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MATHEMATICS ANXIETY AND TECHNOLOGY IN INDONESIAN LOWER SECONDARY MATHEMATICS CURRICULUM DOCUMENTS

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Abstrak

Kecemasan matematika memunculkan persoalan kurikulum tentang keterkaitan tuntutan matematis, aktivitas digital, dan dukungan emosional. Penelitian ini menelaah tiga dokumen kurikulum Indonesia terbitan 2025 untuk pembelajaran matematika SMP. Analisis dokumen kualitatif dengan analisis konten terarah membedakan ketentuan matematis dan teknologi yang eksplisit, dukungan afektif umum, serta rekomendasi hasil interpretasi. Dokumen meliputi capaian pembelajaran nasional, panduan mata pelajaran matematika, serta panduan pembelajaran dan asesmen, dengan batas Fase D dan arahan umum yang relevan. Temuan menunjukkan dukungan terhadap disposisi matematis positif, lingkungan belajar aman, regulasi emosi, umpan balik konstruktif, dan penggunaan teknologi yang fleksibel. Perangkat lunak geometri, spreadsheet, kalkulator, serta asesmen digital menyediakan pilihan pembelajaran, tetapi implikasinya terhadap kecemasan bergantung pada desain tugas dan kondisi kelas. Bagian yang dianalisis belum menetapkan prosedur khusus pengukuran kecemasan matematika atau membuktikan penurunannya. Dua penelitian lokal mendukung interpretasi pemecahan masalah dan inklusi gender tanpa menjadi bukti efektivitas kurikulum. Matriks keselarasan menghubungkan kompetensi, fungsi teknologi, dukungan afektif, dan bukti asesmen. Penelitian menghasilkan kerangka pengembangan pembelajaran yang peka terhadap kecemasan matematika dengan membedakan intensi tertulis dari hasil belajar yang teramati.

***Kata kunci**: kecemasan matematika,; kurikulum, teknologi, matematika SMP, dukungan afektif*

Abstract

Mathematics anxiety raises a curriculum question about how mathematical demands, digital activities, and emotional support are connected. This study examines three Indonesian curriculum documents published in 2025 for lower secondary mathematics. Qualitative document analysis with directed content analysis distinguishes explicit mathematical and technological provisions, broader affective support, and recommendations developed through interpretation. The corpus comprises national learning outcomes, the mathematics subject guide, and the learning and assessment guide, restricted to Phase D and relevant general guidance. The findings identify curricular support for positive mathematical dispositions, safe learning environments, emotional regulation, constructive feedback, and flexible technology use. Geometry software, spreadsheets, calculators, and digital assessment provide documented instructional options, but their anxiety-related implications depend on task design and classroom conditions. The analysed passages do not establish a specified mathematics-anxiety assessment procedure or demonstrate anxiety reduction. Two local studies inform interpretation of problem-solving and gender inclusion without becoming evidence of curricular effectiveness. An integrated alignment matrix connects competencies, technological functions, affective safeguards, and assessment evidence. The study contributes a framework for developing mathematics-anxiety-sensitive learning designs while preserving the distinction between written intentions and observed student outcomes.

***Keywords:** mathematics anxiety, curriculum, technology, lower secondary mathematics, affective support*

1. INTRODUCTION

Mathematics anxiety is relevant to curriculum design because mathematical participation involves both cognitive demands and students' experiences of those demands. A curriculum can expect students to explain a solution, interpret a graph, and solve unfamiliar problems, yet these expectations are enacted through activities that differ in pacing, public exposure, feedback, and opportunities to recover from errors. Digital technology adds further decisions about representation, interaction, and assessment. This study

examines how Indonesian lower secondary mathematics curriculum documents connect these decisions with affective support. Its focus is the written basis for learning designs that are sensitive to mathematics anxiety.

Mathematics anxiety refers here to mathematics-related worry and fear, rather than every instance of difficulty, low achievement, or dislike. Barroso et al. (2021) synthesized evidence of a negative association between mathematics anxiety and achievement across diverse studies. That association supports attending to emotional experiences when interpreting mathematical performance, while leaving causal direction and individual differences open. A student who hesitates during a digital activity may be struggling with the mathematics, the interface, anxiety, or several factors together. Curriculum guidance can help teachers plan for these possibilities, but documents alone cannot identify which explanation applies to a particular learner.

Two studies situated in Indonesian lower secondary education provide a local basis for this focus. Marpaung and Simarmata (2026) examined 35 Grade VII and VIII students at SMP Sangkara in Medan and reported a correlation of $r = 0.774$ between the reported anxiety-scale score and problem-solving score. Because lower anxiety-scale scores represented higher anxiety, the substantive interpretation was that greater anxiety was associated with lower problem-solving performance. The study offers contextual evidence for considering affect alongside problem solving, with the limitations of a small, single-school correlational design.

Marpaung et al. (2025) investigated gender differences in mathematics anxiety among 35 Grade VII and VIII students at the same school and found no statistically significant difference, with $p = 0.289$. This result does not establish equivalence between genders or demonstrate that gender is irrelevant in other settings. It supports avoiding a gender-only assumption when deciding who may need support in this local context. The two publications describe the same school, grade levels, and sample size; without participant-level confirmation, they should not be treated as independent population replications. Neither publication evaluates a technological intervention or the curriculum documents examined here.

