MATHEMATICS TEACHERS IN MODULAR DISTANCE LEARNING: CHALLENGES, ADAPTATIONS, AND POLICY DIRECTIONS

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ABSTRACT

The global shift toward remote teaching during the COVID-19 pandemic exacerbated long-standing structural inequities between education systems, particularly in the Global South. In the Philippines, the emergence of Modular Distance Learning (MDL) as the dominant modality in digitally marginalized regions posed acute pedagogical challenges to mathematics instruction. Given these realities, the study investigates how secondary mathematics teachers navigated, adapted to, and reimagined MDL amid serious systemic constraints. Employing a critical realist stance and invigorated by concepts from Pedagogical Content Knowledge (PCK) and Resilience Theory, the study utilized a qualitative phenomenology design to capture the experiences of ten teachers (in both urban and rural contexts) through interviews, focus groups and document analysis of their curricular artefacts. The findings showed that while MDL caused a disruption of instructional continuity, diminished any credibility regarding assessment, and undermined the emotional sustainability of mathematics instruction, it generated local innovations based on teachers' experiences of grief, instantiate an affective pedagogy focusing on the well-being of students and created possibilities for collaborators to collectively cultivate resilience. Teachers took opportunities to strategically simplify, contextualize course materials, care ethically and think outside-the-box. By doing so, teachers reframed MDL as a site for professional agency rather than being subjected to it passively without any sense of ownership. In theoretical terms, the study posits teacher voice as a form of epistemic resistance, and speaks to the urgent need for decolonial debates on educational governance. Practically, the study calls for policy architectures related to MDL that promote the decentralization of governance processes, the legitimization of emotional labour, and the immediate institution of differentiated professional development. The findings presented resonate with larger political conversations regarding educational equity, state accountability, and educational moral economies, particularly in crisis. By putting forward a set of reforms developed by teachers in response to their experiences, the study is intended to provide a grounded, context sensitive take on modular pedagogies that reject technocratic solutions and reinscribe care, community, and contextual justice to mathematics education.

Keywords: Modular Distance Learning, Mathematics Education, Teacher Agency, Critical Realism, Pedagogical Content Knowledge, Educational Policy Reform

1. INTRODUCTION

The sudden global transition to distance education due to the COVID-19 pandemic has necessitated an urgent re-evaluation of pedagogy within educational systems, especially in contexts where marginalization and a lack of infrastructure are already prevalent. Modular Distance Learning (MDL) became the de facto modality used by public schools in the Philippines, largely due to limited internet access and existing digital divide (Asian Development Bank [ADB], 2021). Although MDL was envisioned as an inclusive approach intended for continuity of instruction, it revealed significant issues, particularly with content that required depth of conceptual understanding and procedural literacy, such as mathematics (Bernardo & Mendoza, 2021). The nature of MDL shifted teachers' roles around content delivery, monitoring of learners, and provision of feedback, required teachers to be flexible about pedagogy, and also left teachers teaching with little institutional support to address these demands. This study aims to investigate the lived experiences of the mathematics teachers who are charged with enacting MDL. The overarching question guiding the investigation that defines the participants' work is as follows:

How do mathematics teachers describe, negotiate, and enact the pedagogical demands of MDL, and what policy and training enactment suggest future implementation? By framing the investigation on the real work of the teachers around preparing modules, distributing modules, monitoring students and providing feedback, we hope to investigate a situated perspective and contribute to equitable policy development and sustainable professional development of teachers.

1.1 Theoretical Framework

This study argues that teaching with the Modular Distance Learning (MDL) approach, particularly in emergency situations, requires more than a transfer of knowledge, it is a complex act that is agentic and contextualized by institutional structures, teacher beliefs, and tangible constraints. This study investigates mathematics teachers' experiences in a MDL format through a multi-theoretical framework of Critical Realism, Pedagogical Content Knowledge (PCK), and Resilience Theory. Critical Realism not only allows ontological depth in research by distinguishing between empirical experience, actual events, and real world or generative mechanisms, it provides avenues to analyze the why and who of what teachers do. PCK on the other hand revealed the specialized, context dependent knowledge mathematics teachers were using to access and teach abstract content, particularly because they were not able to physically speak with the students. Additionally, Resilience Theory added a psychosocial context which reframed teacher adjustment, as relational and situated. Together, these frame the ways in which pedagogical agency can emerge under systemic constraints, but also offer a coherent guide for data collection and analysis, through retroductive logic. Using the frames simultaneously also ameliorated the limitations of each perspective, making space for a more complete and critically engaged exploration of teacher practices in resource and curricular limited, postcolonial educational contexts.

