Changing education amid technology disruption: Students' experiences, challenges, and coping strategies in mathematics learning

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Abstract: *This study explored the challenges, coping mechanisms, and learning experiences of secondary students during the abrupt shift to alternative learning modalities in Baganga, Davao Oriental, amid technology-driven disruptions. Using a qualitative phenomenological approach, five students were purposively selected for in-depth interviews, and data were systematically coded and analyzed according to the research questions. Findings revealed that students faced limited access to devices, unstable internet connectivity, absence of face-to-face teacher guidance, and difficulty following home learning plans. To cope, they employed strategies such as seeking assistance from peers and family, creating structured home learning setups, and borrowing learning resources. Students' experiences highlighted the importance of autonomy, time management, and self-directed learning, demonstrating their adaptability in navigating disruptions. Assessment practices such as feedback provision, supplemental video lessons, and performance-based tasks further supported their continued learning. These results underscore that student-centered learning can persist despite technology disruptions, emphasizing the need for instructional designs that balance digital tools with structured guidance. The study offers practical insights for fostering resilient, autonomous, and future-ready learners in the digital era.*

Keywords: Digital adaptation, Remote learning challenges, Self-directed learning, Student-centered learning, Technology disruption.

1. Introduction

The COVID-19 pandemic has significantly disrupted education worldwide, forcing schools to close and shifting learning from traditional classrooms to remote and modular modalities (UNESCO, 2020). In response, the Department of Education implemented the Basic Education Learning Continuity Plan (BE-LCP) for the 2020–2021 school year, which included alternative learning methods such as modular instruction, television- and radio-based lessons, blended learning, and online platforms (DepEd Order No. 12, 2020). The curriculum was decongested to focus on the Most Essential Learning Competencies (MELCs), promoting 21st-century skills such as collaboration, critical thinking, creativity, and

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communication. This abrupt shift in instructional delivery transformed students' roles in the learning process, requiring them to become more autonomous and self-directed, while navigating new pedagogical approaches that are challenging to implement outside the traditional classroom setting (Lichoro, 2015).

Mathematics instruction, already considered a challenging subject, became even more demanding in remote or modular contexts. Students faced heightened math anxiety compounded by broader pandemic-related stress, limited access to digital devices, unreliable internet connectivity, and the absence of in-person teacher support (Sawchuk & Sparks, 2020). Parents, often unprepared to assist with mathematics learning, became essential facilitators in students' home learning environments. These challenges required students to develop coping mechanisms such as creating structured study routines, seeking help from peers or family, and leveraging available learning resources to sustain their academic performance.

This study explores the lived experiences of secondary mathematics students as they navigated these disruptions, focusing on the challenges they encountered, the strategies they employed to cope, and the insights they gained from their experiences. By examining students' adaptation to alternative learning modalities and assessment practices, the research aims to highlight effective self-directed learning strategies and provide evidence for designing resilient, student-centered instructional approaches. Understanding these experiences contributes to the broader discourse on changing education in the era of technology disruption, offering insights for future interventions that promote inclusive, flexible, and technology-driven learning.

2. Methods

This study used a descriptive phenomenological approach to explore the lived experiences of secondary mathematics students in Baganga, Davao Oriental during the abrupt shift to alternarive learning modalities. Baganga is largely rural municipality of the Davao Oriental with limited internet infrastructure, so many students relied on paper modules, radio, or intermittent online classes. In keeping with phenomenological tradition, the study prioritized rich, in-depth narratives rather than a large sample size. Phenomenology is appropriate when the goal is to understand how individuals make sense of a shared experience, emphasizing depth and meaning rather than statistical generalization (Creswell, 2013; Giorgi, 2009).

2.1 Participants and sampling

Participants were selected through purposive sampling, consistent with phenomenological research that prioritizes depth of lived experiences over representativeness (Creswell, 2013; Polkinghorne, 1989). The inclusion criteria were as follows: 1) students were officially enrolled in secondary mathematics during implementation of alternative modes; 2) they resided in geographically dispersed barangays of Baganga, Davao Oriental, characterized by varying levels of internet connectivity and access to digital devices; 3) they actively participated

in modular, blended, or intermittent online learning modalities for at least one academic quarter; and 4) they were willing and able to articulate their learning experiences thru in-depth interviews.

To ensure variation in perspectives, participants were drawn forn five (5) different public secondary schools, allowing study to capture diverse contextual realities within the same rural municipality. Students with limited exposure to alternative learning modalities or inconsistent participation during the study period were excluded. This selection process ensured that participants possessed sufficient experiential engagement with technology-mediated learning disruptions, thereby strengthening the credibility and richness of the data.