The local findings motivate an educational psychology perspective on technology integration. Digital resources can help students inspect a representation, check a calculation, and revise a response, but an activity may also create additional demands through unfamiliar controls, rapid response requirements, or public comparison. These are design considerations to examine, not effects established by the present document analysis. Drijvers and Sinclair (2024) emphasize that digital tools serve different educational purposes, including learning design and equitable access. Asking which purpose a tool serves is necessary before asking whether it is appropriate for a learner who experiences mathematics anxiety.

Evidence concerning interventions also calls for specificity. Sammallahti et al. (2023) identify cognitive support and emotion regulation as relevant intervention approaches, while Balt et al. (2022) examine varied school-child interventions and their characteristics. These syntheses justify examining both instructional and emotional support; they do not validate any particular feature of an Indonesian curriculum. Ersozlu (2024) reports mixed findings on technology and anxiety in primary education. Its younger population limits direct transfer to SMP, but its conditional findings caution against equating technology use with anxiety reduction. The present study therefore examines opportunities and design decisions rather than estimating treatment effects.

Technology research also clarifies the limits of the argument. Clark-Wilson et al. (2020) links educational value to tool and task design, teacher activity, and context. Hillmayr et al. (2020) synthesize learning outcomes in secondary mathematics and science, while Rahma and Nurlaelah (2024) examine Indonesian secondary mathematics achievement. These studies support examining how resources are used and which mathematical outcomes are targeted. Achievement evidence alone cannot establish an anxiety outcome, so the present analysis treats cognitive performance and emotional experience as related but distinct dimensions.

Three 2025 Indonesian documents provide complementary evidence. The national learning outcomes define competencies and mathematical dispositions, the mathematics guide elaborates subject activities, and the learning and assessment guide sets out broader pedagogical principles. Affective language can occur in general guidance even when a subject outcome does not explicitly name mathematics anxiety. Conversely, a named digital application can appear in a lesson example without an accompanying account of emotional support. Comparing these levels makes it possible to identify connections and areas that require teacher interpretation without imposing the same level of detail on documents with different purposes.

Phase D generally covers Grades VII–IX in SMP, MTs, and equivalent programmes. Its expectations include numerical reasoning, algebra, geometric relationships, measurement, and data and probability. These competencies create opportunities for digital tools, but a mathematical opportunity is not

automatically an explicit direction to use technology. Similarly, positive dispositions, enjoyable learning, and reflection are not interchangeable with a mathematics-anxiety intervention. A useful documentary analysis must preserve both distinctions. Otherwise, it risks describing the curriculum as either entirely silent about emotional experience or already equipped with a validated programme for reducing anxiety.

The study addresses three questions. First, what mathematical, technological, and affective provisions are identifiable in the selected documents for Phase D? Second, how can documented technological activities be interpreted in relation to mathematics-anxiety-sensitive design, and which elements require additional teacher decisions? Third, where are competencies, technology use, affective support, and assessment aligned, and where is further specification needed? The contribution is an integrated analytical matrix grounded in source-located passages and interpreted through mathematics education and educational psychology. The study assesses written curricular intentions and proposes design implications for subsequent classroom investigation.

2. RESEARCH METHOD

Research design and version boundary

This study uses qualitative document analysis with a directed content analysis orientation. Assarroudi et al. (2018) supports systematic examination of documents, and Morgan (2022) explain the use of theory and prior research in forming initial categories. The analysis combines a curriculum-and-technology lens with an affective lens informed by mathematics anxiety research. These lenses guide interpretation rather than generate a validated numerical measure. The design identifies what the documents state, how provisions relate to one another, and what implications can reasonably be proposed for lower secondary learning activities.

The corpus is bounded to three official publications issued in 2025. The document analysis was conducted during the first semester of the 2025/2026 academic year. The curriculum documents were collected during the first semester of the 2025/2026 academic year and analyzed in November 2026. This is a version-bounded analysis, not a statement that these publications exhaust all subsequent policies or resources. The documents were retrieved from official ministry sources. Their institutional provenance establishes their suitability for examining intended guidance, but does not establish implementation, teacher acceptance, or student outcomes. No students were recruited, no new psychological scores were collected, and no treatment was administered.

Corpus and contextual literature

Document D1 is Keputusan Kepala BSKAP Nomor 046/H/KR/2025 tentang Capaian Pembelajaran (2025). General mathematics rationale, objectives and characteristics, together with Phase D outcomes, are included. D2 is Panduan Mata Pelajaran Matematika by Setiyani et al. (2025), including relevant general guidance, Phase D essential material and objectives, and the Grade VII financial-literacy plan. D3 is Panduan Pembelajaran dan Asesmen by Anggraena et al. (2025), including general principles on comfort, emotional regulation, learning environments, assessment, and the lower secondary mathematics example. D3 is treated as cross-subject guidance relevant to mathematics rather than as a mathematics-only document.

Table 1. Corpus boundaries and analytical roles

Code and source	Included material and PDF locations	Analytical role
D1 BSKAP (2025)	General mathematics rationale, objectives and characteristics, pp. 106–111; Phase D outcomes, pp. 116–118.	Competency expectations; no claims about other subjects or phases.
D2 Setiyani et al. (2025)	General mathematics and planning guidance, pp. 12–17, 250–273; Phase D material, pp. 137–188; Phase D sequence, pp. 266–268; Grade VII plan, pp. 286–294.	Subject-specific elaboration. Only relevant general text and Phase D passages are analysed.
D3 Anggraena et al. (2025)	Relevant general affective and assessment guidance, pp. 14–22 and 36; lower secondary mathematics example, pp. 115–122.	General support for emotion, comfort, feedback and technology, plus a mathematics example.

