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INTEGRATING TEACHER AND EXAMINATION EVIDENCE TO DERIVE DESIGN REQUIREMENTS FOR A FORM FOUR TOPOGRAPHIC-MAP E-MODULE

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ABSTRACT

This qualitative descriptive study identified instructional requirements for an interactive e-module for Form Four topographic-map learning. Conducted within the Analysis phase of an ADDIE-based development project, it treated ADDIE as an instructional design framework rather than a research methodology. Four experienced secondary Geography teachers were selected through criterion-based purposive sampling. Documentary evidence comprised an anonymised item-level matrix for 38 students and 14 complete low-performing scripts from a common 15-mark question in the 2025 Form Four Year End Geography Examination. Interviews were analysed through hybrid deductive-inductive thematic analysis; the records were examined through descriptive summaries and qualitative content analysis. Scores ranged from 0 to 9/15 (M = 3.79, SD = 1.95). Grid reference and bearing each yielded 5 of 38 available marks (13.2%), whereas crop-symbol identification yielded 30 of 38 (78.9%). Integrated analysis identified convergent procedural and explanatory difficulties while preserving evidential limits concerning learner behaviour. The findings generated provisional requirements for segmented visualisation, guided practice, explanatory feedback, higher-order tasks, self-checking and online-offline access. They do not establish e-module effectiveness, which requires subsequent validation and evaluation.

Keywords: *Geography education, interactive e-module, instructional needs analysis, qualitative description, topographic-map skills.*

INTRODUCTION

Geographical skills enable students to interpret spatial representations and reason with evidence. The Malaysian Form Four curriculum requires direction, six-figure grid references, bearing, distance, area, relief and relationships between physical and cultural features (Bahagian Pembangunan Kurikulum, 2018). These tasks combine procedural sequences, visual-spatial information, numerical operations and geographical concepts.

Topographic-map interpretation is therefore cognitively demanding. Students must translate two-dimensional symbols and contours into spatial relationships, select correct reference points and justify conclusions with map evidence (Carbonell Carrera & Bermejo Asensio, 2017; National Research Council, 2006). Research also reports difficulty visualising landforms and transferring basic map knowledge to analytical tasks (Mathews et al., 2023; Wedikandage, 2024).

Digital resources can enlarge maps, demonstrate procedures and provide practice with feedback, but multimedia alone does not ensure instructional relevance. Design decisions must respond to the curriculum, students' error patterns, classroom conditions and unequal access to devices and connectivity. They must also specify which difficulty a feature is intended to address and what later

evidence would show that the response is useful. A needs analysis is therefore required before content, scaffolds and delivery arrangements are specified.

Self-directed learning (SDL) is relevant because map skills require repeated practice. Knowles (1975) described SDL as learners' increasing responsibility for diagnosing needs, selecting strategies and evaluating learning. Examination responses, however, show written performance rather than revision, monitoring or initiative; such behaviours require interview, observation or trace evidence.

This study integrated experienced teachers' accounts with item-level examination evidence and low-performing scripts. Its contribution is a transparent evidence-to-design pathway for curriculum-specific e-module requirements in Form Four Geography. By keeping each source within its evidential limits, the study seeks to show why particular supports are proposed and which claims must await later testing. It is not an evaluation of an e-module.

The study was guided by three research questions:

1. What procedural, conceptual and written-response difficulties are evident in the item-level examination records of 38 Form Four students and the complete examination scripts of 14 low-performing students examined as information-rich cases?
2. How do experienced Geography teachers perceive students' instructional dependence, independent learning practices and support needs when learning topographic-map skills?
3. What provisional e-module design requirements emerge from integrating teacher interview evidence with students' examination-response patterns?

LITERATURE REVIEW

Geography Skills and Topographic-Map Interpretation

Spatial thinking combines concepts of space, tools for representing space and reasoning with spatial relationships (National Research Council, 2006). Topographic maps bring these components together:

students must recognise the representational system, locate features, determine direction and distance, and relate mapped evidence to geographical processes. Procedural accuracy and interpretation are therefore interdependent. An incorrect location or measurement can undermine later reasoning, while weak conceptual understanding can make an observation geographically meaningless.

The shift between a two-dimensional map and a three-dimensional landscape is particularly demanding. Augmented three-dimensional representations can support relief interpretation and spatial orientation (Carbonell Carrera & Bermejo Asensio, 2017), while sustained hands-on and geospatial activities can strengthen understanding of topographic maps (Mathews et al., 2023). These supports do not remove the need for explicit teaching of reference-point selection, eastings-northings order and bearing measurement.