1.2 Conceptual Framework

This conceptual framework explores the ways that mathematics teachers' experiences in Modular Distance Learning (MDL) are mediated through three theoretical lenses: Critical Realism, Pedagogical Content Knowledge (PCK), and Resilience Theory. First, Critical Realism provides the ontological framework to understand what happens in MDL teaching situations, and why it happens, by paying attention to structure and agency, the layered reality of empirical, actual and real, and the causal mechanisms contributing to visible practice. Second, PCK provides a content-specific lens of analysis, while emphasizing how teachers render complicated mathematical ideas into accessible learning experiences. PCK emphasizes how teachers are required to consider anticipatory planning, counteracting misconceptions, and supplementing the absence of face-to-face scaffolding present in MDL. Finally, Resilience Theory considers the effectual and adaptive aspects of teacher experience, recognizing that resilience is relational and situated, shaped by institutional, cultural and personal factors. Altogether, these lenses demonstrate a holistic approach to understanding mathematics teachers' experiences in MDL contexts, accounting for the systemic constraints experienced through rigid module structures and technology-based limitations, the agency exercised through improvisation and innovation, and their emotional and professional experiences in times of crisis or improvisational teaching scenarios.

1.3 Objectives of the Study

This study aims to explore the lived experiences of mathematics teachers in implementing Modular Distance Learning (MDL) and how these experiences can inform policy development and teacher training. Specifically, it seeks to answer the following questions:

1. How do mathematics teachers describe their experiences in implementing Modular Distance Learning (MDL) in relation to the following tasks?
1.1 Module Preparation: How do teachers develop and adapt instructional materials for MDL?
1.2Module Distribution: What processes and challenges do teachers encounter in ensuring the timely and effective delivery of modules?
1.3Monitoring of Students' Performance: How do teachers track student progress and engagement in a remote learning setup? and
1.4 Providing Feedback: What strategies do teachers use to assess student understanding and provide meaningful feedback?

2. What challenges and opportunities do teachers encounter in the implementation of MDL, and how do these impact their teaching effectiveness?
3. How do teachers adapt and cope with the challenges of MDL to ensure meaningful learning experiences for students?
4. What policy recommendations and capacity-building initiatives can be proposed to enhance the implementation of MDL based on teachers' experiences?

2. METHODOLOGY

2.1 Research Design

This study utilizes a qualitative phenomenological design, underpinned by a critical realist ontology and a constructivist-interpretivist epistemology, to investigate the lives of mathematics teachers engaging in Modular Distance Learning (MDL). Van Manen describes phenomenology as an approach to investigate the essence of experience, so it is useful for exploring how teachers dealt with their tasks around preparing their modules, distributing the modules, and monitoring the students, in the wider sociopolitical context of MDL. The critical realist lens provides ontological depth by differentiating observable teacher practices and the structural mechanisms underpinning them, while the constructivist-interpretivist lens evidences meaning as socially and contextually constructed, advocating for teachers' narratives as legitimate knowledge sources. Together, these methodological and epistemological frameworks correspond closely with the theoretical framework of the study- fusing Critical Realism with PCK and Resilience Theory- to enable a multi-layered analysis of how teachers were able to adapt, respond and reshape who they are in relation to their practices and the systemic constraints placed on their practices.

2.2 Research Participants

In the study, participants were purposefully sampled, a method that is appropriate for phenomenological research as it focuses on verifying information-rich cases (Patton, 2015). This study involved ten secondary mathematics teachers from public schools in Surigao del Sur, a combination of urban and rural schools, thereby maximizing variation in the perspectives being studied. The sampling criteria designated that the participants would be actively teaching in a public secondary education school in the study area, and that they had a minimum of one year of experience in the implementation of Modular Distance Learning (MDL). Participants also had to be directly involved in key functions of MDL like: planning the modules, distributing them to students, monitoring lesson completion, and providing feedback to students as they complete lessons. Participants were also required to be willing to conduct interviews, provide documents to be reviewed, and participate in reflective dialogues throughout the study. The selection of participants in this way maximized the relevance of data, while capturing the experiences of teachers shaped by geographical, infrastructural, and institutional contexts.