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Vol. 9. No. 3 November 2026

The studies by Marpaung et al. (2025) and Marpaung and Simarmata (2026) are contextual research, not additional curriculum documents. They inform discussion of gender inclusion and the anxiety–problem-solving association, respectively. They are not used as confirmation that a coded curricular provision reduces anxiety. International reviews likewise inform the interpretive framework rather than become observations of the Indonesian curriculum. Separating document evidence from contextual literature prevents a literature finding from being mistakenly reported as an outcome of the present analysis.

Only Phase D passages and general guidance applicable to that phase are included in subject-level claims. Primary and upper secondary examples in D2 are excluded even when they name attractive digital tools. Source locations use one-based PDF page positions, including preliminary pages. For orientation, D2 PDF page 179 corresponds to printed page 173, while D3 PDF page 115 corresponds to printed page 107. A page containing material from two phases is included only for its relevant passage. The text of externally linked worksheets, quiz settings, videos, and assessment forms is outside the corpus.

Units and two complementary coding lenses

The unit of analysis is a meaningful passage comprising a sentence, related paragraph, table entry, or short instructional sequence. Retrieval used technological terms, such as teknologi, digital, kalkulator, spreadsheet, perangkat lunak and asesmen, alongside affective terms, such as kecemasan, emosi, aman, nyaman, percaya diri, merefleksi and umpan balik. Keyword searches locate candidate passages; their meaning is checked against the surrounding activity and document section. A digital topic, such as file storage, is not automatically coded as digital tool use, and a generally positive classroom statement is not automatically coded as explicit mathematics-anxiety provision.

The first lens records the mathematical competency, the digital function, and the assessed student action. Functions include contextual presentation, computation, representation or exploration, data organization, and assessment. The second lens records affective provisions: emotional safety, recognition or regulation of emotion, manageable challenge, feedback and recovery, participation and inclusion, and access. These are categories developed for this analysis, not diagnostic criteria. A passage may receive several codes, but overlaps are not transformed into a readiness percentage. Table 2 specifies the distinctions that constrain interpretation.

Table 2. Coding lenses and limits of inference

Dimension	Document evidence	Interpretive limit
Mathematical demand	Competency, reasoning, representation, or problem-solving activity.	Difficulty or low performance alone is not evidence of anxiety.
Technological function	Named digital tool or explicit digital action in a relevant activity.	A technological context does not establish tool use.
Emotional safety	Explicit comfort, safety, belonging, or supportive interaction.	General support is not an evaluated anxiety intervention.
Reflection and regulation	Attention to emotions, self-regulation, reflection, or student choice.	Self-reflection is not a validated anxiety measure.
Assessment and recovery	Initial or formative assessment, constructive feedback, suitable challenge.	Do not infer privacy, unlimited retries, or untimed settings unless stated.
Inclusion and access	Alternative media, accessibility, or participation arrangements.	Documented options do not prove availability or gender equivalence.
Anxiety-specific provision	A named anxiety construct, measure, or specified anxiety response.	Only explicit evidence supports this code; absence is bounded to the analysed passages.

Three evidence statuses are retained. Direct provision is an explicit statement about a mathematical, technological, or affective feature. Indirect relevance is an explicit general support whose relationship to mathematics anxiety is inferred through literature, such as emotional regulation without a named anxiety measure. Proposed extension is a design recommendation added by this article. Thus, a safe learning environment is a direct affective provision but only indirectly relevant to a specific anxiety intervention.

Untimed private response, if not specified in a lesson, remains a proposed extension even when the selected platform could support it.

Comparison procedure and interpretive safeguards

Analysis proceeds through source identification, contextual retrieval, coding, within-document interpretation, and cross-document comparison. Competency statements are first examined for mathematical and dispositional expectations. General guidance is then checked for affective and technological support. Finally, Phase D examples are examined for the connections among objectives, tools, student actions, feedback, and participation conditions. The principal evidence register provides source locations, while the proposed alignment matrix records design implications. Contrary cases, including a physical probability experiment and offline alternatives, are retained to avoid assuming that digital provision is always required.

Repeated financial-literacy material in D2 and D3 is treated as reused guidance. It supports continuity across publications but is not counted as independent classroom evidence. Missing detail is described within the selected passages rather than generalized to every curriculum resource. Where a lesson names a quiz platform but does not specify timing, public ranking, anonymity, or attempts, those settings are recorded as unspecified. The analysis does not infer platform configuration from a product name or assume that a classroom feature has an established emotional effect.

The interpretation has not undergone independent second-coder assessment, participant validation, or classroom testing. No inter-rater coefficient or claim of statistical representativeness is made. Artificial intelligence assisted extraction, organization, and drafting; the author should verify the source passages, interpretations, and citations before submission. The codebook and evidence locations make this draft reviewable, but they do not substitute for independent validation. The study's conclusions concern the support visible in the selected documents and the design decisions that need further specification before an anxiety-related intervention can be evaluated.

3. RESULTS AND DISCUSSION

Mathematical dispositions and affective support in the written curriculum

The documents contain affective provisions that become visible when the analysis extends beyond application names. D1 includes curiosity, persistence, resilience, and confidence among mathematical dispositions (Badan Standar, Kurikulum, dan Asesmen Pendidikan (BSKAP), 2025, p. 108). These objectives position students' orientations toward mathematics alongside reasoning and problem solving. Their relevance to mathematics anxiety is indirect: a dispositional objective describes an intended educational direction, whereas an anxiety construct requires its own definition and measurement. Confidence should therefore not be treated as the inverse of an observed anxiety score, and persistence should not be used to dismiss distress.