A structured map item may require a student to identify a feature, select a tool, recall a sequence, calculate or estimate a value and record it in the required form. When component knowledge is not automated, simultaneous demands may exceed working-memory capacity (Sweller, 2011). Instruction should therefore segment complex procedures, highlight critical features and provide repeated practice before support is reduced.

Procedural Accuracy and Geographical Reasoning

Procedural accuracy is necessary but insufficient for geographical competence. Six-figure grid references and bearings test accurate rule application, whereas higher-order items require students to infer relationships among relief, drainage, accessibility, land use and settlement. Those responses must select relevant mapped features and use them as evidence rather than list general geographical facts.

Students may identify a symbol yet misclassify it or fail to relate it to the wider landscape. Difficulties often persist when learners move from map reading to interpretation (Wedikandage, 2024), while guided inquiry can develop geographical concepts and reasoning (Kriewaldt et al., 2023). Errors may also reflect numeracy, tool use, language, command-word interpretation or time pressure; a needs analysis should not assign every error to one deficit.

The transition from identification to explanation should therefore be visible in the learning sequence. Learners may first classify individual features, then compare relationships, select evidence and justify a conclusion. At the same time, alternative explanations such as language difficulty, numeracy, unfamiliar tools and examination pressure must remain open until tested with evidence that can distinguish them.

Self-Directed Learning and Teacher Support

SDL concerns learners' increasing responsibility for identifying needs, choosing resources and judging progress (Knowles, 1975). It is related to, but distinct from, self-regulated learning, which emphasises planning, monitoring, motivation and reflection during task performance (Pintrich, 2004; Zimmerman, 2000). Relevant map-learning behaviours may include replaying a demonstration, practising with a new map, checking an answer against criteria and seeking help after identifying a specific difficulty.

Teacher guidance remains necessary while complex skills are developing. Scaffolding adjusts support as competence grows (van de Pol et al., 2010; Wood et al., 1976), and digital environments can provide worked examples, prompts, feedback and hints (Azevedo & Hadwin, 2005; Sharma & Hannafin, 2007). Such features cannot be assumed to produce independence without evaluation.

This distinction determines what each source can support. Teacher interviews can describe observed classroom patterns and professional interpretations of revision or help-seeking. Examination scripts can show whether a response is correct, inaccurate, incomplete, irrelevant or blank, but not why the student responded in that way. The scripts were therefore restricted to written performance and were not used to measure SDL.

Interactive E-Modules and Digital Learning

Interactive e-modules commonly combine structured content, multimedia, navigation, practice and feedback, but their pedagogical purposes vary. Geography modules have supported problem-based environmental learning (Wijayanto et al., 2023), ICARE-STEM spatial thinking (Zuhria et al., 2023), project-based lithosphere learning (Marpaung et al., 2025) and basic map knowledge (Sya'bani et al., 2026). Collectively, these studies show that the term e-module covers products ranging from digital flipbooks to more interactive resources. Their value must be judged by instructional alignment, learner use and tested outcomes rather than digital format alone.

The proposed resource is specific to Malaysian Form Four map skills and begins with integrated teacher and examination evidence. It combines procedural scaffolding with geographical reasoning and must support online and offline use. These distinctions identify a design niche, not superiority; usability and learning effects require later testing.

Specifically, the intended design must address six-figure grid references, bearing, distance and interpretation of topographic-map evidence. It also needs to connect procedural scaffolding with higher-order geographical reasoning, rather than concentrate on one content topic or learning model. Finally, essential explanations and practice must remain usable when connectivity, devices or school facilities are limited. These requirements define the context for design rather than evidence that the future resource will be superior.

Research Gap

Digital geography studies report engagement, spatial-thinking or achievement outcomes in particular contexts, but fewer studies show

how curriculum-specific e-module requirements are derived from complementary needs evidence before a product is designed. Authentic examination patterns are not always traced explicitly to the scaffolds, feedback and task structures proposed for a later resource. The gap is therefore methodological as well as contextual: a defensible chain is needed from evidence of instructional need to provisional design requirements without premature effectiveness claims.

This qualitative descriptive assessment addressed that gap by analysing teacher interviews and examination records separately before comparing convergence, complementarity and evidential limits. Interviews provided contextual accounts of instruction and perceived learning practices; records provided a distinct view of procedural and written-response patterns. The integrated requirements were treated as testable design hypotheses.