2.4 Data Gathering Procedure

This qualitative study involved a planned and ethical data collection process primarily focused on understanding mathematic teachers' lived experiences in Modular Distance Learning (MDL). After securing ethical clearance, the researcher selected ten secondary mathematics teachers from public schools in Surigao del Sur via purposive sampling, achieving diversity across both urban and rural settings. Data was collected after obtaining informed consent both in writing and verbally. Data was collected through methodological triangulation of data collection strategies across semi-structured interviews, focus group discussions (FGDs), and document analysis, enabling the researcher to explore the teachers' individual experiences, share collective experiences, and gather information taking into consideration the school and district contexts. All data collection instruments were framed by the study's theoretical framework and developed through piloting. Interviews and FGDs were audio-recorded, transcribed verbatim, and made anonymous, while also taking reflexive field notes and memos in order to document developing themes. Member checking and debriefing discussions were used to validate data, as well as ensuring participants' emotional safety. Overall, the combination of data collection methods would provide a rich and trustworthy account of the pedagogical, emotional, and institutional aspects of what it was like for mathematics teachers during the implementation of MDL.

2.5 Data Analysis Approach

The study employed Braun and Clarke’s six-phase reflexive thematic analysis method to interpret the data and utilized a combination of theory-based coding and inductive coding to capture the multiple dimensions of participant experience. Thematic development and refinement were carried out throughout the process, with peer debriefing, memoing, and final alignment of analytic interpretations with the theoretical framework of the study. ChatGPT software assisted in the organization and consistency of many facets of the data coding. The trustworthiness of the study included member checking, triangulation from multiple sources of data, and maintaining

audit trails and reflexive journals. Altogether these processes add credibility, transferability, dependability, and confirmability according to the standards of Guba and Lincoln qualitative rigor.

2.6 Reflexivity and Positionality

The principal researcher is a mathematics educator and qualitative researcher with lived experience in the Philippine basic education system. While being an insider offered empathetic engagement and an understanding of cultural nuances, insider status also brought challenges, particularly concerns around blind spots and confirmation bias. To address this, reflexivity was consciously promoted through field journaling, analytic memoing, and peer debriefing. This involved attending to reflexive questions (e.g., "What assumptions am I bringing into the analysis?" and "Whose voice is privileged?") after each phase of the research and documenting this process. Importantly, the researcher's dual identity as an academic and a former practitioner was not subordinated but rather was acknowledged as a legitimate lens through which meaning was co-constructed with participants. This reflexive stance is in accordance with the epistemological relativism of Critical Realism and deepens the ethical and analytical rigor of the research (Scott, 2019).

2.7 Ethical Considerations

This study was conducted fully adhering to ethical guidelines at both the international and local levels with ethical approval being received prior to the commencement of the fieldwork. Ethical processes included obtaining informed consent, informing participants of the potential risks associated with their participation, their rights as participants, and reinforcing the voluntary nature of their participation. Confidentiality was strictly maintained in relation to the anonymization of data, and all data was stored on encrypted drives accessible only to the research team. Participant agency was respected with their right to withdraw ramifications-free at any time throughout the study. The emotional safety of participants, in particular during focus group discussions, was carefully ensured through skilled facilitation and post session debriefing. No psychological harm was reported and participants stated they 'valued engaging in the deep reflection of their experiences'.

2.8 Methodological Limitations and Rigor

As is the case with all qualitative research, this research is nevertheless bound to a particular context. Hence, research findings are not statistically generalizable - the findings can be analytically transferred with thick description and theme resonance. The three semi-structured interviews with three participants could be deemed a small sample size, but were appropriate methodologically for phenomenological depth (Creswell & Poth, 2018). Reliance on self-reported data in qualitative research may lead to recall bias and social desirability; however, this potential subjectivity in theme development was countered by document triangulation and prolonged engagement. The meshing of the oxymoronic Critical Realism with PCK and Resilience Theory, while conceptually and theoretically exciting, presented ontological challenges for the researcher. The ontological incompatibility between Critical Realism and the other two theories in terms of explanation created additional interpretive phases, and this was mitigated through methodological pluralism and transparency involving the theoretical framings and describing the pauses and endings. Against the limitations, this research comes with theoretical richness, pedagogical knowledge, and findings that matter to policy. This research should be situated in both the mathematics crisis' education literature as well as the methodological conversations regarding a critical-constructivist approach to teacher research.

