array of tools designed to hone students' spatial representation skills. As highlighted by participants Dijha Ayu and Sugiarto, "In portraying spatial referential data, certain features cater to students' spatial proficiencies. Tools like GeoExplorer and GeoInfo are particularly intriguing and stand out in deepening students' comprehension across cognitive, affective, and psychomotor domains."

b) *Spatial Reasoning*

The facet of spatial reasoning accentuates the cultivation of intricate cognitive abilities, enabling students to autonomously seek, aggregate, and interpret data. A perspective shared by Amantho, Ali Ridha, and Shinta Dewi Nirwana reinforces this: "Content, challenges, and evaluative metrics within mobile digital textbooks steer students toward intricate cognitive engagements, thereby bolstering their argumentative acumen rooted in extant spatial data."

4.2 Teacher's perception of the use of mobile digital textbooks with STEM approach to student's HOTS: Analyzing, evaluating, and creating

The analytical facet of higher-order thinking skills is paramount in the pedagogical milieu. Participants' perceptions resonate with the sentiment that mobile digital textbooks can enhance students' analytical prowess. Echoing this, Bonari and Saiful Abu Bakar note, "Such digital textbooks enable students to engage in active reading, assimilate information proactively, and initiate queries about complex topics. This iterative process nudges students toward systematic contemplation, paving the way for problem-solving." Similarly, Muhammad Hermawanto and Lilis Mudrawati posit that, "Textbooks that embrace a multidisciplinary STEM approach propel students toward advanced cognitive capabilities."

Moreover, there's a burgeoning perception that mobile digital textbooks amplify students' capacity for evaluating ideas or actions critically. As outlined by Lintang Ayu Riwanti and Riska Nanda Adekanti, "An individual's equanimous emotional disposition while interfacing with digital textbooks undergirds their cognitive processes, coupled with a receptivity to novel knowledge. This cognitive and emotional synergy fosters students' ability to discern and evaluate the merits and demerits of specific ideas or actions."

Furthermore, some educators advocate that these textbooks inspire creativity amongst students. Anggita Septiana Eka Pratiwi and Mariati elucidate this perspective, asserting, "Students are not mere recipients of information; they are actively engaged in its application. These medium sparks inspiration, galvanizing students to ideate and orchestrate geographical projects. Given its structured delivery of content, this tool is especially beneficial for topics like population dynamics within the discipline of geography."

5 DISCUSSION

This investigation seeks to elucidate educators' perceptions regarding the employment of mobile digital textbooks infused with a STEM methodology in enhancing students' spatial cognition capabilities and Higher Order Thinking Skills (HOTS). Employing a semi-structured interview paradigm, the collected data were subsequently organized, categorized, and subjected to analytical scrutiny via NVIVO software. From the insights of 15 participants, it emerged that the STEM-integrated mobile digital textbook significantly augments spatial cognitive abilities and HOTS, especially within the context of population dynamics.

The teacher's perception of utilizing the mobile digital textbook in the geography learning process. According to the research findings, a positive perception emerges due to the integration of deserve media types within the mobile digital textbook, along with its contextual explanations of everyday phenomena. Furthermore, the mobile digital textbook incorporates a "let's think" feature, comprising problem-solving exercises that encourage students to engage in critical thinking and seek solutions. This feature with STEM approach has been implemented in Tobing and Sukma research, which is able to improve high-level thinking abilities because it is easy to use and provide clear solution.

In the pedagogical realm of geography, the educators' perspectives on the deployment of this digital textbook revealed three pivotal elements that underscored their positive outlook towards its efficacy in fostering spatial thinking and HOTS. For spatial thinking, these encompassed: (1) enhanced material accessibility,

(2) the potential for reconstructing intricate spatial constructs, and (3) the instrumental role of technology in pedagogical processes. Concurrently, for HOTS, these elements were: (1) bolstered problem-solving aptitudes, (2) intricate cognitive processes in decision-making, and (3) pragmatic content application.