D2 explicitly includes regulating emotions in learning within its account of reflection, and its planning guidance connects reflection with consciously managed thoughts, emotions, and behaviour (Setiyani et al., 2025). D3 includes comfort, a sense of safety, appropriate challenge, and flexible allocation of learning time among its general principles (Anggraena et al., 2025). These passages offer a written basis for attending to how students experience mathematical activity. They are broader than a subject-specific anxiety programme and remain open to contextual interpretation by teachers.

The documentary distinction is consequently between explicit affective support and explicit mathematics-anxiety management. The analysed support passages do not set out a named mathematics-anxiety screening instrument, an anxiety-specific response pathway, or a measured anxiety outcome. This observation does not establish that no other national resource addresses anxiety. It identifies the level of specification in this corpus. A teacher can use the general provisions to plan emotionally supportive lessons, but a claim that the curriculum reduces mathematics anxiety would require implementation and student-level evidence beyond these documents.

The relation between challenge and support deserves attention. The guides encourage learning that is engaging and challenging as well as comfortable. Interpreting comfort as the removal of unfamiliar problems would weaken mathematical opportunities. A more defensible implication is to preserve the intended reasoning while adjusting entry points, explanation time, assistance, and opportunities to revise. These are proposed translations of the written principles. Whether they help a particular learner depends on

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http://journal.ipts.ac.id/index.php/MathEdu
Vol. 9. No. 3 November 2026

the learner, task, and classroom conditions, and should be investigated through evidence rather than assumed from the language of enjoyable learning.

Interpreting both local studies without extending their claims

The two local publications offer different reasons for retaining this distinction. Marpaung and Simarmata (2026) connect anxiety-scale scores with problem-solving performance, suggesting that a correct-answer record may provide an incomplete account of students' mathematical experiences. This does not mean that low performance can be diagnosed as anxiety or that an anxious student necessarily lacks competence. For the curriculum analysis, the implication is to ask whether activities create opportunities for explanation and supportive follow-up, alongside evidence of the intended mathematical knowledge.

Marpaung et al. (2025) found no statistically significant gender difference in their sample. A non-significant test is compatible with uncertainty and should not be presented as proof that all genders have identical experiences. The finding is relevant to an inclusive interpretation: initial support should respond to students' reported needs and task experiences rather than assign anxiety on the basis of gender alone. Different learners within the same gender group may need different forms of assistance. The present analysis consequently treats inclusion as a planning principle, not a prediction of who will be anxious.

Both studies concern a small sample from SMP Sangkara. Their shared setting is useful for developing a locally grounded research programme, but it does not broaden the geographical coverage of the evidence. The present curriculum study adds a different level of inquiry: the documentary conditions under which teaching activities are proposed. It does not reanalyse the participants, pool the results, or test a technological solution. This progression from local affective findings to curriculum questions provides a coherent educational psychology focus while preserving the limits of each study.

From mathematical outcomes to operational technological guidance

The clearest cross-document pattern is a change in specificity. D1 defines expected mathematical activity without naming applications in the Phase D outcomes examined. Its competencies include numerical operations and estimation, algebraic relationships and graphs, measurement, geometric reasoning, and data analysis and probability (Badan Standar, Kurikulum, dan Asesmen Pendidikan (BSKAP), 2025). The document consequently supplies mathematical ends while leaving substantial room for instructional choices. This pattern should not be interpreted as technological opposition. An outcome statement and a lesson-planning guide serve different functions, and an outcome does not need to specify software in order to be compatible with digital learning.

D2 and D3 make technological choices more visible through examples and general planning guidance. The mathematics guide includes interactive geometry software, spreadsheets, calculators, videos, and an online assessment application. The broader learning and assessment guide describes digital technology as support for planning, implementation, and assessment, while also identifying strategic and optional use (Anggraena et al., 2025). The combined reading therefore supports a distinction between competency expectations and possible means of achieving them. Naming a tool in an illustrative guide does not establish a requirement that every school use that particular product.

This distinction is important for evaluating alignment. If alignment meant identical terminology in all three documents, a mathematically framed outcome could appear disconnected from a detailed digital lesson simply because it omits a product name. A more useful interpretation asks whether the student activity in the guide advances the competency in the outcome. A spreadsheet task involving rational numbers can be aligned with numerical reasoning when students explain and compare their calculations. The same task may provide weaker evidence of understanding if students only copy values into a prepared file. Alignment depends on the mathematical demand, not on repetition of technological vocabulary.

Table 3. Source-located evidence register for the principal findings

Source location	Documented content in paraphrase	Interpretation and boundary
D1 p. 108	Mathematical dispositions include persistence, resilience and confidence.	Explicit disposition; an indirect basis for anxiety-sensitive design.
D2 pp. 256, 273	Reflection includes emotion regulation and conscious management of thoughts, emotions and behaviour.	Explicit affective support; no anxiety-reduction outcome is established.