3. RESULTS AND DISCUSSION

This section provides a brief recap of the findings of this study about Mathematics Teachers in Modular Distance Learning: Challenges, Adaptations, and Policy Directions. The analysis derived from interviews, focus group discussions, and document analysis illustrates the contrasting experiences of secondary mathematics teachers who engaged educationally under MDL and dealt with pedagogical and practical challenges. Teachers were deeply understanding in their articulation of how they made adaptations in their practice, while simultaneously navigating institutional constraints, demonstrating resilience and professionalism. Drawing on Critical Realism, Pedagogical Content Knowledge (PCK), and Resilience Theory, the discussion also reflects on various aspects of teachers' instructional adjustments and suggests that in times of crisis, teachers need supportive and context-sensitive education policies.

3.1 Mathematics Teachers' Experiences with Modular Distance Learning (MDL)

Table-1. Thematic Analysis of Mathematics Teachers' Experiences with Modular Distance Learning (MDL)

Generated Themes	Codes / Key Concepts
Policy Localization and Structural Responsiveness in MDL Governance	Local delivery models; flexible schedules; module retrieval protocols; consultative planning; school-level adaptation
Equity and Inclusion through Flexible and Differentiated Access Models	Equitable access; internet connectivity; print/digital parity; rural teacher contexts; funding disparities
Teacher-Centered Capacity Building and Systemic Resource Mobilization	Curriculum design training; feedback strategies; contextualized instruction; instructional resilience; mental health support
Reimagining MDL for Post-Pandemic Resilience and Pedagogical Continuity	MDL as blended supplement; post-crisis use; individualized pacing; independent learning; long-term teaching continuity

The results showed four themes that emphasize the critically and transformational view of Modular Distance Learning (MDL) through the lived experiences of mathematics teachers. The first, the theme of localized policy, was about teachers' support of decentralized governance, and meant teachers argued that policy needs to avoid top-down governance that does not consider many of the urgent local needs of different learners, in challenging and diverse contexts. Teachers expressed their desire for autonomy, to be able to adjust MDL practices to local contexts and needs - this meant renaming policy into an act of collaborative and localized policy. Second, the theme of equity and inclusion, which highlighted how MDL as a stressed elongated version of a pedagogical survival model has engendered the shift toward systemic inequalities, especially conditions of work for teachers in under-resourced school systems. Teachers were overwhelmed by their work, whilst having limited materials to ensure students could survive in a level of engagement; they pedagogical agency was increasingly contextualized as operating in a context with a chunk of the value being about surviving rather than supported. Teachers' refusal to simply accept these conditions, and elect to engage when possible, represents a sector within the spaces of this study, pedagogical activism, which creates possibilities to resist culpability for their teaching and labour being depersonalized. Third, the theme of teacher-centered capacity building focused on the demand for a holistic approach for professional learning and development that incorporated training on curriculum development, technology, assessment, and mental health of their learners. Teachers particularly were firm in their denial of a deficit perspective of their capacities, and responded with autonomy to design localized learning that was contextualized. Finally, the theme of imagining MDL for resilience viewed MDL as a viable, longer-term approach. Teachers held a view MDL could continue to engage under challenging conditions for learners experiencing barriers to schooling environments; it could support learners develop their resilience to learning because it represented an inclusive and flexible approach engaging their schooling. Collectively, the themes offered critique toward MDL as a technical, or instructional tool, instead of MDL as a socio-political space with implications on power, care, and pedagogy. The analysis proposed a restoration of practice, and long-lasting teacher support for schools to develop localized thinking, sustainability, and administrative conditions to develop subjectivity, while committing as an educational institution to meaningfully consider lived experience as a legitimate resource for educational knowledge as part of a broader project of decolonizing educational governance.