METHODOLOGY

Research Design and Relationship to ADDIE

A qualitative descriptive design (Sandelowski, 2000) was used for a practice-oriented and contextually grounded assessment of Form Four topographic-map learning. The study sought a direct account of students' learning difficulties, teachers' observations of support needs and requirements for a digital resource. It formed the Analysis phase of a wider ADDIE project; ADDIE guided instructional development and was not the research methodology. Later design, validation, implementation and evaluation were outside this article.

Two complementary evidence sources were used: individual semi-structured interviews with experienced Geography teachers and existing examination records. The documents comprised an anonymised item-level matrix for 38 students and 14 complete low-performing scripts. Descriptive statistics characterised the supplied record and contextualised written-response patterns only. They were not treated as an independent quantitative strand, and no inferential analysis was conducted; the design remained qualitatively oriented.

The unit of analysis differed by source. For interviews, it was a meaning unit addressing difficulty, instructional support, independent learning or e-module requirements. For documents, the analytical units were marks for each of nine subitems and individual written responses within the 14 complete scripts. Teachers and complete scripts remained the cases within which those units were interpreted.

Research Context and Teacher Participants

The teacher dataset was collected in Sabah, Malaysia. Four secondary Geography teachers from Beaufort, Tawau, Tuaran and Kota Kinabalu were selected through criterion-based purposive sampling. Reporting the districts provides contextual variation without linking a participant to a particular school.

Eligibility required at least 10 years of Geography teaching; Form Four or upper-secondary experience; experience teaching and assessing grid references, bearing, distance, scale and topographic-map interpretation; familiarity with the Form Four curriculum; and willingness to participate voluntarily.

Table 1
Characteristics of the Teacher Participants

Teacher	Geography teaching experience	Upper-secondary experience	Relevance to the needs analysis
R1	11 years	Forms Four and Five	Grid references, bearing, distance and topographic-map skills; slides and self-produced demonstrations
R2	16 years	Forms Four and Five	Bearing, distance, direction and map-interpretation difficulties

R3	More than 22 years overall	Approximately 3-4 years in Forms Four and Five		Visual materials, worksheets, group work and topographic-map exercises
R4	17 years	Approximately 15 years in upper secondary		Lower-performing classes; grid-reference, bearing, distance and interpretation difficulties

The adequacy of four interviews was considered against the narrow aim, participant specificity and focused protocol rather than statistical representation (Malterud et al., 2016). All participants had lengthy, directly relevant experience. Data adequacy was judged by depth, relevance and recurrence of important patterns. The study does not claim universal thematic saturation or representation of all Sabah Geography teachers.

Documentary Records and Selection of Examination Scripts

The documentary dataset originated from one school's 2025 Form Four Year-End Geography Examination. The supplied records included an anonymised 38-case matrix across nine subitems in a common 15-mark topographic-map question. The entire matrix was retained to describe item-level performance. Fourteen complete low-performing scripts were available for close examination because they contained low scores, omissions or errors directly relevant to the target skills. Their scores were 0-6/15 (M = 3.0): 0 (one script), 2 (five), 3 (three), 4 (three), 5 (one) and 6 (one).

The 14 scripts were treated as information-rich cases rather than a statistically representative subsample. They enabled examination of incorrect, incomplete, unsupported, irrelevant and blank responses. Because the available selection record documented no formal numerical cut-off, 0-6/15 is reported descriptively rather than as a pre-specified threshold. The scripts were not used to estimate prevalence among all Form Four students. Personal identifiers were removed and the scripts coded S01-S14.

Instruments and Data Collection Semi-Structured Interview Protocol

The semi-structured protocol contained 15 questions across five domains: teaching practice; students' mastery and cognitive difficulty; classroom guidance and scaffolding; teachers' perceptions of independent, self-directed and self-regulated learning; and e-module requirements. Three content experts reviewed relevance and adequacy, producing item- and scale-level content-validity indices of 1.00. One language expert reviewed clarity and wording (mean = 3.73/4). Recommended revisions were incorporated before data collection.

Interviews were conducted individually in Malay and digitally recorded after participants granted verbal permission to participate and be recorded. The common protocol ensured domain coverage, while follow-up questions elicited concrete examples, contrasting cases and contextual constraints. Recordings were transcribed in Malay. Reported quotations were translated into English and lightly edited only to remove fillers and obvious transcription artefacts while preserving meaning.