Although the sample size was small (n = 5), this is consistent with established phenomenological research standards. Scholars emphasize that phenomenological studies commonly involve small samples, often ranging from 3 to 25 participants, as the objective is to obtain rich, detailed accounts of lived experiences rather than broad generalizability (Creswell, 2013; Pokinghorne, 1989; Vagle, 2018). Data collection and analysis were conducted iteratively until thematic saturation was reached, indicating that no substantially new meanings or themes were emerging from the interviews (Guest, Bunce & Johnson, 2006).

2.2 Data collection

Data was collected through semi-structured, in-depth interviews conducted at a mutually agreed time and location. Participants were informed of the study's purpose, procedures, potential risks, and confidentiality measures prior to participation, and informed consent was obtained. Interviews were audio-recorded with permission, transcribed verbatim, and returned to participants for verification to ensure accuracy. Interview questions encouraged students to describe their challenges, coping strategies, learning insights, and experiences with assessment practices during the alternative learning setup.

2.3 Data analysis

The transcribed data were analyzed using Colaizzi's descriptive phenomenological method, which involves identifying significant statements, formulating meanings, clustering themes, and developing an exhaustive description of the phenomenon (Colaizzi, 1978). This systematic process allowed the researcher to capture both shared patternsand nuanced individual experiences, Reflexive journaling and peer debriefing were employed throughout the analysis to minimize researcher bias and enhance analytical rigor.

2.4 Trustworthiness and transferability

Trustworthiness was ensured through strategies addressing credibility, dependability, confirmability, and transferability (Lincoln & Guba, 1985). Credibility was established through member checking and peer review, whole an audit trai; supported dependability and confirmability. Although the findings are

context-specific, transferability was addressed through rich, thick descriptions of participants' contexts, learning conditions, and experiences. These detailed accounts enable readers to similar rural, low resource, or technology-constrained educational settings beyond Baganga, Davao Oriental (Lincoln & Guba, 1985; Creswell, 2013).

2.5 Ethical considerations

Ethical principles of voluntary participation, confidentiality, and data protection were strictly observed. Participants were assigned code names, and all recordings and transcripts were securely stored and accessed only by the research team. The methodology provided a rigorous and ethical framework for capturing authentic student experience and their adaptive responses to educational disruption.

3. Results

3.1 Challenging experiences of students in the abrupt transition of learning modality

Students encountered a range of difficulties as they adapted to modular and blended forms of distance learning. Figure 1 llustrates the interplay among three dominant challenges: the *absence of a physical teacher*, the *unfollowed weekly home-learning plan*, and the *lack of gadgets coupled with poor internet connectivity*.

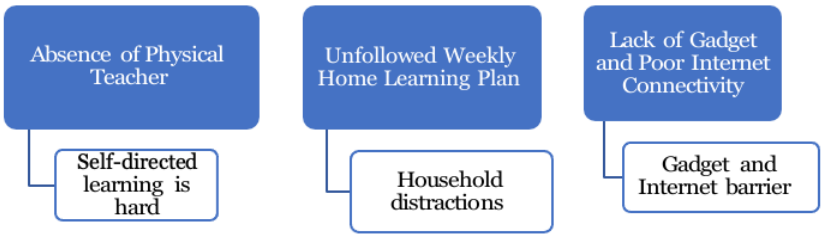

Figure 1. Key Themes in Students' Challenges During the Abrupt Shift in Learning Modalities

In the first theme, the *absence of a physical teacher* emerged as the most frequently cited source of difficulty. Students explained that mathematics requires direct explanation and step-by-step demonstration, elements that printed self-learning modules (SLMs) could not provide. Without immediate feedback, misconceptions persisted. One participant shared that "it is hard to understand the lessons when nobody explains the steps." The loss of real-time teacher–student interaction generated feelings of isolation and frustration, aligning with Moore's (2011) notion of *transactional distance*, where limited dialogue increases cognitive gaps between learner and content.

The second theme, unfollowed weekly home-learning plan, highlighted challenges in time management and home environment. Although the Department of Education prescribed a Weekly Home Learning Plan (WHLP), most students

admitted difficulty in following it due to household chores, family obligations, and distracting surroundings. They described studying late at night, multitasking with domestic responsibilities, or sharing learning spaces with siblings. These conditions disrupted the rhythm of learning and weakened focus, confirming earlier studies that home settings often lack the structure necessary for sustained academic engagement.

The third theme concerned *limited resources and unstable connectivity*. Many students reported the absence of personal gadgets, dependence on borrowed devices, and intermittent internet signals. Communication with teachers was delayed, and submission of outputs was often late. These conditions, shown in Table 1 (summary of students' resource constraints and effects on learning), constrained equitable access to learning and compounded students' stress and anxiety.