3.2 Mathematics Teachers' Challenges and Opportunities in Modular Distance Learning (MDL)

Table-2. Thematic Analysis of Mathematics Teachers' Challenges and Opportunities in Modular Distance Learning (MDL)

Generated Themes	Codes / Key Concepts
1. Pedagogical Fragmentation and the Crisis of Instructional Continuity	Asynchronous delivery, delayed feedback, instructional overload, limited real-time correction, missed learning targets

Generated Themes	Codes / Key Concepts
2. Infrastructural Injustice and the Geography of Disengagement	Signal scarcity, lack of gadgets, unequal home support, rural isolation, environmental barriers
3. Epistemic Uncertainty and the Erosion of Assessment Integrity	AI-facilitated cheating, parental overreach, absence of formative observation, decontextualized outputs
4. Emotional Labor and the Reconfiguration of Teacher Identity	Teacher exhaustion, emotional investment, compassion fatigue, teacher-parent collaboration, student validation
5. Transformative Pedagogy through Reflexivity and Relationality	Self-paced autonomy, contextualized design, empathy-driven teaching, strengthened home-school ties, teacher innovation

The results yielded five interrelated themes that illustrate the nuanced realities of mathematics teachers in Modular Distance Learning (MDL). The first theme, pedagogical fragmentation, noted that teachers experienced a breakdown in their continuity of instruction. The sequential nature of mathematics made such fragmentation particularly problematic, as cognitive gaps emerged leading to lingering misconceptions, removal of student confidence, and lack of retention from the previous school year. The second theme, infrastructural injustice differed substantially between geographic regions and socio-economic realities, but for both rural and urban teachers, they reported mounting disengagement from learners as well as new logistical and emotional burden for teachers. The third theme indicated a level of epistemic uncertainty. Many building leaders acknowledged an infringement of assessment protocols and the inequitable nature of MDL, where cheating and disconnection ~were submerged in a lack of monitoring meant to value authentic relationships. Fourth, emotional labour became a distinct function of educators where teachers were not only responsible for educating but also tending to the psychosocial needs of students, ultimately forming new professional identities rooted in care and resilience. Finally, five of the teachers demonstrated transformative pedagogy through reflexive, relational and community-embedded practice, engaging in innovation beyond government edicts to embody delightful, situated methods of learning. We illustrate how the findings paint a more complex picture than one solely dominated by discretion to follow educational mandates, MDL and the pandemic created disagreement and, more importantly, a potentially generative middle ground where practice, equity and policy converged. Theoretical contributions of the study include challenging the view of instructional effectiveness as solely viewed in isolation, elucidating some of the emotional and epistemological labour of teachers, and developing notions of educational resilience from the lived experience and context of teachers within the Global South context.

3.3 Teachers' Adaptation to Modular Distance Learning in Mathematics

Table-3. Thematic Matrix of Teachers' Adaptation to Modular Distance Learning in Mathematics

Generated Themes	Codes / Key Concepts
Contextual Differentiation as a Response to Pedagogical Disruption	modular adjustments; pacing flexibility; guided examples; culturally relevant problems; learner variability
Affective Relationality and the Ethics of Encouragement	empathy; motivational messaging; student-centered coping; emotional attunement; mental wellness
Collaborative Resilience and the Reconstitution of Professional Community	peer support; administrative validation; emotional reciprocity; professional solidarity
Strategic Simplification and Modular Redesign	simplified instructions; visual scaffolding; flexible deadlines;

Generated Themes	Codes / Key Concepts
as Equity Measures	alternate activities; equitable task access
Technological Improvisation and Localized Instructional Innovation	video explanations; use of common objects; multimedia enhancement; digital platforms; LGU coordination

The results generated five interconnected themes which collectively reconceptualized Modular Distance Learning (MDL) as a complex socio-pedagogical context defined by teacher agency, care, and innovation. The first, contextual differentiation, showed how mathematics teachers altered their instruction by reducing the degree of complexity in content and including culturally relevant content to serve diverse learners by demonstrating pedagogical flexibility in the midst of disruption. Second, affective relationality, described the teachers' emotional labor and ethics of care, including non-cognitive check-ins and empathic communication strategies that supported student wellbeing. Third, collaborative resilience, illustrated how teachers formed peer networks of support (entailing back and forth communication), which created collective resilience through horizontal mentoring relationships, despite limited formal organizational cohesion. Fourth, strategic simplification and modular redesign, demonstrates how teachers took inclusive design practices and reduced complexities by substituting similar local materials to increase access and engagement for their learners, especially for those with poorer resourcing. Fifth, technological improvisation shows how teachers expressed a grassroots concept of EdTech which operationally illustrates a low-tech, informal network of collaborations with their community-based partnerships to effectively sustain their instruction without formal infrastructures. Taken together, the five themes do more than describe the adaptations made to MDL experiences, they are also meant to interrogate the implications of centralized and technocratic approaches to education and describe how teachers exhibit creative, relational, and context-responsive practices. This study invokes call for policies that recognize and formalize these experiences as legitimate forms of professional, ethical expertise and educational innovation.