Spatial cognition remains a cornerstone in geographical pedagogy, given the discipline's inherent spatial information orientation [46]. The adoption of mobile digital textbooks facilitates learners in molding their spatial thinking, primarily through heightened material accessibility [47]. Such resources empower learners to independently navigate and assimilate content. Specifically, the Population Migration content—characterized by rudimentary spatial indicators like movement, transition, and distance—serves as a catalyst for learners in crafting elementary spatial constructs [48]. The cognitive dimensions of elementary spatial notions manifest via content that accentuates spatial interrelationships (movement, transition, and distance) [49].

Moreover, educators' perceptions pivot towards the potential of textbooks in reshaping facets of learners' intricate spatial notions. Complex spatial indicators, pivotal to assimilating geospatial information and data within textbooks, become evident. Nuanced spatial constructs—patterns, spatial correlations, and clustering—pertaining to content on fertility and population mortality, emerge prominently in instructional endeavors employing these textbooks. Furthermore, the synergy of textbooks and technology facilitates learners in independently accessing content, thereby fostering intricate cognitive abilities, profound conceptual grasp, and the sculpting of memory structures [50]. The STEM methodology further augments spatial cognition [51].

The positive educator perceptions concerning textbook utilization in nurturing spatial thinking underscore the indispensable role of technology as a pedagogical adjunct. The current educational milieu witnesses educators recognizing the imperativeness of meticulously curating learning experiences to intellectually engage learners [52]. The supportive features embedded within the STEM-integrated mobile digital textbook—memo pads, highlighting utilities, integrated QR code scanners, navigational aids, GeoExplore, and GeoInfo visualization options—act as catalysts in refining spatial cognitive abilities. The spatially anchored data within textbooks, articulated through diverse models, aids in the reconstruction of spatial constructs [53].

Furthermore, educators' perspectives underscore the profound impact of textbook utilization on amplifying analytical metrics pertaining to student HOTS. Pedagogical endeavors within the textbook necessitate proactive and autonomous learning, fostering profound understanding, knowledge assimilation, and problem-solving aptitude. These perceptions accentuate the nuanced presentation of population dynamics, with content that echoes the STEM paradigm, thereby accentuating content scrutiny and problem resolution [54].

The STEM-infused mobile digital textbooks serve as potent tools in appraising HOTS indicators through sharpened decision-making proficiencies. The interdisciplinary nature of the content offers learners a rejuvenated perspective in their geographical studies, thereby influencing evaluative thinking and judicious decision-making grounded in multifaceted approaches [55], [56].

The judicious selection of models, evaluation mechanisms, and content is paramount in fostering advanced cognitive skills. Such perceptions resonate profoundly within the realm of population dynamics content. The STEM-oriented content fosters a learner-centric pedagogical milieu, characterized by autonomous learning. This ambiance grants learner's expansive latitude to navigate pertinent content, thereby enabling them to pragmatically apply content through innovative projects and assignments.

6 CONCLUSION

The findings of this study unequivocally indicate that educators harbor a favorable perception towards the integration of the STEM methodology within Mobile Digital Textbooks in enhancing learners' Spatial Cognitive Proficiencies and Higher Order Thinking Skills (HOTS). One salient advantage of the STEM-integrated Mobile Digital Textbook in bolstering students' Spatial Cognitive Proficiencies resides in its multifaceted features. Through this platform, learners autonomously navigate and reconfigure a plethora of spatial constructs in a meticulously organized and systematic manner. Furthermore, the content, underpinned by the STEM paradigm, exerts a positive influence on the development of students' HOTS. The strategic delineation of content, employing a multidisciplinary lens, serves as a catalyst in the crystallization of students' HOTS. Consequently, it can be posited that the STEM-infused Mobile Digital Textbook holds the potential to significantly elevate learners' Spatial Cognitive Proficiencies and HOTS.

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