Table 1. Summary of students' reported challenges

Theme	Frequency (n = 5)	Illustrative Statement
Absence of physical teacher	5	"It's hard to learn math when no one explains."
Unfollowed WHLP / home distractions	4	"I can't follow the schedule because I help at home."
Lack of gadget / poor internet	4	"We share one phone and the signal is weak."

3.2 Coping mechanisms of students

Despite these challenges, students demonstrated notable adaptability. Three major coping strategies were identified: *seeking assistance from others*, *creating a home-based learning setup*, and *borrowing learning resources*. These strategies are conceptually summarized in Figure 2**,** which depicts students' movement from dependence to self-regulation.

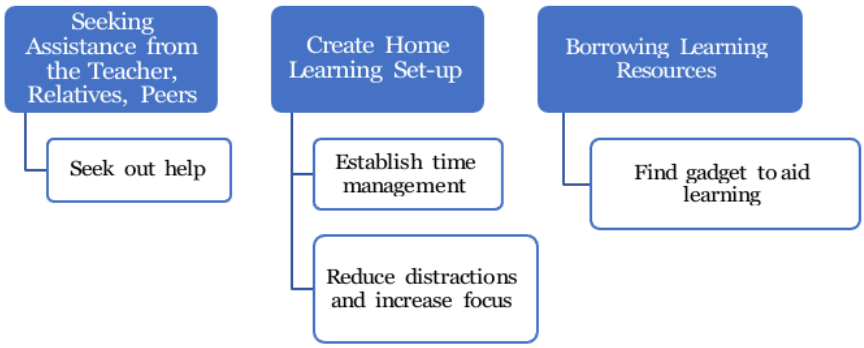

Figure 2. Key themes in coping mechanisms

Under the first strategy, *seeking assistance*, students actively reached out to teachers, relatives, and peers to clarify lessons. Family members, particularly siblings and parents, often served as immediate tutors. Peer-to-peer messaging

groups also became informal support systems where students exchanged solutions and moral encouragement. This social dimension of coping reinforced Vygotsky's principle that learning is socially mediated.

The second coping pattern involved *creating a home-learning setup*. Students converted corners of their homes into study areas, set personal schedules, and disciplined themselves to reduce distractions. This effort indicated a developing sense of self-regulated learning. Participants expressed pride in "learning to manage [their] own time," which transformed a previously passive learning habit into an active process of planning and goal setting.

The third coping mechanism, *borrowing learning resources*, showcased creativity in the face of scarcity. Learners borrowed mobile phones, laptops, or printed materials from relatives and neighbors, usually on a rotational basis. Some traveled to public areas with stronger signals just to send outputs or download modules. These accounts portray Filipino students' resilience and commitment to continuing education despite technological and financial limitations.

3.3 Insights of students on the alternative delivery mode

Students' reflections on their modular and blended experiences revealed three interconnected insights: student autonomy, the continuing need for a physical teacher, and the importance of time management. These are outlined conceptually in Figure 3 as overlapping spheres representing cognitive, affective, and behavioral growth.

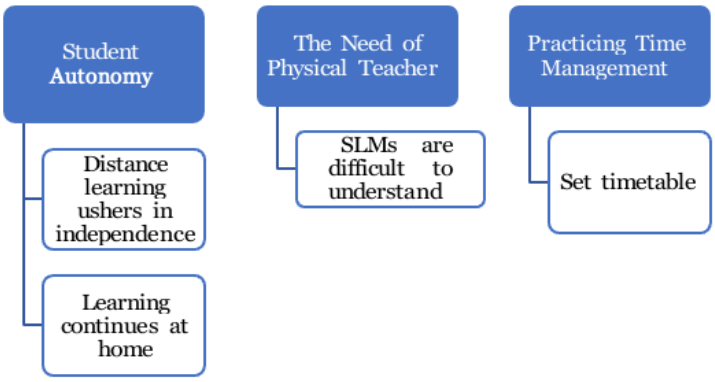

Figure 3. Key themes students' insights on alternative delivery modes

Student autonomy was widely acknowledged as both a challenge and a positive outcome. Learners realized that distance education required them to take responsibility for their own progress. They learned to read instructions carefully, search for additional references, and plan ahead. Although initially uncomfortable, this autonomy nurtured self-discipline and confidence.

At the same time, students emphasized *the irreplaceable value of teacher presence*. Many asserted that while modules guided them, they still needed teachers to explain complex mathematical concepts. The absence of real-time

interaction limited opportunities for questioning and clarification. This reinforces the argument that technology or printed materials cannot fully substitute for human facilitation in conceptual subjects such as mathematics.

Finally, *time management* emerged as a skill developed through necessity. Students described crafting daily routines, allocating specific hours for study, and balancing schoolwork with household tasks. Effective time management reduced stress and allowed them to meet submission deadlines, reflecting adaptive behavior under constrained conditions.

