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Teacher Agency in Adapting Learning Resources for Deep Learning: A Qualitative Study of Indonesian Junior Secondary Mathematics Teachers

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Abstract

Indonesia's pedagogical deep learning reform assumes that teachers can turn mathematics resources into opportunities for understanding, yet little is known about how teachers themselves describe this work. This in-depth qualitative multiple-case study analysed semi-structured interview transcripts from three junior secondary mathematics teachers (G1, G2, G3), collected with a six-indicator interview guide and a teacher profile sheet. Thematic analysis combining indicator-based and inductive coding produced six themes. All three teachers described deep learning as understanding beyond formulas and procedures, but they accepted different evidence of it. They described adapting resources by selecting, modifying and reconstructing them, and they reported routine single-answer tasks, dictating or over-general instructions, narrow representations and unguided discussion as features that close down thinking. Resources that prompt thinking, allow trial and error, offer contextual problems and review prerequisites were described as supports. Time, learner diversity, class size and assessment limited what was feasible, and the teachers located the decisive factor in teachers' integration of resources (G1, G3) or in students' prerequisite foundations (G2). The analysis distinguishes selecting, modifying and reconstructing resources as forms of teacher agency and shows learners' prerequisite knowledge informing teachers' resource decisions. The findings point to teacher agency in adapting resources, and to the conditions that enable it, as central concerns for deep learning reform.

Keywords: teacher agency, deep learning, mathematics teachers

INTRODUCTION

Indonesia has made deep learning a national policy aspiration for schools, with deep learning pedagogy to be integrated into curriculum delivery (Sudirman & Pandang, 2025). In mathematics education the term has a pedagogical meaning (conceptual understanding, problem solving, real-world application) and a computational one (neural networks), and reviews find that the two are not always kept apart (Gusti & Amastini, 2025; Salma & Wijayanti, 2025). In the pedagogical sense, deep learning has been described as meaningful learning through contextual and open-ended problems, mindful learning through discussion and reflection, and joyful learning through active participation, with the teacher as facilitator (Siregar et al., 2025).

Whether classrooms can realise such an aspiration depends partly on the resources teachers use and on what teachers do with them. Tasks are central, because the assignments students receive shape what they are asked to think about and therefore what they can learn (Tekkumru-Kisa et al., 2020). Yet many textbook tasks leave little room for reasoning: an analysis of more than 5,700 tasks in secondary mathematics textbooks from twelve countries found that most could be solved by copying a template (Jäder et al., 2020). Teachers,

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for their part, report challenges in recognising, solving and designing cognitively demanding tasks, including challenges related to students' knowledge and to the curriculum (Monarrez & Tchoshanov, 2022).

Research on teacher–resource interaction treats teachers as active participants in designing instruction with resources. Design does not stop when a resource is published; it continues in use (Pepin, Choppin, et al., 2017). Design capacity has been described through a goal or point of reference, design principles and reflection-in-action (Pepin, Gueudet, et al., 2017), and case studies show a lower-secondary teacher moving between offloading, adapting and improvising, with awareness of a textbook's affordances and constraints shaping these choices (Jukić Matić, 2019). Different theoretical lenses on lesson preparation bring out different aspects of this interaction (Trouche et al., 2019), and teachers' own accounts have been used to study their resource systems (Pepin, Xu, et al., 2017). Findings on how far teachers change resources vary. In a lesson-study setting, teachers' decisions were largely driven by the textbook, which they followed closely and changed only superficially (Thobela et al., 2023), and in collaborative planning teachers gave authority to curriculum resources, with conflicts of authority emerging when those resources did not support their agency (Gustafsson et al., 2024). Such variation points to teacher agency, which is not a personal capacity alone: it has been shown to depend on individual, school and system conditions such as leadership, staffing and timetabling (Kneen et al., 2023) and, in ecological accounts, on teachers' past experience, present resources and relationships, and future aims (Hizli-Alkan et al., 2026).

In Indonesia, studies of the Merdeka Curriculum report teachers' positive views of its effect on numeracy alongside constraints of time, training and assessment (Hidayah et al., 2025), and a qualitative study in two junior secondary schools found contextual, open-ended questioning but also one-directional assessment and weaker participation by students with weak foundations (Suriyana et al., 2026). A qualitative case study of eight primary school teachers in South Sulawesi reported limited conceptual clarity, inadequate training and constraints on resources and institutional support in implementing deep learning pedagogy (Sudirman & Pandang, 2025).

Taken together, the literature shows that deep learning is a policy aspiration with a pedagogical meaning, that textbook tasks often invite template solving, and that teachers' resource work and agency vary with teacher, setting and resource. What remains insufficiently understood is how teachers in Indonesian junior secondary mathematics, where deep learning is now a reform aim, describe their own interpretation of the aim, their choices among and changes to resources, and the conditions that constrain them. The Indonesian studies above describe practices and perceptions of the curriculum and of deep learning pedagogy but do not centre on teachers' choices among and changes to mathematics resources. The search conducted for this study did not locate work that addresses this combination.

