

E-Learning in University Mathematics Education in Libya: A Critical Review of Student Attitudes and Technology Acceptance Evidence

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اتجاهات طلبة الرياضيات نحو التعليم الإلكتروني في ليبيا: تحليل نقدي للأدلة البحثية المتعلقة بالقبول والاستخدام التعليمي

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Abstract

Mathematics departments need evidence about students' attitudes before expanding electronic coursework. This paper examines published findings relevant to Libya and Bani Walid. It presents a critical narrative review of publicly accessible research. Searches combined English and Arabic location terms with mathematics, attitudes, electronic learning, and technology acceptance. Evidence was grouped by discipline, location, research design, and measured outcome. Direct Libyan evidence includes a survey of 392 mathematics and statistics students concerning electronic books. Related studies address engineering students, mathematics teachers, and physics students in Bani Walid. Published mathematics interventions provide additional evidence about feedback, visual learning, and blended instruction. Across these sources, acceptance depends on perceived learning value, usable tools, confidence, and practical access. However, favorable attitudes do not establish improved mathematical achievement. Local reporting also requires care. One Bani Walid physics paper combines categories differently between its abstract and results table. No verified study identified here directly estimates attitudes among Bani Walid university mathematics students. The review therefore proposes a local study combining an accessible questionnaire, coursework records, interviews, and a controlled teaching pilot. The proposed pilot compares equivalent mathematics tasks while measuring attitudes and achievement separately. Recommendations favor readable mathematical notation, downloadable explanations, useful feedback, and support for students with unreliable access. The paper provides an evidence base for local research without inventing participants, results, or causal effects.

Keywords: mathematics education; student attitudes; e-learning; Libya; Bani Walid; coursework; technology acceptance.

المخلص.

تحتاج أقسام الرياضيات إلى أدلة حول اتجاهات الطلبة قبل التوسع في استخدام المقررات الإلكترونية. وتتناول هذه الورقة النتائج المنشورة ذات الصلة بليبيا وبني وليد، حيث تقدم مراجعة سردية نقدية للأبحاث المتاحة للعامة. جمعت عمليات البحث بين المصطلحات الجغرافية باللغة الإنجليزية والعربية، إلى جانب مصطلحات الرياضيات، والاتجاهات، والتعلم الإلكتروني، وقبول التكنولوجيا. وتم تصنيف الأدلة وفقاً للتخصص، والموقع الجغرافي، وتصميم البحث، والنتائج المقاسة.

تشمل الأدلة الليبية المباشرة دراسة مسحية شملت 392 طالباً من طلبة الرياضيات والإحصاء حول استخدام الكتب الإلكترونية. كما تتناول الدراسات المرتبطة بطلبة الهندسة، ومعلمي الرياضيات، وطلبة الفيزياء في بني وليد. وتوفر التدخلات التعليمية المنشورة في مجال الرياضيات أدلة إضافية حول التغذية الراجعة، والتعلم البصري، والتعليم المدمج.

وتشير هذه المصادر مجتمعة إلى أن قبول التعليم الإلكتروني يعتمد على القيمة التعليمية المدركة، وتوفر أدوات قابلة للاستخدام، والثقة في التعامل مع التكنولوجيا، وإمكانية الوصول العملية إليها. ومع ذلك، فإن الاتجاهات الإيجابية لا تثبت حدوث تحسن في التحصيل الرياضي.

كما يتطلب عرض النتائج محلياً قدرًا من الحذر؛ إذ تجمع إحدى الدراسات المنشورة حول فيزياء بني وليد الفئات بطريقة مختلفة بين ملخصها وجدول النتائج. ولم تحدد أي دراسة موثقة ضمن الأدلة التي تمت مراجعتها تقديرًا مباشرًا لاتجاهات طلبة الرياضيات في جامعة بني وليد نحو التعليم الإلكتروني.

وبناءً على ذلك، تقترح المراجعة إجراء دراسة محلية تجمع بين استبيان سهل الوصول، وسجلات المقررات الدراسية، والمقابلات، وتجربة تعليمية مضبوطة. وتقرن التجربة المقترحة بين مهام رياضية متكافئة، مع قياس الاتجاهات والتحصيل الأكاديمي بصورة منفصلة.

وتوصي الدراسة باستخدام رموز رياضية واضحة وسهلة القراءة، وتوفير شروحات قابلة للتنزيل، وتقديم تغذية راجعة مفيدة، ودعم الطلبة الذين يعانون من صعوبات أو عدم استقرار في الوصول إلى الموارد الإلكترونية. وتوفر هذه الورقة قاعدة أدلة للبحث المحلي دون اختلاق مشاركين أو نتائج أو علاقات سببية غير مثبتة.

الكلمات المفتاحية: تعليم الرياضيات؛ اتجاهات الطلبة؛ التعليم الإلكتروني؛ ليبيا؛ بني وليد؛ المقررات الدراسية؛ قبول التكنولوجيا.