Source location	Documented content in paraphrase	Interpretation and boundary
D3 pp. 14–15, 18	General principles include comfort, safety, appropriate challenge, time adjustment and emotion regulation.	Broad pedagogical support applicable to Phase D; not a subject-specific protocol.
D3 pp. 21–22	Assessment includes constructive feedback, suitable difficulty and supportive language.	A documented entry point for supportive assessment; specific digital settings remain open.
D1 pp. 116–118	Phase D competencies specify mathematical operations, representations, reasoning, data and probability.	Mathematical outcomes with instructional media open; not an explicit application mandate.
D2 p. 144	Scientific notation is contextualized through file sizes and other technological quantities.	Technology as context; this does not by itself require a digital learning tool.
D2 pp. 175–176	Pythagorean learning includes video, concrete media or interactive animation, and calculator use.	Presentation, representation and computation; no measured learning effect is reported.
D2 p. 179	Transformation designs can use graph paper or interactive geometry software.	Explicit alternative digital representation; a named application is not prescribed here.
D2 pp. 180–181	Survey data can be represented using paper-based construction or a simple spreadsheet.	Explicit data-representation function linked with interpretation.
D2 pp. 186–188	Probability is developed through physical draws of coloured sticks and recorded frequencies.	Non-digital counterexample; a spreadsheet simulation would be a proposed extension.
D2 p. 257; D3 p. 20	General guidance connects technology with planning, teaching and assessment.	Broad pedagogical positioning; not Phase D-specific proof of enactment.
D3 p. 36	Digital support is described as optional and strategic.	Flexibility in implementation; no universal platform requirement inferred.
D2 pp. 286–294; D3 pp. 115–122	Grade VII financial literacy uses named resources, spreadsheet work, discussion and assessment.	Related example reused across guides; not independent intervention evidence.
D2 p. 287; D3 p. 116	The initial digital quiz has a board-based alternative if internet access is not feasible.	Explicit connectivity contingency; equivalent participation is not demonstrated.
D2 p. 292; D3 p. 120	An offline spreadsheet option is distinguished from an online option.	An explicit delivery choice, still dependent on device and software access.
D3 p. 20	General guidance includes assistive technology.	Access beyond connectivity is acknowledged; no detailed mathematics accessibility protocol is inferred.

The evidence register shows several functions rather than a single model of integration. Some references concern presentation, others support student calculation or representation, and some place technology within assessment. These functions should not be ranked automatically. A short video can provide a useful context without being an exploratory environment, and a calculator can reduce routine workload without replacing the need for estimation. The analytical task is to identify what each resource is

expected to contribute and what remains the responsibility of the learner. This approach preserves differences that would disappear in a simple count of digital applications.

The combined lenses also reveal a design issue: technological specificity and affective specificity do not always appear together. A guide can identify a spreadsheet precisely while expressing emotional support only in a general section. Conversely, a statement on emotional regulation may leave the tool, task, and assessment arrangement open. The cross-document link is therefore partly explicit and partly supplied through teacher judgement. An integrated plan should identify the mathematical demand, the technological action, the relevant affective consideration, and how learning will be assessed in the same activity.

Digital contexts and actual use of digital tools

One important distinction concerns the role of technology as a topic within a mathematical situation. D2 uses digital file sizes and related scientific or technological quantities when discussing powers, roots, and scientific notation (Setiyani et al., 2025). These contexts can make numerical scale meaningful, but they do not necessarily require students to operate a digital tool. A teacher can present file-size information on paper and ask students to compare quantities. The presence of a digital subject matter is therefore not sufficient evidence of technology-supported student activity.

This observation prevents a common overstatement in curriculum analysis. If every reference to a battery, online shop, digital file, or technological occupation were classified as integration, the curriculum would appear more operationally digital than the text supports. A defensible coding decision distinguishes the situation being modelled from the medium through which students model it. Online shopping can provide data for reasoning about percentages while the calculation remains handwritten. Conversely, a locally collected survey about extracurricular activities becomes explicitly technology-supported when the guide offers a spreadsheet for organizing and presenting the data.

The same caution applies to presentation. References to short videos and infographics suggest ways to introduce situations, but their mathematical value depends on the questions that accompany them. Watching a video of a ladder does not by itself establish understanding of a right triangle. Students need to identify quantities, select relationships, and justify their model. The documentary finding is that presentation resources are available within the guidance. The further proposition that these resources could be strengthened through prediction and explanation is an analytical recommendation. Keeping these claims separate allows curriculum developers to revise activities without overstating what the existing document already requires.

Representation and exploration in geometry

The transformation example provides explicit evidence that students may use interactive geometry software as an alternative to paper-based construction (Setiyani et al., 2025). The activity concerns transformations on a coordinate plane and connects the production of a design with reflection on the differences among transformations. The source identifies a mathematical task and permits more than one medium. Its significance lies in the relation between student construction and mathematical explanation rather than in the adoption of a named software package. The Phase D passage does not need to be relabelled with an application name from a different phase.

The example supports representation, but it leaves some exploratory decisions to the teacher. A digital construction may allow a student to vary an object and observe a transformation repeatedly, yet that possibility is not identical to a requirement to investigate invariants. A stronger activity could ask students to predict coordinates before applying a transformation, compare the prediction with the output, and explain which properties changed. This proposed extension connects the affordances of a geometry environment to mathematical reasoning. It is not reported as an additional instruction already present in the source.

The Pythagorean discussion offers a related but different function. It combines a contextual video, physical representations or interactive animation, and calculator-supported problem solving (Setiyani et al., 2025). These resources can make geometric relationships visible and reduce some routine calculation. However, seeing an animation is not equivalent to establishing a general mathematical justification. Teachers need to distinguish a visual example that suggests a relationship from an argument that explains why it holds. The curriculum example creates room for this distinction, while the assessment of justification remains a design decision that should be made explicit in classroom materials.