This study uses four concepts as a sensitising framework, not as a theory to be tested. Teachers' goals and design principles (Pepin, Gueudet, et al., 2017) describe what teachers aim for and how they decide. Forms of resource work (offloading, adapting and improvising; Jukić Matić, 2019) provide the starting point from which the analysis derives its own distinction among selecting, modifying and reconstructing resources; this distinction is an analytic interpretation of the interview data, not a validated taxonomy. Tasks as contexts for students' thinking (Tekkumru-Kisa et al., 2020) link resource work to deep learning, because changing a task changes what students are asked to think about. Teacher agency, shaped by individual, school and system conditions (Kneen et al., 2023), helps to explain why the same resource may be used differently. Section 3.3 explains how these concepts inform the interpretation. This in-depth qualitative study examines how three Indonesian junior secondary mathematics teachers describe their understanding of deep learning and their use, adaptation and evaluation of learning resources. It addresses four research questions. RQ1: How do the teachers conceptualise deep learning in mathematics, and what do they report as evidence of it and as ways

of fostering it? RQ2: How do they report selecting, interpreting and adapting existing resources when planning for deep learning, and what reasons do they give? RQ3: Which resource features do they perceive as supporting or constraining deep learning? RQ4: Which contextual conditions do they report as shaping their resource decisions, and what support do they say they need?

METHODS

Research Design

This study used a qualitative multiple-case design in which each of three teachers is a case. A multiple-case design suits this aim because the same questions were put to each teacher, which allows contrasts and contradictions to be retained and each account to be analysed in depth (Creswell & Poth, 2018). The aim was an in-depth account of how teachers interpret deep learning and use, adapt and evaluate learning resources, and a comparison of these accounts across cases. The analysis is based on what the teachers said in interviews; the study does not include classroom observation or measures of student learning.

Research Subjects / Participants

Three junior secondary (SMP) mathematics teachers from one public school in Jakarta, Indonesia, took part, identified as G1, G2 and G3. They were recruited by purposive sampling through the author's professional colleagues and existing professional networks, and the author already knew them professionally. No additional selection criteria were documented. According to the profile sheets, G1 had 15 years of teaching experience, a master's degree and taught grades 7 to 9, and listed textbook and student worksheets with several digital tools (for example Desmos, Quizizz, Khan Academy and PhET simulations) among the resources used most. G2 had 7 years of experience, a master's degree and taught grades 8 and 9, and listed self-made material, textbook, online sources and AI-generated material. G3 had 12 years of experience, a bachelor's degree and taught grade 7, and listed textbook, teaching modules, worksheets, videos, a question bank and online sources. All three teach under the Merdeka Curriculum and reported some professional learning on deep learning. The three cases differ in experience, qualification and grade level, which provides contrast across the accounts. Because they work in the same school, shared school conditions may contribute to similarities. All three teachers gave informed consent. Pseudonyms are used, and names and identifying details are omitted.

Research Procedures

Data were collected with two instruments developed by the author: a teacher profile sheet and a semi-structured interview guide for teachers. The guide is organised around six indicators: (1) conceptual understanding of deep learning, (2) its meaning in practice, (3) use of existing resources, (4) interpretation and adaptation, (5) resource affordances and constraints, and (6) contextual factors, followed by two closing questions. Each indicator has a main question and probes. The procedure had three phases. In the preparation phase, the instruments were developed and participants were recruited through professional networks. In the data collection phase, face-to-face semi-structured interviews were conducted with each of the three teachers in August 2026 and were audio-recorded, and each teacher completed the profile sheet. In the analysis phase, the recordings were transcribed and the transcripts were analysed as described in Section 2.5. The profile sheet also asks which resource will be used in a lesson to be observed; lesson observation is not part of the present analysis.

Data Sources and Data Collection Techniques

The data sources are the audio-recorded interviews with the three teachers, in transcribed form, and the three teacher profile sheets. The interviews were semi-structured and face to face, and the transcripts were organised under the questions and probes of the interview guide. The profile sheets supplied background information on experience, qualification, grades taught, professional learning and resources. The transcripts and profile sheets are treated as the teachers' accounts of their conceptions and practice. Because the interviews were the main source of data, comparison across the three cases allowed the accounts to be checked against one another. Quotations in Section 3 are taken from the transcripts in Indonesian.

Data Analysis Techniques

The transcripts were analysed in Indonesian, in the original language, using thematic analysis that combined deductive and inductive coding in six phases. (1) All three transcripts were read in full several times. (2) A starting codebook was seeded deductively from the six indicators (conceptions, practice, resource use, interpretation and adaptation, affordances and constraints, context), and open codes were added inductively where responses used distinctions the indicators did not anticipate, for example recipe-like instructions or shortcut-formula boxes. (3) Every response was coded, and coded segments were compared within and across teachers. (4) Codes were grouped into categories and then into candidate themes. A first grouping produced eight themes that followed the indicators closely. Because indicator headings are not themes, these were checked against the transcripts and revised: adaptation was merged with selection into one theme on teacher authority over resources because the accounts did not separate them cleanly, and contextual conditions were merged with support needs because the teachers attributed the decisive factor differently within the same list of conditions. This left six themes. (5) Differences, contradictions and single-teacher positions were kept and reported as such. (6) Quotations were checked verbatim against the transcripts. Table 1 shows how excerpts moved from code to category to theme. Quotations are given in Indonesian with English translations by the analyst, and [sic] marks the participants' own spelling.