Documentary Analysis Framework

Two linked matrices organised the documentary evidence. One recorded marks for each of nine subitems across 38 anonymised cases. A second retained the 14 complete scripts by case and subitem, classifying responses as accurate, inaccurate, incomplete or unsupported, irrelevant, or blank. Responses were also classified by feature identification, six-figure grid reference, bearing, physical-cultural interpretation, settlement or land-use interpretation and geographical justification.

Data Analysis

Analysis of Teacher Interviews. Interviews were analysed through a hybrid deductive-inductive thematic approach (Braun & Clarke, 2022). Deductive domains followed the research questions: technical map skills, interpretation, teacher support, independent learning and e-module requirements.

Coding remained open to unanticipated patterns. Inductive codes included reversed eastings and northings, bearings above 180 degrees, classification errors, contrasting revision practices and online-offline access.

Analysis involved repeated transcript reading, identification and coding of meaning units, within- and cross-participant comparison, grouping of related codes, candidate-theme development and review against complete transcripts. Contrasting cases were retained rather than forced into a single account. Reports of independent revision by R1 and R3, for example, prevented a general claim that all students lacked SDL.

Analysis of Documentary Records. The 38-case matrix was summarised by score frequencies, mean, median, standard deviation and the proportion of marks obtained relative to those available for each subitem. These figures described the supplied record and did not support population estimates. The 14 scripts underwent qualitative content analysis (Bowen, 2009) for accuracy, completeness, relevance and evidential support, with patterns grouped by topographic-map skill. Complete cases distinguished wholly blank scripts from partial mastery. Records described written performance only and were not used to infer motivation, confidence, persistence or monitoring.

Integration of Interview and Documentary Evidence. After the datasets had been analysed separately, a joint matrix compared teacher themes with patterns in the examination records. Convergence denoted the same instructional difficulty; complementarity denoted added explanation or specificity; divergence or limitation denoted difference or an unsupported interpretation. Thus, teacher reports of dependence remained professional perceptions because scripts could not confirm revision, monitoring or initiative. Integrated findings generated provisional, testable design requirements rather than effectiveness claims.

Trustworthiness and Reflexivity

Credibility was supported by complementary sources, direct quotations, anonymised script examples and retention of contrasting cases. Dependability and confirmability were supported by coding records linking evidence to codes and themes, consistent case-by-item analysis and checks of aggregate interpretations against the 38-case matrix. Description of context, selection and study boundaries supported transferability.

One researcher conducted the coding; no inter-rater coefficient was calculated. The first author's experience as a secondary Geography teacher supported curricular and contextual understanding but also risked privileging familiar classroom explanations. Reflexive checks therefore revisited original evidence, considered alternative explanations, retained negative cases and distinguished teacher interpretation from documentary findings.

Ethical and Administrative Considerations

Administrative approval was obtained through the Ministry of Education Malaysia's Education Research Application System on 18 April 2026 (KPM.600-3/2/3-eras (28426)) and the Sabah State Education Department on 13 May 2026 (JPNSBH.SPS.600-1/1/1 Jld. 48 (28)). Universiti Malaysia Sabah issued a school request on 18 May 2026 (DT2511005T), after which the principal authorised data collection and record access. These were administrative, not institutional research-ethics, approvals. Teachers participated voluntarily after being informed of the study and confidentiality arrangements and gave recorded verbal consent. They were identified as R1-R4.

The marks and scripts were existing educational records; students were neither recruited nor contacted. School access was facilitated by the subject teacher. Names were removed from the matrix and complete scripts coded S01-S14. Formal prospective UMS ethics review and student or parental consent were not obtained for the archival analysis. Administrative permission, de-identification and restricted reporting do not resolve this limitation. Publication use of the records therefore requires explicit institutional and editorial determination; otherwise, the student-record evidence should be removed.

FINDINGS

Five themes were identified: procedural fragility; conceptual confusion and limited map-based reasoning; uneven written performance; teachers' perceptions of dependence and varied independent practice; and requirements for scaffolded, flexible support. Figures describe only the 38 supplied records; S01-S14 denote the complete scripts. Quotations are English translations from Malay.

Procedural Fragility in Grid References and Bearing

All teachers identified recurring procedural difficulty. R2 stressed the need for repeated practice:

> They usually need a lot of practice before they understand how to measure a bearing accurately. (R2)

R4 reported reversal of eastings and northings and confusion when bearings exceeded 180 degrees. The documentary evidence converged: grid reference and bearing each yielded only 5/38 available marks (13.2%). These very low item totals describe the available record rather than the wider student population, but they identify the same procedural areas raised independently by the teachers.
S01 (4/15) identified Bukit Mayang and rubber but recorded an invalid grid reference and no valid bearing. S12 (6/15) identified several features yet still produced inaccurate grid-reference and bearing responses. Factual recognition therefore did not ensure procedural mastery.