These observations can be interpreted through the relationship between technology, pedagogy, and mathematical content. Kholid et al. (2023) explain why technology integration requires knowledge of these interacting domains rather than technical skill alone. In the present analysis, this framework serves as an interpretive lens, not as evidence that teachers possess a particular level of knowledge. It helps identify a

practical requirement: a teacher selecting geometry software must connect its actions to the intended mathematical reasoning and to a suitable way of assessing that reasoning. Product familiarity alone does not establish that connection.

From a mathematics anxiety perspective, the geometry examples create a possible route for trying and checking ideas before explaining them. A teacher might offer paired prediction, private rehearsal, or a saved intermediate construction before whole-class discussion. These are proposed arrangements rather than documented anxiety-reduction effects of the software. They should preserve the requirement to explain a transformation or justify a relationship. Interface demands also need checking: a student's difficulty dragging an object should not automatically be interpreted as deficient spatial reasoning or as mathematics anxiety.

Spreadsheets and the transition from calculation to interpretation

The data-presentation example in D2 explicitly offers a spreadsheet alongside paper-based diagram construction. Students collect survey information and represent it through bar and pie charts, followed by interpretation and reflection (Setiyani et al., 2025). This is a relatively direct connection between a mathematical competency and a digital function. The spreadsheet can organize a frequency table and generate a representation, while students retain responsibility for choosing a suitable chart and interpreting its meaning. The example is therefore more specific than a general statement that technology makes learning interactive.

Nevertheless, automated chart production introduces an assessment issue. A correctly generated chart may result from a student's understanding, from following a sequence of clicks, or from accepting default software settings. The final image alone cannot distinguish these processes. A useful assessment can ask students to justify the chart type, explain the relationship between frequencies and sectors or bar heights, and identify a misleading representation. These prompts are recommendations arising from the documentary analysis. They translate the guide's emphasis on interpretation into evidence that is less dependent on a polished digital product.

The financial-literacy example extends spreadsheet use beyond categorical data presentation. D2 identifies Excel and an online spreadsheet option in a sequence involving investment problems, discussion, presentation, and formative assessment. D3 contains a closely corresponding Grade VII example (Anggraena et al., 2025; Setiyani et al., 2025). The documented function includes numerical work in a context that requires decisions. However, the article does not infer that the linked worksheet implements a particular simulation, automated feedback system, or validated investment model. Those external links were not treated as separate documents in the corpus.

The pedagogical opportunity is to move from obtaining a numerical answer to examining the assumptions behind it. For example, students could compare how a conclusion changes when a fee or rate changes, provided that the calculation remains suitable for their mathematical level. A teacher could also ask students to estimate an answer before using a formula and explain why the result is reasonable. These are proposed extensions, not findings about the contents of the linked spreadsheet. Their purpose is to show how a broad curricular opportunity can become an activity with observable reasoning.

The spreadsheet examples also require a distinction between procedural assistance and emotional support. Delegating arithmetic can change the work students must manage, but it does not guarantee that students understand the formula or feel safe explaining it. A proposed sequence is to predict a result, inspect a worked formula, modify one assumption, and explain the change. Shared-device groups can rotate the roles of operator, checker, and explainer so that access to the keyboard does not determine participation. These recommendations target reviewable classroom conditions, and their anxiety-related value remains an empirical question.

Assessment support without assuming automated feedback

Assessment-related evidence appears at more than one level. General guidance allows digital technology to support assessment, while the Grade VII example names Quizizz for an initial check of numerical understanding. The same sequence includes teacher feedback and formative assessment associated with spreadsheet work. These references establish a documented connection between technology and assessment, but they do not establish that all feedback is generated automatically or adapted to individual misconceptions. A platform's capacity and a document's actual instructional description must be distinguished. The latter is the basis of the present finding.

This distinction matters because assessment has an instructional consequence beyond collecting answers. An online quiz can quickly reveal patterns of responses, yet the teacher must interpret the

mathematical reasons for those responses. An incorrect answer to a discount problem might reflect a misunderstanding of percentages, additive treatment of successive discounts, or an arithmetic error. Different explanations require different follow-up activities. The recommendation is to attach likely reasoning patterns and follow-up questions to digital assessment tasks. The present documents provide an entry point through their attention to initial and formative assessment; the analysis does not claim that this detailed diagnostic layer is already fully specified.

Weigand et al. (2024) position assessment alongside teaching and learning when discussing mathematics in the digital age. Their perspective supports examining whether tasks reveal conceptual understanding rather than merely exploiting efficient response collection. In this study, the curriculum evidence suggests that technology is linked to assessment activity, while the criteria for evaluating technology-supported reasoning are less explicit in the selected examples than the identification of tools and broad activities. This is a bounded interpretive finding. It does not imply that all rubrics in the complete publications lack useful mathematical criteria or that teachers cannot supply those criteria themselves.

An alignment matrix can help make this distinction operational. For each digital task, it should identify the competency, the action performed by the student, the function delegated to the tool, the reasoning retained by the student, and the assessment evidence. If the tool computes totals, the student might be assessed on selecting operations and interpreting differences. If the tool produces a graph, the student might be assessed on explaining its features. This matrix does not require every task to use technology. It provides a way to check that the medium supports the purpose whenever technology is selected.