Table 1. Example of the coding trail from excerpt to theme

Participant and excerpt	Initial code	Category	Theme
G1: "soal prosedural yang hanya meminta siswa memasukkan angka ke dalam rumus" (procedural problems that only ask students to put numbers into a formula)	Textbook tasks procedural (inductive)	Task features that leave no room for reasoning	Theme 4
G3: "didominasi soal rutin dan prosedural dengan konteks yang terbatas" (dominated by routine, procedural problems with limited context)	Routine tasks, limited context (inductive, within Indicator 5)	Task features that leave no room for reasoning	Theme 4
G2: "beberapa soal tidak sesuai kebutuhan" (some problems do not fit needs)	Items mismatched to learners' needs (deductive, Indicator 5)	Fit between resource and learners (contrasting case)	Theme 4
G1: "bertindak sebagai pemicu atau pemantik" (acts as a trigger)	Resource as trigger (deductive, Indicator 4, refined inductively)	Resource features that prompt thinking	Theme 5

Data Validity Verification Techniques

Credibility was supported by repeated full reading of the transcripts, retention of a codebook, verbatim checking of quotations and the inclusion of contradictory positions. Dependability and confirmability were supported by the explicit analytic sequence in Section 2.5 and by marking interpretation separately from participants' statements. Transferability rests on the description of the participants and their setting in Section 2.2, so that readers can judge the relevance of the findings to other contexts; the findings are analytic and are not intended to be statistically generalisable.

The author developed the instrument, conducted the interviews and analysed the transcripts, and already knew the three teachers professionally. This relationship may have encouraged openness, but it may also have led participants to give socially desirable accounts or led the author to read the transcripts sympathetically. The analysis sought to separate participants' statements from the author's interpretation by quoting participants and marking interpretation separately. The author's background in mathematics education may also have led to emphasising teacher agency and resource features over other explanations. Coding was carried out by the author alone, so the audit trail in Section 2.5 and Table 1 is the main safeguard for dependability.

RESULTS AND DISCUSSION

Overview of themes and levels of evidence

The analysis produced six themes in four groups, one group per research question (Table 2). The themes were developed from coded segments and were not taken directly from the interview indicators: a first grouping produced eight candidate themes that followed the indicators closely, and checking them against the transcripts led to merging adaptation with selection and merging contextual conditions with support needs (Section 2.5). Figure 1 shows the thematic map. Participants' statements are quoted in Indonesian with the analyst's English translation, and the analyst's interpretation is marked as Interpretation.

The findings are grounded in the teachers' accounts of their conceptions and practice, and statements about effects on students are the teachers' own perceptions.

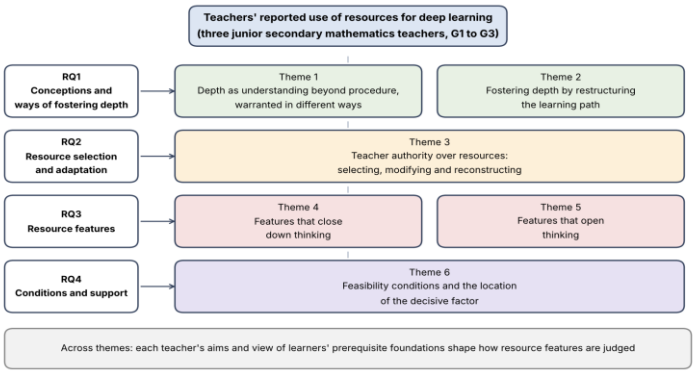


Figure 1. Thematic map of the six themes, grouped by research question

Depth as understanding beyond procedure, warranted in different ways

All three teachers defined deep learning against drill and procedure, but the evidence they accepted for it differed. G1: "*tidak sekedar drill soal, menghafal rumus saja*" (not merely drilling problems and memorising formulas). G2: learning that directs students "*tidak hanya bisa dalam menyelesaikan soal, melainkan memahami bagaimana konsep diterapkan dan bagaimana makna dari suatu pembelajaran*" (not only able to solve problems but understanding how concepts are applied and what the lesson means). G3:

learning that "*tidak hanya menekankan pada penguasaan rumus dan prosedur, tetapi mendorong peserta didik untuk memahami konsep secara mendalam*" (does not only stress mastery of formulas and procedures but pushes learners to understand concepts deeply), carried out "*secara bermakna, berkesadaran dan menggembirakan*" (meaningfully, mindfully and joyfully).

As evidence of deep learning, G1 listed students who solve non-routine problems, explain why and how in discussion, and know that a double discount of 50% and 20% is not 70%; G1 also stressed self-checking: "*Murid mampu menilai dan mengoreksi dirinya sendiri terhadap masalah matematika yang dihadapi*" (students can judge and correct themselves on the mathematical problems they face). G3 pointed to "*kemampuan siswa dalam menjelaskan konsep dengan pemahamannya sendiri, menerapkan konsep pada masalah kontekstual, memberikan alasan atas jawabannya serta melakukan refleksi*" (students' ability to explain concepts in their own understanding, apply them to contextual problems, give reasons for answers, and reflect). G2 pointed to an affective sign and gave a cautious estimate: "Ada “Ahaa!” effect yang terlihat dari raut wajah mereka" (there is an "Aha!" effect visible on their faces), adding that "*secara proporsional paling maksimal hanya 25% saja di kelas yang mengalami deep learning*" (proportionally, at most only 25% in the class experience deep learning), shown in solving problems "*bahkan ketika permasalahan dimodifikasi*" (even when the problems are modified).