The pattern may reflect sequencing, reference-point selection, protractor use, numeracy or examination pressure. It supports visible step-by-step demonstrations and error-specific feedback but does not establish one cause.

Conceptual Confusion and Limited Map-Based Reasoning

Teachers distinguished symbol recognition from geographical classification. R2 stated:

> They say oil palm, rubber and paddy are physical features, even though these are cultural features. (R2)

Item marks showed the same transition problem. Crop-symbol identification yielded 30/38 available marks (78.9%), compared with 21/76 (27.6%) for a crop factor, 15/76 (19.7%) for physical features, 13/114 (11.4%) for housing-site evaluation and 27/114 (23.7%) for settlement function. Thus, the strongest performance occurred on direct identification, whereas questions requiring classification, interpretation or a supported judgement produced much lower proportions of the available marks.

S01 answered selected identification items but supplied no developed explanation; S12 showed stronger identification but insufficiently supported analytical responses. Instruction should model how map evidence supports a geographical claim.

These findings concern written reasoning, not students' complete internal understanding. Command-word interpretation, language and time may also have affected responses.

Uneven and Incomplete Written Performance

Scores were 0-9/15 (M = 3.79, SD = 1.95); 33/38 cases (86.8%) scored 5 or below.

The 14 scripts ranged from S03, which left every subitem blank, to partial mastery. S12 earned 6/15 through correct identifications but did not complete the procedural and analytical components. Other scripts attempted most subitems but combined accurate basic responses with incorrect procedures or unsupported explanations. Low scores therefore represented different response profiles rather than an identical absence of map knowledge.

Non-completion under examination conditions does not demonstrate low confidence, weak revision or dependence. Time, anxiety, prerequisite knowledge or strategic omission remain plausible.

Teachers' Perceptions of Dependence and Varied Independent Learning Practices

R2 and R4 perceived substantial reliance on guidance among weaker students. R2 stated:

> They really need guidance and practice from the teacher. (R2)

The accounts were not uniform. R3 reported:

> Some do it, but some depend on the teacher. Motivated students revise independently and ask the teacher. (R3)

Teachers therefore perceived varied practices shaped by motivation, prior mastery, access and class context, rather than uniformly weak SDL. The contrasting account is important because it prevents the design from treating every learner as equally dependent.

This theme is based on teacher observation. The scripts contain no behavioural evidence of revision, monitoring or initiative.

Requirements for Interactive, Scaffolded and Flexible Support

Teachers requested step-by-step explanation, practice and explanatory feedback. R3 proposed:

> Interactive exercises that students answer should provide the answer immediately and explain why their answer is wrong. (R3)

For grid references and bearing, teachers wanted replayable demonstrations and guided practice. For interpretation, they proposed enlarged symbols, annotated examples, physical-cultural comparisons and guided higher-order questions. These are proposed functions, not proven effects.

Connectivity, device ownership, school phone rules and ICT access also varied. R2 summarised the requirement:

> I think both are needed ... when there is an internet disruption, offline materials are also necessary. (R2)

Essential explanations and practice should therefore remain available offline, with online interactive functions used where facilities permit.

Table 2 integrates the evidence and states provisional requirements rather than effectiveness claims.

Table 2

Integrated Summary of Evidence and Provisional E-Module Requirements

Integrated theme	Interview evidence	Document evidence	Interpretation and boundary	Provisional design requirement
Procedural fragility	Difficulty with bearings, reference points, eastings-northings order and practice	Grid reference and bearing each yielded 5/38 marks (13.2%); invalid, inaccurate and blank responses occurred	Both sources indicate difficulty but not one cause	Segment procedures; show reference-point selection; add guided practice and step-specific feedback

Classification and reasoning	Confusion between physical and cultural features and linking features in explanations	Crop identification yielded 78.9%; analytical items yielded 11.4%-27.6%; explanations were often unsupported	Written answers show a recognition-to-explanation gap	Use symbol comparisons, annotated maps, evidence prompts and model explanations
Uneven performance	Teachers reported omission of difficult items	Scores were 0-9/15; 33/38 scored 5 or below; scripts ranged from blank to partial mastery	Non-completion does not reveal its cause	Use graduated tasks, prompts and retries; test completion and transfer
Dependence and independent practice	R2/R4 perceived dependence; R1/R3 reported independent revision among some students	Not assessable from scripts	SDL-related claims remain teacher perceptions	Provide optional hints, self-checks and progress cues; evaluate actual use
Flexible access	Teachers requested online and offline options because access varied	Not assessable from scripts	Accessibility is an implementation requirement	Provide an offline core and an online interactive version; evaluate accessibility and usability