Anxiety-sensitive assessment requires more specification than the identification of an online quiz. In the selected Grade VII example, timing, visibility of individual scores, competitive ranking, retry rules, and privacy are not specified in the printed passage. The document therefore cannot establish whether students respond privately, competitively, or under time pressure. A teacher should make those decisions in relation to the diagnostic purpose. For example, private responses followed by a discussion of common errors could be trialled when the aim is to understand reasoning. This is a proposal; it is not an account of the quiz's actual configuration.

D3 provides relevant support through constructive feedback and an educational assessment function, including supportive language and assessment as part of learning (Anggraena et al., 2025). A proposed extension is to pair an item with a prompt asking which step was difficult and what support would help. Such a prompt is a classroom conversation aid, not a validated anxiety scale. If research aims to estimate change in mathematics anxiety, it should collect an appropriate measure separately and examine its validity for the age group and language used.

Access as an explicit design consideration

The source documents contain more concrete attention to access than a general claim that students should use online resources. In the Grade VII initial assessment, the digital quiz can be replaced with board presentation when internet access is not feasible. The planning sequence also distinguishes an offline spreadsheet option from an online one (Anggraena et al., 2025; Setiyani et al., 2025). These are explicit contingency arrangements. They show that at least some examples acknowledge differences in connectivity rather than making online delivery the only acceptable route.

The alternatives should be interpreted carefully. An offline spreadsheet still requires a suitable device and software, whereas a board-based task changes how responses can be collected and reviewed. The documents do not demonstrate that every school has the required equipment or that all alternatives offer identical participation opportunities. The finding is therefore that access contingencies are documented, not that access inequity has been resolved. An implementation study would need to examine device availability, shared use, student familiarity, accessibility needs, and the classroom arrangements through which the alternatives are used.

The broader guide also identifies assistive technology in its general discussion of digital learning (Anggraena et al., 2025). This broadens the concept of access beyond internet connectivity, but the general statement is not treated as a mathematics-specific accessibility protocol. A useful follow-up would develop accessible graph descriptions, keyboard-operable activities, or alternative formats for particular tasks. These recommendations arise from the access category in the analysis. Their value would need to be checked with students and teachers, especially because a technically available resource may still be difficult to use with a particular sensory, physical, or learning need.

Access and anxiety can interact in classroom experience, although their relationship is not measured here. A student without a reliable device may face difficulty completing a task for reasons unrelated to mathematical understanding. A technically available task may also be difficult to navigate or inaccessible

to a student with a particular need. The printed alternatives provide a basis for planning, but teachers still need to check participation. Proposed follow-up questions include whether each learner had a meaningful turn, could ask for assistance, and could demonstrate reasoning through an accessible medium. The questions supplement rather than replace mathematics assessment.

Repetition and uneven elaboration across mathematical domains

The reuse of the financial-literacy sequence across D2 and D3 is a substantive feature of the corpus. It gives readers a recognisable example linking a mathematical objective with planning principles, named resources, and assessment activities. This continuity can reduce ambiguity about how general guidance might be interpreted. Nevertheless, the two occurrences should not be counted as independent validation of the activity. They record a related planning example in two publications; they do not report two interventions, two groups of students, or two evaluations of effectiveness. The distinction is necessary for defensible documentary inference.

The examples also vary in the detail they provide for different mathematical domains. The financial-literacy sequence offers a relatively extended plan, while other passages offer shorter technological alternatives within an essential-material discussion. Variation of this kind may reflect the illustrative purpose and space constraints of the guides. It cannot be converted into a numerical ranking of domain quality without an explicitly defined and consistently applied rubric. The present study therefore describes differences in the form and specificity of support rather than assigning percentages of curricular readiness.

The probability passage offers a useful counterexample. D2 describes a physical drawing experiment using coloured sticks, with recorded frequencies and comparison between empirical and theoretical probability (Setiyani et al., 2025). Although a spreadsheet simulation could extend this activity, the selected passage does not explicitly require one. Coding it as digital would therefore misrepresent the source. Its inclusion demonstrates that meaningful mathematical exploration can remain physical and that a technology analysis should also record where the medium is left open or a non-digital approach is clearly described.

An alignment matrix for pedagogical translation

The proposed matrix in Table 4 translates the documentary findings into planning decisions. It is an analytical recommendation, not a validated intervention or an additional official curriculum. The matrix connects an intended competency with a student action, a tool function, a form of reasoning, and a possible access arrangement. Its purpose is to make the teacher's choices visible enough to review. The same competency can support more than one legitimate tool choice, and a non-digital route can remain appropriate when it preserves the central mathematical demand and enables students to participate.

Table 4. Proposed curriculum technology and affective alignment matrix

Competency and tool	Proposed affective safeguard	Evidence and follow-up
Numerical and financial reasoning; calculator or spreadsheet	Allow estimation, a worked example, and revision before presentation.	Assess operation choice and explanation; ask privately which step needed support.
Coordinate transformations; interactive geometry	Use paired prediction and rehearsal; check interface familiarity.	Assess coordinates and invariants; distinguish tool difficulty from mathematical reasoning.
Data representation; spreadsheet	Rotate operator, checker and explainer roles; offer accessible alternatives.	Assess chart choice and interpretation; check whether every learner participated.
Pythagorean reasoning; animation or calculator	Move between concrete and digital representations with explanation time.	Assess the argument and model; invite questions about confusing representations.
Initial assessment; digital quiz	Specify response time, score visibility and follow-up; trial private responses and revision.	Use answer explanations and feedback. Do not infer anxiety from errors or speed alone.
Probability; physical experiment with optional digital extension	Retain a concrete entry point and predictable instructions.	Assess empirical–theoretical comparisons; evaluate any digital extension separately.