The teachers share a boundary definition (not drill, not formula memorisation) but warrant depth differently: through self-regulation and questioning (G1), through explanation, application and reflection that mirror the mindful and meaningful wording of the policy (G3), and through visible engagement and flexibility when problems change (G2). Only G2 described a gap between design and practice: "secara praktik, hal ini gagal dilaksanakan" (in practice, this fails to be carried out), likening it to a house with a good design but "pondasi sangat lemah" (a very weak foundation). G3's wording closely follows the policy phrase "bermakna, berkesadaran dan menggembirakan", which may indicate the use of policy language, a point the transcripts cannot settle. These are the teachers' own descriptions of how they recognise depth.

Fostering depth by restructuring the learning path

Asked how they apply deep learning, the teachers described changing the order or form of the learning path, but through different principles. G1 described not giving answers directly: "*saya tidak langsung memberikan jawaban akhirnya, tetapi dengan pemantik, panduan/ petunjuk* (hints)" (I do not immediately give the final answer, but use triggers and guiding hints), inviting students "*mengkonstruksi rumus melalui eksplorasi*" (to construct formulas through exploration), and deliberately presenting a wrong solution "*untuk memancing murid agar nanti dikoreksi*" (to prompt students to correct it later), hoping the class becomes a "*ruang debat matematika*" (space for mathematical debate). G1 described the teacher as a facilitator and not only a "*pemberi jawaban*" (giver of answers). G1's exemplar lesson had students create nets of curved solids, prompted by "*membuat kreasi jaring-jaring seperti menyusun* [sic] puzzle" (making creative nets like arranging a puzzle).

G2 listed a sequence of moves beginning with prerequisites: "*meminta siswa belajar terkait materi prasyarat*" (asking students to study prerequisite material), then "*memberikan pertanyaan pemantik*" (giving trigger questions), and later "*memberikan permasalahan* [sic] *baru, modifikasi permasalahan sebelumnya*" (giving new problems that modify earlier ones). Students are also "*wajib untuk memberikan alasan dari jawaban yang diberikan*" (obliged to give reasons for their answers), which is done "*untuk meminimalisir miskonsepsi pada siswa*" (to minimise student misconceptions). In G2's exemplar, students used what they knew about adding like terms to infer rules for adding radicals, which G2 considered deep learning because "*pemahaman dibangun sendiri, bukan diberikan*" (understanding is built by the students, not given). G3

described using "*pertanyaan pemantik, permasalahan kontekstual, diskusi, serta meminta mereka menjelaskan alasan dan langkah penyelesaian sebelum menyampaikan jawabannya*" (trigger questions, contextual problems, discussion, and asking them to explain reasons and steps before giving an answer), and gave as an exemplar rational-number lessons built on "*diskon dan perbandingan harga*" (discounts and price comparison) in which students "*membandingkan strategi, dan melakukan refleksi*" (compare strategies and reflect). On transfer to other situations, G1 and G3 answered affirmatively (G1 citing double discounts and the meaning of linear equations; G3 "Iya"), whereas G2 said "*sesekali iya, seringkali tidak*" (sometimes yes, often not).

Trigger questions are common ground, but each teacher expressed a different design principle: withholding answers and using productive error (G1), building new concepts from prerequisite knowledge (G2), and cycles of contextual problems, reasons and reflection (G3). In terms of design capacity, the goal is shared and the principles differ. G3's answers to the three probes were brief, and all three accounts describe intended and habitual moves.

Teacher authority over resources: selecting, modifying and reconstructing

The teachers described resources as material over which they have authority, but they exercised it in different ways. G2 described building material from several sources: "*mengumpulkan data, informasi, dan teori dari beberapa sumber kemudian membuat suatu bahan ajar sendiri*" (collecting data, information and theory from several sources and then making teaching material of my own). Asked whether resources are followed directly, whether parts are selected and whether activities or problems are changed, G2 answered "*terkadang*" (sometimes) to all three, and described taking practice problems "*sesuai dengan kisi-kisi awal yang sudah ditentukan* (*jadi tidak semua diambil langsung*)" (according to the initial grid that had been set, so not everything is taken directly). The reasons given were learners' ability and "*kebutuhan pembelajaran yang telah disepakati oleh guru MGMP*" (learning needs agreed by the subject teachers' forum). G1 answered "ya" (yes) to all three probes and described combining resources by topic: "*mengkombinasikan, sesuai dengan topik yang dibicarakan*" (combining, according to the topic), with more manipulatives and digital tools for geometry. G1 also selected within topics, for example treating "*kubus, balok dan prisma segiempat*" (cube, cuboid and rectangular prism) as one concept for finding the volume formula, and adjusted problem characteristics to the time of the lesson. G3 said resources are not followed directly: "*Resource digunakan sebagai acuan dan dapat disesuaikan dengan tujuan pembelajaran, kondisi kelas, serta kebutuhan dan karakteristik peserta didik*" (a resource is used as a reference and can be adjusted to learning goals, class conditions and learners' needs).