3.4 Assessment-related reflections

When asked about assessment practices, students appreciated performance-based and feedback-oriented evaluations. They preferred teachers who provided solution videos or annotated corrections rather than merely numerical scores. This formative approach helped them understand errors and guided their independent learning. Some students suggested incorporating short online consultations before module submission, reinforcing that assessment should serve not only as measurement but also as guidance.

4. Discussion

4.1 Challenges in learning modality transition

The absence of a physical teacher emerged as the most significant difficulty, aligning with Moore's (2011) concept of transactional distance, where reduced interaction increases cognitive gaps between learners and content. Globally, studies have documented similar experiences. In Italy, Garrote et al. (2020) reported that students in mathematics courses struggled with comprehension when teachers were not physically present, highlighting the critical role of direct explanations in conceptual subjects. Likewise, in India, it was noted that lack of teacher-student interaction contributed to misconceptions and decreased motivation among secondary students during remote learning (Do, 2024).

Unfollowed weekly home-learning plans due to household responsibilities and distractions also mirror patterns found internationally. Research in Turkey (Kalman et al., 2023) observed that students' home environments often lacked structured study spaces, leading to irregular study habits and reduced engagement. highlighted that domestic obligations disproportionately affected students' ability to adhere to online learning schedules, underscoring socioeconomic influences on educational equity (Tate & Warschauer, 2022).

Limited access to gadgets and unstable internet connectivity is another challenge identified in this study. Globally, the digital divide has been a recurring issue during the pandemic. In Sub-Saharan Africa, Nyongesa & Van Der Westhuizein, J. (2025) reported that many students relied on shared devices and experienced poor connectivity, resulting in delayed submissions and reduced participation. The impact of digital teaching tools on student engagement and learning outcomes in higher education in Africa. In the United States, although

internet access is more widespread, low-income households faced similar barriers, affecting engagement in synchronous sessions (Reich et al., 2020). These findings demonstrate that technological constraints are a universal concern, though their severity varies by context.

4.2 Coping mechanisms

Students' coping strategies, seeking assistance, creating home-learning setups, and borrowing resources, reflect adaptive behaviors observed globally. Peer and family support, as noted in this study, aligns with Vygotsky's social constructivist theory and has been reported in other countries. For instance, in the Philippines and Kenya, peer-to-peer WhatsApp groups facilitated problem-solving and emotional support (Jacobs et al., 2023; Ndunge, 2020). Similarly, students' efforts to establish home-based learning routines reflect self-regulated learning strategies documented in Spain (Geduld, 2024), where learners who organized study schedules and minimized distractions demonstrated higher academic resilience. Borrowing resources or traveling to access connectivity mirrors findings from rural India (Singh et al., 2020), emphasizing students' creativity and commitment to learning despite resource constraints.

4.3 Insights on alternative delivery mode

Students' reflections highlighted the dual outcomes of autonomy and dependence. While autonomy fostered self-discipline and independent learning, the persistent need for teacher facilitation indicates that human interaction remains essential for understanding complex concepts. Internationally, similar observations have been made. In Hong Kong, Yeung and Yau (2022) found that students appreciated increased responsibility for their own learning but still required timely teacher guidance to prevent misconceptions. Time management as a learned skill has been documented in multiple contexts, including Canada and Italy, where students developed structured routines to cope with blended and distance learning (Spadafora & Marini, 2018; Garrote et al., 2020).

4.4 Assessment reflections

Students' preference for formative, feedback-oriented assessments aligns with global trends emphasizing assessment as a learning tool. In the United Kingdom, online formative feedback improved students' understanding and engagement during remote instruction (Moorhouse & Kohnke, 2023). Similarly, in China, annotated corrections and short online consultations were found to enhance students' conceptual grasp and self-efficacy (Chen et al., 2021). These parallels suggest that integrating guided feedback into ADMs can bridge gaps created by the absence of direct teacher presence.

5. Conclusions

This study revealed that secondary students demonstrated remarkable adaptability and resilience amid technology-driven disruptions in mathematics learning. Despite encountering significant challenges such as limited access to digital tools, unstable internet connectivity, absence of direct teacher interaction, and difficulty maintaining structured home-study routines, learners developed coping strategies that fostered autonomy and self-regulation. They sought academic and emotional support from peers and family members, created personalized study environments, and borrowed learning resources to sustain participation. These adaptive responses highlight that meaningful learning can persist even in constrained contexts when supported by responsive assessment and feedback practices. Ultimately, the findings affirm the need for instructional frameworks that integrate technological accessibility with strong teacher guidance, enabling students to become resilient, self-directed, and future-ready learners in an increasingly digital educational landscape.

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