3.4 Proposed Policy Recommendations and Capacity-building Initiatives to Enhance the Implementation of MDL

Table-4. Thematic Analysis of the Proposed Policy Recommendations and Capacity-building Initiatives to Enhance the Implementation of MDL

Generated Themes	Codes / Key Concepts
Reframing Policy through Equity: Bridging Structural Gaps in Access and Delivery	Digital divide; rural marginalization; funding for materials; localized delivery; community-supported module retrieval
Teacher-Centered Capacity Building: Embedding Pedagogical Autonomy and Professional Development	Training on module writing; differentiated instruction; digital literacy; curriculum contextualization; peer mentoring
Feedback Infrastructure and Assessment Reform: Enabling Responsive Teaching in MDL	Timely feedback; workload management; simplified formative assessments; feedback-loop systems; instructional clarity

Generated Themes	Codes / Key Concepts
Institutional Care and Psychosocial Support: Recognizing Emotional Labor in Distance Education	Mental health; emotional exhaustion; teacher recognition; supportive leadership; consultation mechanisms
Post-Pandemic Integration and Adaptive Governance: MDL as Contingency and Continuity Framework	Remediation use; blended learning expansion; emergency preparedness; independent learning; policy flexibility

The results presented five interconnected themes which present a serious call for a rethinking of Modular Distance Learning (MDL) beyond its short-term fix to a crisis. First, there is a need to tackle structural inequity by making changes to policies at a local level that are equitable, centered, and address access and delivery, especially for inequitable and rural contexts. Second, there must be equitable and context-relevant professional learning that is centered on pedagogical autonomy, thus recognizing teachers as active agents who co-construct the curriculum. Third, based on these previous findings, there is urgency in reforming feedback and assessment underpinnings in order to promote responsive, formative practices that are vital for distance learning to be effective. Fourth, the emotional labor that many teachers assumed was often invisible and at the very least institutional care and psychosocial support reflect an important area for educational governance to support. Finally, teachers wanted MDL to be seen as part of the mainstream education system as one flexible, inclusive modality rather than a ‘good enough ’ format in response to a crisis. These themes converge on the necessity of policy directions that are equity-based, teacher-driven, and human-centred and positioned the lived experiences of educators as critical knowledge to re-imagine adaptive & just educational futures.

4. CONCLUSIONS

This study closely examined how mathematics teachers’ lives were complicated by Modular Distance Learning (MDL) during the interruption in schooling caused by the COVID-19 pandemic. The findings offer dimensions of understanding based on rich, place-based narratives. The discussion demonstrates how teachers were strategizing around the ways they had accepted, adapted, and parented MDL in three areas: instructional (teaching), logistical (schooling), and emotional (characterizing teacher roles). The findings highlighted teachers’ perceptions of MDL as a pedagogical disruption and a site of innovation. Major themes included instructional discontinuity attributable to asynchronous learning, impinging on salient and timely feedback and the sequential nature of mathematics learning; other structural inequities (e.g., digital poverty, and the rural ‘education isolation’) amplified student disengagement and teachers’ reduced agency; issues related to integrity of assessments (with students not engaging in academic honesty, as well as a lack of any meaningful formative assessment process) jeopardized the nature legitimacy of any learning taking place. Additionally, the prominence of emotional labor (which is conceptualized and discussed as largely invisible and without value) was paramount in developing resilience and caring for their students; However, while teaching faces such complexities, teachers exhibited limitations regarding their critical agency at times but nevertheless contextualized their differentiated teaching practices, creatively adopted technology, and used affective pedagogies. As such, the findings further position MDL not simply as a way to deliver content, but as a complex socio-pedagogical ecosystem in which teaching, learning, and caring coexist amongst multiple sites and temporalities, as educational constructs.

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