Two teachers gave item-level examples. G1 changed a textbook bath-tub volume problem by adding an illustration, replacing volume with capacity ("*termasuk mengubah satuan dalam liter*", including changing the unit to litres), and "*menambahkan pertanyaan tentang debit air*" (adding a question about water flow rate), and then comparing the bath-tub with the bathroom; the reason was "*memaksa otak bekerja terbalik dan memahami konsep kapasitas secara mendalam*" (to force the brain to work in reverse and understand the concept of capacity deeply). G3 changed book problems on rational numbers into contextual problems about discounts and price comparison, and reported changing "*konteks soal, tingkat kesulitan, dan bentuk aktivitas*" (the context of the problem, the level of difficulty and the form of the activity) so that students explain strategies and reasons. G2 gave no item-level example; G2's adaptation was described as assembling material "*dari konsep sampai hal yang kompleks*" (from the concept to complex matters). All three reported positive effects on students, which are the teachers' own perceptions: G2, "*sedikit banyak, pemehaman [sic] siswa jadi lebih baik*" (to some extent, students' understanding becomes better); G3, students become "*lebih aktif dan*

terlibat" (more active and engaged); G1, students are "*lebih terpacu untuk berfikir secara kritis, objektif dan realistis*" (more driven to think critically, objectively and realistically).

Interpretation. The transcripts allow three forms of resource work to be distinguished analytically; the distinction is the author's interpretation of these accounts, not a validated taxonomy. Selection, choosing and omitting parts of a resource, appears in all three accounts. Modification, changing the context, difficulty or question set, is described concretely by G1 and G3. Reconstruction, assembling new material from several sources, is G2's main mode and part of G1's. The accounts also differ on fidelity: G1 says resources are followed directly and also changed, which suggests a hybrid practice; G3 treats resources as references; G2 reports "sometimes" for each. G2's selection was tied to an item grid and to agreements with colleagues, so agency was not only individual. The item-level examples are narrated, so they show the changes in task demand that the teachers intended and reported.

Features that close down thinking

Asked about parts of resources that hinder deep learning, G1 and G3 described closure, features that narrow what students are asked to do. G1 named textbook problems "*yang hanya meminta siswa memasukkan angka ke dalam rumus*" (that only ask students to put numbers into a formula), problems whose "*polanya persis sama, hanya angkanya saja yang diganti*" (pattern is the same, only the numbers are changed), and a tutoring-centre module's box of shortcut formulas titled "*Trik Cepat Kilat*" that "*langsung mematikan rasa ingin tahu siswa*" (immediately kills students' curiosity). G3 said that "*beberapa resource masih didominasi soal rutin dan prosedural dengan konteks yang terbatas*" (some resources are still dominated by routine, procedural problems with limited context). On representations, G1 described students learning "*satu representasi saja, yaitu simbol abstrak*" (one representation only, abstract symbols) and G3 representations "*masih terbatas pada simbol dan angka*" (still limited to symbols and numbers). G2 said only that "*tidak semuanya merepresentasikan apa yang menjadi kebutuhan*" (not all of them represent what is needed) and that "*beberapa soal memiliki Tingkat kesulitan yang tidak sesuai, kadang lebih mudah, kadang sangat sukar*" (some problems have an unsuitable level of difficulty, sometimes easier, sometimes very hard).

Views on instructions and discussion diverged. G1 criticised "*Petunjuk yang Terlalu Mendikte*" (instructions that dictate too much), step-by-step like a recipe, whose execution "*merampas proses berpikir*" (robs the thinking process); G3 said instructions that are "*terlalu umum atau terlalu berfokus pada langkah-langkah prosedural*" (too general or too focused on procedural steps) limit exploration; G2 said "so far, *petunjuk mudah diterapkan*" (so far, the instructions are easy to apply). On discussion, G2 noted that some sources offer discussion "*akan tetapi tidak pada tahap pendampingan, sehingga tetap peran guru dibutuhkan*" (but without a guidance stage, so the teacher's role is still needed), and G1 warned that group discussion can become "*pemborosan waktu yang tidak membuahkan pemahaman konseptual*" (a waste of time that yields no conceptual understanding) if poorly managed. G3, in contrast, described resources as limited in discussion activities and said "*saya menambahkan kegiatan diskusi dan kerja kelompok*" (I add discussion and group work).

Interpretation For G1 and G3 the constraints cluster around closure: single answers, fixed patterns, dictated steps and single representations leave little for students to reason about, which is consistent with the finding that textbook tasks are often template-solvable (Jäder et al., 2020). G2's constraints concern fit, in difficulty and coverage, and missing guidance for discussion, not closure. The contradictions about instructions and discussion are retained because they show the same kind of feature being judged against different aims. G1's shortcut-box example comes from a tutoring-centre module that students use, so it describes a resource in students' environment more than a classroom resource.

Features that open thinking

Asked which characteristics help them enact deep learning, G1 described resources that "*tidak langsung memberikan jawaban akhir*" (do not give the final answer directly) but act as a "*pemicu atau pemantik*" (trigger), and digital or manipulative resources that let students do trial and error instantly, such as GeoGebra or PhET simulations. G3 listed resources "*yang memiliki permasalahan kontekstual, mendorong penalaran dan pemecahan masalah, memberikan kesempatan untuk berdiskusi, menggunakan berbagai strategi, serta melakukan refleksi*" (that have contextual problems, encourage reasoning and problem solving, give opportunities to discuss, use various strategies and reflect). G2 named something different: "*bagian yang terlupakan dari deep learning adalah memastikan pondasi ada dan sudah kuat*" (the forgotten part of deep learning is making sure the foundation exists and is strong), so that "*perlu ada pembahasan atau review materi prasyarat sebelum konsep baru ditanam"* (prerequisite material needs to be discussed or reviewed before a new concept is planted).