DISCUSSION

Procedural Difficulty as a Multi-Component Problem

Teacher and documentary evidence indicates that grid reference and bearing should be design priorities. The evidence locates difficulty in reference-point selection, eastings-northings sequence, protractor orientation and response format, consistent with map reading as coordinated spatial, procedural and numerical work (National Research Council, 2006). An e-module should therefore expose the decisions within the procedure, not merely display a completed answer.

Cognitive load theory supports segmented procedures and worked examples followed by less-supported practice (Sweller, 2011). Yet missing tools, unclear printing and mixed numeracy may also explain errors. Animation alone is insufficient; activities should be tested across prior-knowledge and access differences.

From Feature Recognition to Evidence-Based Explanation

The contrast between crop identification (78.9%) and analytical items (11.4%-27.6%) supports a progression from recognition to justified interpretation. Spatial thinking requires reasoning with representations (National Research Council, 2006), and guided inquiry can develop geographical relationships (Kriewaldt et al., 2023). The instructional sequence should therefore make the move from naming a feature to selecting, connecting and explaining evidence explicit.

Digital tasks should require classification, selection of map evidence and construction of a conclusion. Coordinated words and relevant visuals are consistent with multimedia-learning principles (Mayer, 2020). Explicit modelling of command words and answer construction is also needed because weak responses may reflect language as well as spatial reasoning.

Teacher Support, Variation and Claims About SDL

Dependence appeared strongest among students perceived as weaker or less motivated. Scaffolding is appropriate when support enables gradual transfer of task responsibility (van de Pol et al., 2010). Contrasting accounts from R1 and R3, however, show that some students revised online and sought targeted help; a deficit description of all Form Four students is unwarranted. Optional rather than compulsory support may better accommodate variation in prior mastery and initiative.

Scripts cannot explain blank responses or measure SDL. Hints, progress cues, self-checks and retries should therefore remain design hypotheses. Later work should examine their use, fading and transfer to new maps without prompts.

Relationship to Existing Geography E-Modules

Existing problem-, project- and spatial-thinking e-modules support organised content, active tasks and visual representation (Marpaung et al., 2025; Wijayanto et al., 2023; Zuhria et al., 2023), and an interactive module has reported gains in basic map knowledge (Sya'bani et al., 2026). Their different content, learners and designs prevent transfer of effectiveness claims to the unbuilt module. The relevant lesson is the range of possible pedagogical structures, not an assumption that digitising content will reproduce another study's outcome.

This study adds curriculum-specific procedural feedback and explicit scaffolding of written geographical justification. Its methodological contribution is an auditable chain from separate teacher and examination evidence to testable design requirements.

Access and Implementation Context

A continuously online resource may exclude students who share devices or lack connectivity, while a static offline document cannot provide automated feedback. An offline core with explanations and printable practice, paired with online manipulation and checking, should be evaluated for usability and accessibility.

Limitations

The bounded study involved four purposively selected teachers, 38 item-level records and 14 low-performing scripts from one examination question. It does not estimate prevalence or represent average- and high-performing students. Teacher accounts may reflect particular classes and expectations; students were neither interviewed nor observed. The findings are therefore transferable only through comparison with similarly described contexts, not statistical generalisation.

One researcher coded the data without inter-rater reliability. The document analysis cannot distinguish knowledge gaps from time, language, anxiety or strategic omission. Most importantly, prospective institutional ethics review and student or parental consent were not obtained for the archival records. Publication remains subject to institutional and editorial determination.

CONCLUSION

This qualitative descriptive assessment integrated records for 38 Form Four students, 14 complete low-performing scripts and four teachers' accounts. The strongest convergence concerned six-figure grid references, bearing and the transition from feature identification to evidence-based explanation. Teachers also perceived variation in dependence and independent practice, but these behaviours were not inferred from scripts.

The evidence supports segmented demonstrations, guided and gradually released practice, explanatory feedback, support for higher-order answers, self-checking and online-offline access. These are hypotheses for design and evaluation, not evidence of improved achievement or independence. Future prospective student research should obtain the required ethics approval and consent before data collection.

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