The matrix deliberately separates tool function from evidence of learning. This prevents a common planning shortcut in which an activity is considered successful because students completed a digital product. For example, a chart can be assessed for mathematical suitability even when it is hand-drawn, and a spreadsheet can be assessed for the assumptions and relationships its formulas encode. The central question is what the learner must understand to complete and explain the task. This question connects the written outcome to observable performance more directly than the question of which application was used.

The proposal also accommodates teacher judgement. Thurm and Barzel (2022) show that teachers' beliefs about technology are multidimensional and related to modes of use. That research does not describe the teachers who will use these Indonesian guides, but it cautions against assuming that the availability of examples guarantees their intended enactment. Professional learning could ask teachers to compare alternative versions of the same task, identify the mathematical demand in each, and examine student explanations. Such work would address the transition between documented opportunity and classroom practice without treating the curriculum itself as an intervention.

Recent reviews support a similarly conditional approach. Engelbrecht and Borba (2024) describe developments in digital mathematics education alongside concerns about access and educational purpose. Valero Larico et al. (2026) also emphasize pedagogical intentionality when synthesizing digital applications in secondary mathematics. These publications are contextual literature, not additional curriculum documents in the present corpus. Their role is to help interpret the finding that identifying resources is only one part of integration. They do not justify importing unobserved classroom benefits into the documentary results or assuming that newer technologies are automatically preferable to simpler resources.

The integrated matrix adds affective safeguards to the existing competency–technology–assessment connection. The safeguards are practical hypotheses for lesson design: appropriate pacing, feedback on process, opportunity to revise, multiple participation routes, and access arrangements. They are not a package shown to reduce anxiety. The mathematics remains visible in each row so that support does not become a reason to remove reasoning or replace learning with reassurance. Student explanations and privately collected reports of experience can inform revision of the design, while validated measurement is needed for any formal anxiety outcome.

The broader literature supports investigating these hypotheses with caution. Balt et al. (2022) describe the diversity of intervention approaches, and Sammallahti et al. (2023) report evidence for cognitive and emotional support. These findings concern evaluated interventions, whereas the matrix is a proposal derived from documents. Ersozlu (2024) further indicates that technological arrangements can be associated with different anxiety experiences in primary education; transfer to SMP requires age-appropriate investigation. None of these sources makes a named application intrinsically protective. Their contribution is to justify testing the interaction between mathematical task, support, and learning environment.

Limitations and implications for further research

Several limits define the interpretation. The corpus consists of three related official publications from one year, selected for their complementary roles. It does not include school-developed operational curricula, textbooks, teacher lesson plans, student work, or classroom observations. It also does not include later policy revisions or the contents of externally linked worksheets and assessment forms. Consequently, absence of a detail in the analysed passages does not establish its absence from all Indonesian curriculum resources. The study identifies the support and decisions visible in this bounded corpus rather than providing an exhaustive account of national practice.

The affective interpretation is theory-informed and has not been independently replicated by a second coder. The categories do not distinguish state and trait anxiety through measurement, and no clinical interpretation is intended. The category system clarifies the distinctions used in this draft, but it has not been validated as a scoring instrument. A future study could have multiple analysts independently classify a defined set of passages, compare disagreements, and refine the codebook before extending the corpus. A subsequent classroom study could compare how teachers translate the guides into digital tasks, assess mathematical reasoning, and collect age-appropriate anxiety measures before and after a clearly specified sequence. It should account for baseline performance, access conditions, and the classroom grouping of students. These approaches would add evidence about reproducibility and enactment without changing the documentary claims made here.

Practical implications follow from these limits as well as the findings. Curriculum developers can preserve flexible tool choice while adding short explanations of what students should predict, compare,

justify, or critique. Teacher educators can use existing examples to discuss the difference between calculation assistance and conceptual reasoning. Schools can review whether proposed offline and shared-device alternatives preserve assessment fairness. Researchers can study the resulting activities before making claims about achievement, engagement, or equity. The present contribution is the identification of these reviewable decisions at the interface between outcomes and pedagogical guidance.

4. CONCLUSION

The selected Indonesian curriculum documents offer a basis for connecting mathematical competence, digital learning, and affective support in Phase D. Mathematical dispositions, safe learning environments, emotion regulation, constructive feedback, and flexible participation are identifiable in the written guidance. Digital resources provide examples of calculation, representation, data work, and assessment. Their conjunction supports the development of mathematics-anxiety-sensitive activities, but the relationship is partly dependent on teacher interpretation because the analysed passages do not specify a complete anxiety-assessment or intervention procedure.

The two local studies contribute complementary context. The anxiety–problem-solving association reported by Marpaung and Simarmata (2026) supports attending to emotional experience alongside performance. The non-significant gender comparison reported by Marpaung et al. (2025) cautions against allocating support through gender assumptions alone. Their shared single-school scope and non-intervention designs limit generalization, and neither establishes the effects of technology or curriculum. They provide a foundation for the present documentary questions rather than evidence that the proposed design matrix has been validated.

The main implication is to specify mathematical goals, technological functions, participation arrangements, feedback, and affective safeguards together. The proposed matrix can guide that planning and make it open to review. Future research should independently examine the coding, study teachers' adaptations, and evaluate clearly specified classroom sequences using both mathematical outcomes and appropriate anxiety measures. Conclusions about anxiety reduction require those additional data. This study contributes a bounded account of curricular support and a researchable framework for developing psychologically informed mathematics learning at the lower secondary level.

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