The improvements the teachers wanted point the same way. G1 would provide "3-5 *soal saja per sub-bab, tetapi bertipe tugas terbuka* (Open-Ended) *atau kaya akan konteks nyata*" (only 3 to 5 problems per sub-chapter, but of an open-ended type or rich in real contexts). G3 would add "*soal kontekstual dan terbuka*" (contextual and open problems) and visual representations. G2 would change "*hamper* [sic] *semuanya*" (almost everything), "*Mulai dari pra learning, mean learning, asesmen, hingga tindak lanjut*" (from pre-learning and main learning to assessment and follow-up), because "*Belum ada yang secara lengkap mengakomodir kebutuhan guru*" (nothing yet fully accommodates teachers' needs).

For G1 and G3 a supportive resource hands thinking to students: it triggers, allows trial and error, or sets open and contextual problems. For G2 a supportive resource is complete and sequenced, with prerequisites reviewed first. These are compatible but different views of what depth requires, openness in one case and foundation in the other. That the teachers can name affordances and constraints in these terms resembles the awareness of a resource's affordances and constraints that has been linked to design capacity (Jukić Matić, 2019).

Feasibility conditions and the location of the decisive factor

All three teachers named time, learner diversity, class size and assessment. On time, G2 said that "*kebanyakan alur pembelajaran membutuhkan waktu yang lama, sementara kenyataan hanya singkat*" (most learning sequences need a long time while in reality the time is short), G1 that the curriculum is crowded while deep learning needs longer exploration, discussion and reflection, and G3 that the response is to "*memilih aktivitas yang paling esensial dan mengatur waktu secara efektif*" (choose the most essential activities and manage time effectively). On diversity, G2 described "*kemampuan anak yang sangat beragam dengan* gap knowledge *yang sangat jauh*" (very varied abilities with very large knowledge gaps), and G1 said that students with a weak base "*bisa tertinggal*" (can be left behind). On class size, G2 said "1 *guru dengan 36 siswa itu akan sangat tidak maksimal*" (one teacher with 36 students is far from optimal) and G1 that almost all classes have more than 30 students. On assessment, G2 said it "*akhirnya harus dibuat sama, paling hanya membedakan siswa yang berkebutuhan khusus saja*" (in the end has to be the same, only differentiating students with special needs), G1 that many school assessments are still multiple-choice or quick calculation, and G3 that deep learning needs assessment of "*proses berpikir, penalaran, strategi penyelesaian, dan kemampuan refleksi*" (thinking process, reasoning, solution strategies and reflection). Facilities were judged differently: G2, "*cukup baik dan menunjang*" (fairly good and supportive); G3 described limited facilities for media and technology; and G1 observed that "*Terkadang fasilitas sudah ok, tetapi guru ingin yang praktis*

dan cepat, akhirnya ragu-ragu untuk memulai" (sometimes facilities are fine but teachers want something practical and fast and end up hesitant to start).

The teachers located the decisive factor differently. G1: "*yang paling menantang bukan ketersediaan resource, tetapi bagaimana guru mengintegrasikan resource dengan kurikulum, asesmen, dan manajemen kelas*" (what is most challenging is not the availability of resources but how teachers integrate resources with curriculum, assessment and classroom management). G3: effectiveness "*tetap bergantung pada kemampuan guru dalam memilih, menyesuaikan, dan mengembangkan* resource" (still depends on the teacher's ability to select, adapt and develop resources). G2 pointed upstream: the curriculum is "*sangat baik*, *hanya* missed 1 *hal, tidak melihat input, tidak melihat pondasi*" (very good, but misses one thing, it does not look at input or foundations), and the remaining question is "*bagaimana mengenali pondasi atau kemampuan awal*" (how to recognise foundations or prior ability). For support, G1 asked for "Workshop, *seminar, atau* lesson study" and a "Forum *berbagi pengalaman, ide, dan bahan ajar antar guru*" (forum for sharing experience, ideas and teaching materials among teachers); G3 for "*pelatihan dan pendampingan yang berkelanjutan, ketersediaan resource yang sesuai, serta waktu yang cukup*" (continuing training and mentoring, suitable resources and enough time); and G2 for "*semua aspek dari permasalahan di atas*" (all aspects of the problems above).

Interpretation. The three accounts share the same constraints but attribute them differently. G1 and G3 place the decisive factor in the teacher's work of integration and adaptation, which makes teacher agency central but leaves the burden of time and assessment alignment with the teacher. G2 places it in learners' prior knowledge and in a curriculum that, in G2's view, does not take it into account; in this account adaptation is necessary but cannot compensate.

Table 2 Themes, participants' positions and analytical contrasts

RQ	Theme	Participants' positions	Analytical contrast
RQ1	1. Depth as understanding beyond procedure, warranted in different ways	G1: self-correction, asking why. G2: "Ahaa!" effect, at most 25% of the class. G3: explanation, application, reflection	Same definition, different evidence; only G2 describes a gap between design and practice
RQ1	2. Fostering depth by restructuring the learning path	G1: hints, constructed formulas, deliberate error. G2: prerequisites, then modified problems. G3: trigger questions, contextual problems, reasons	Three design principles; reported transfer differs (G2: often not)
RQ2	3. Teacher authority over resources: selecting, modifying and reconstructing	G1: combines resources, rewrites items. G2: builds material from several sources, selects by item grid. G3: uses resources as reference, changes context and difficulty	Selection, modification and reconstruction are distinct forms of resource work (an analytic distinction); G2's choices tied to colleague agreements
RQ3	4. Features that close down thinking	G1: shortcut boxes, repeated patterns, dictating instructions. G2: items mismatched in difficulty, discussion without guidance. G3: routine items, narrow representations	Views on instructions and discussion diverge (G2: instructions easy to apply; G3: too few discussion tasks)

RQ3	5. Features that open thinking	G1: triggers, trial and error, open tasks. G2: prerequisite review, complete lesson cycle. G3: context, reasoning, strategies, reflection	G1 and G3 stress openness; G2 stresses foundations and completeness
RQ4	6. Feasibility conditions and the location of the decisive factor	All: time, learner diversity, class size, assessment. G1 and G3: teacher integration. G2: learners' foundations and curriculum input	Same constraints, different attribution; facilities judged adequate (G2) and limiting (G3)

Discussion

The findings are grounded in what the teachers reported about their understanding of deep learning and their work with resources. The discussion therefore treats the described adaptations as the teachers' own accounts, and their statements about effects on students as perceptions.

The teachers' definitions correspond to the pedagogical meaning of deep learning identified in reviews of mathematics education (Gusti & Amastini, 2025; Salma & Wijayanti, 2025) and to the meaningful, mindful and joyful framing in a recent pedagogical account (Siregar et al., 2025). G3's repeated use of the policy phrase suggests that policy language is available to teachers as a vocabulary for describing their aims. What the transcripts add is variation in warrants: self-correction and questioning (G1), explanation, application and reflection (G3), and visible engagement when problems are modified (G2). G2's estimate that at most a quarter of the class experiences deep learning, and the image of a house built on a weak foundation, treat depth as dependent on prior learning and not only on lesson design, a point taken up below.

The accounts of resource work are consistent with a view of teachers as designers who continue designing as they use resources (Pepin, Choppin, et al., 2017) and with case studies of teachers who offload, adapt and improvise (Jukić Matić, 2019). The three components of design capacity (Pepin, Gueudet, et al., 2017) help to read the data. The goal the teachers described, understanding beyond procedure, was similar, whereas the design principles they expressed differed: withholding answers and inviting error (G1), building from prerequisites (G2), and cycles of contextual problems and reasons (G3). Reflection appears mainly as a classroom aim and not as a reported way of revising resources.

The accounts also suggest a distinction among selecting, modifying and reconstructing resources that these frameworks do not make explicit. Selection, choosing and omitting parts of a resource, appears in all three accounts (for example G2's use of an item grid). Modification, changing the context, difficulty or question set of individual items, is described concretely by G1 and G3. Reconstruction, assembling new material from several sources, is G2's main mode and part of G1's. This distinction is offered as an analytic interpretation derived from the interview data, not as a validated taxonomy. It separates changes of different scope, namely to the set of resources, to individual tasks and to the lesson material as a whole, and it asks who controls each change: the teacher, the textbook author or the subject teachers' forum. Whether the three forms differ in cognitive demand would require analysis of the original and adapted resources, which is a task for further research.

Agency was also bounded. G2's choices were tied to an item grid and to agreements with colleagues in the subject teachers' forum, and all three teachers named time and assessment as limits. This parallels evidence that agency in curriculum work is shaped at the school level as well as the individual level (Kneen et al., 2023), arises from the interplay of past experience, present material and relational conditions and future aims (Hizli-Alkan et al., 2026), and is contested when curriculum resources do not support it (Gustafsson et al., 2024). The accounts also differ from a lesson-study study in which teachers followed textbook activities

closely and made only superficial changes (Thobela et al., 2023); the difference may reflect the teachers, the setting or the form of the data.

The features the teachers described as closing down thinking, namely single-answer routine items, recipe-like instructions and single representations, resemble the textbook task profile reported across twelve countries, where most tasks could be solved by copying a template (Jäder et al., 2020). If the task is read as the context for students' thinking (Tekkumru-Kisa et al., 2020), it is understandable that G1 and G3 treat modifying items as the central adaptation, because changing the task changes what students are asked to do. The teachers did not agree on which features matter, however. G2 regarded instructions as easy to apply and located problems in fit and coverage, while G1 and G3 regarded instructions as dictating or too procedural. On discussion, G1 and G2 warned that unsupported group work may not yield understanding, whereas G3 described a lack of discussion tasks and added them. These disagreements indicate that a feature is supportive or constraining in relation to a teacher's aims and class, not as a property of the resource alone. This supports an interactional reading of resources and cautions against fixed checklists of ideal resource features.

Prerequisite knowledge emerged as an input into teachers' resource decisions, with different weight in the three accounts. G2 made it central: depth was said to depend on a sufficiently strong foundation ("pondasi"), a lesson sequence begins with review of prerequisite material, items were judged by whether their difficulty fits learners (some are "kadang lebih mudah, kadang sangat sukar", sometimes easier, sometimes very hard), and the curriculum was criticised for not looking at learners' input. In G2's account, prerequisite knowledge therefore served as a criterion for judging items, as the starting point for restructuring the learning path, and as the limit of what adaptation can achieve. G1 mentioned it more briefly, noting that students with a weak base can be left behind, and G3 referred to learners' needs and characteristics in general terms without naming prior knowledge. If tasks are read as contexts for students' thinking (Tekkumru-Kisa et al., 2020), a judgement that a task is too easy, too hard or well placed is also a judgement about what students already know. Prerequisite knowledge therefore appears to operate as an implicit input in each form of resource work: when items are selected by difficulty, when a context is modified, and when material is reconstructed from prerequisites towards complex ideas. Similar concerns appear in an Indonesian study in which students with weak foundations participated less (Suriyana et al., 2026) and in a study of secondary teachers who reported challenges related to students' knowledge when implementing cognitively demanding tasks (Monarrez & Tchoshanov, 2022). The teachers did not describe how they assess prior knowledge, and G2 named this as an open question; how prerequisite knowledge is diagnosed therefore remains a question for further research.

The accounts also suggest that the policy aspiration is realised through teachers' decisions under constraints of time, assessment and class size, which echoes reported constraints in the Merdeka Curriculum and in the implementation of deep learning pedagogy in primary schools (Hidayah et al., 2025; Sudirman & Pandang, 2025; Suriyana et al., 2026). Time constraints, assessment difficulties and the value of collaboration with colleagues also appear in secondary teachers' perspectives on integrating rich mathematical tasks (McKie et al., 2025). The divergence between locating the decisive factor in teacher integration of resources (G1, G3) and in learners' foundations and curriculum input (G2) cautions against assuming that resources and training alone will realise deep learning. The data do not allow the differences to be attributed to experience (15, 7 and 12 years), qualification or school context.

The study is an in-depth qualitative examination of three teachers from one public school in Jakarta, recruited through the author's professional networks. Its findings are analytic and are not intended to represent teachers more widely, and shared school conditions may contribute to similarities across the accounts. The author knew the teachers professionally, which may have shaped what they said and how it was interpreted. The data are interview accounts; classroom observation, the resources themselves and student data were not

part of the study. Coding was carried out by one analyst, and the distinction among selection, modification and reconstruction was derived from these accounts and has not been tested on other data. Future studies could pair interviews with lesson observation, collect original and adapted resources, examine student work, and include teachers from other schools and regions.

CONCLUSION

This study examined how three Indonesian junior secondary mathematics teachers describe their understanding of deep learning and their selection, adaptation and evaluation of learning resources. In answer to RQ1, all three described deep learning as understanding beyond formulas and procedures, but they accepted different evidence of it (self-correction and questioning for G1, visible engagement and transfer when problems are modified for G2, explanation, application and reflection for G3), and they described fostering it by restructuring the learning path through hints, prerequisite review or contextual reasoning cycles. In answer to RQ2, they reported exercising authority over resources by selecting, modifying and reconstructing them, with G1 and G3 giving item-level examples of modification and G2 describing the reconstruction of material from several sources. In answer to RQ3, they reported that routine single-answer items, dictating or over-general instructions, single representations and unguided discussion close down thinking, whereas triggers, trial and error, open and contextual problems and prerequisite review open it up; they did not agree on every feature. In answer to RQ4, time, learner diversity, class size and assessment limited what was feasible, and the teachers located the decisive factor in teacher integration of resources (G1, G3) or in learners' foundations and curriculum input (G2).

The study offers an in-depth qualitative account of teacher agency in adapting learning resources for deep learning, grounded in the interview accounts of three junior secondary mathematics teachers. Its main analytical contribution is a distinction among selecting, modifying and reconstructing resources, derived from the interviews rather than imposed on them, which describes forms of resource work that differ in scope, in time demands and in who controls the change. It also shows learners' prerequisite knowledge informing teachers' resource decisions, as a criterion for judging items, a starting point for sequencing and a limit on what adaptation can achieve, an input that is not made explicit in the frameworks used here. Practically, the accounts point resource developers to prerequisite review, open and contextual tasks, multiple representations and guided discussion, and point professional development to task adaptation and collegial sharing. For curriculum reform, they indicate that these teachers see the realisation of deep learning as depending on time, assessment and class conditions as well as on resources and training. Because the evidence consists of interview accounts from one school, these interpretations concern teachers' reported reasoning and practice, and they are offered for comparison with studies of classroom practice, student learning and other settings.

RECOMENDATIONS

Based on the findings, the following recommendations are offered as proposals for practice and further testing. For resource developers: include prerequisite review, open or context-rich tasks, more than one representation and guidance for discussion, while leaving room for teachers to adapt. For professional development: address how teachers select, modify and reconstruct resources, how they plan within limited time, and how they can share and review adapted materials in collegial forums or lesson study, as G1 requested. For curriculum reform: recognise that time, class size, assessment format and learners' prior knowledge shape what teachers can do with any resource. For future research, it is recommended that interviews be combined with lesson observation, collection of original and adapted resources, and analysis of student work, and that more teachers and schools be included.

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