Introduction Introduction

A mathematics course requires more than access to lecture files. Students must read symbols, follow arguments, test methods, and explain solutions. Electronic coursework changes how these activities reach students. It also changes how students request help and receive comments. These changes make attitudes a practical teaching concern.

A student may welcome recorded explanations but dislike entering algebra through a small screen. Another may value online exercises while lacking dependable access at home. A single question about liking electronic learning cannot distinguish these experiences. Research must identify which activities students evaluate and under which conditions.

The strongest disciplinary match identified here concerns electronic books among Libyan mathematics and statistics students (Smeda et al., 2015). That study offers a starting point for examining acceptance. However, electronic reading covers only part of mathematics coursework. Uploading solutions, discussing proofs, and receiving automated feedback involve different demands.

The geographical focus also needs precision. Evidence collected elsewhere in Libya can guide questions for Bani Walid. It cannot establish the attitudes of students living or studying there. Likewise, an author's institutional address does not identify the study population. This distinction matters when nearby evidence appears more plentiful than it actually is.

This review addresses three connected questions. What published evidence concerns Libyan students' acceptance of electronic mathematics coursework? Which findings from other disciplines and countries help explain that evidence? What local research would resolve the remaining uncertainty in Bani Walid?

Scope and contribution

The paper focuses on university mathematics students, while treating school and other disciplinary studies as supporting evidence. Its contribution is a careful comparison of what each source can establish. It also develops a practical protocol for collecting missing local evidence. The proposed design follows from the reviewed limitations, rather than assumed local results.

Throughout this paper, electronic learning includes digital activities that support coursework. These activities may occur online, offline, or alongside classroom teaching. Attitude means a student's favorable or unfavorable evaluation of a specified activity. Intention means planned

future use. Participation means observed use. Achievement means demonstrated mathematical understanding or performance.

These outcomes must remain separate. Required platform use can occur despite negative attitudes. Positive attitudes can occur before sustained participation. High participation can involve copying answers without understanding them. A useful study therefore measures more than satisfaction or login frequency.

Review methods

This paper uses a focused critical narrative review. Such reviews require a clear purpose and transparent selection decisions (Snyder, 2019). The search sought directly relevant evidence, rather than complete coverage of every educational technology publication. No protocol was registered. No claim of a systematic review or meta-analysis is made.

Web searches were conducted on September 30, 2026. Journal websites, university repositories, and public research archives supplied the checked records. Search terms included spelling variants of Bani Walid and Bani Waleed. Arabic searches included بني وليد, الرياضيات, and التعليم الإلكتروني. Reference details were checked against publisher pages or institutional records.

Table 1 Search scope and selection rules

Element	Applied rule
Direct evidence	Libyan mathematics or statistics students evaluating digital learning resources.
Local context	Bani Walid student evidence, with discipline and actual study location retained.
Supporting evidence	Libyan university surveys, mathematics teacher research, and public mathematics interventions.
Conceptual sources	Technology acceptance theory, review methodology, and distinctions between planned and emergency teaching.
Exclusions	Stock imagery, promotional claims, untraceable statistics, and findings attributed to the wrong population.
Search examples	Libya university students attitudes e learning mathematics; Bani Walid mathematics e-learning attitudes students.

Selection considered relevance, accessible methods, identifiable participants, and traceable results. Sixteen sources were retained, including twelve empirical reports and four conceptual or methodological sources. Some empirical records were accessible mainly through abstracts or repository summaries. These records support narrower claims than inspected full texts.

Extraction recorded population, setting, design, outcome, main result, and transfer limits. Appraisal examined selection bias, self-reporting, comparison groups, reporting consistency, and geographical fit. This appraisal did not use a validated scoring checklist. It therefore supports qualitative judgments rather than formal certainty grades.

Related studies were compared narratively. Their percentages were not pooled because instruments and populations differ. Existing survey reports were not treated as new participant data. Search indexing and inaccessible documents may have left relevant studies undiscovered. The absence of a verified local mathematics study is therefore a search finding, not proof of nonexistence.

Evidence map

The empirical evidence addresses several different questions. Table 2 separates disciplinary relevance from geographical relevance. The two dimensions should not be collapsed into one claim about local students. Later sections examine published findings and their limits.

Table 2 Empirical sources and their relationship to the research question

Source	Population or setting	Design or focus	Relevance
Smeda et al., 2015	392 mathematics and statistics students; Libya	Survey and acceptance model	Direct disciplinary evidence
Getton, 2025	Female physics students; Bani Walid	Attitude survey	Local, different discipline
Rhema & Miliszewska, 2014	348 engineering students; two Libyan universities	Survey	Related quantitative coursework
Bukhatwa et al., 2023	69 mathematics teachers; Benghazi	Survey	Teacher perspective
Masoud et al., 2024	100 students and 30 educators; Tripoli	Mixed methods	University context
Alsoufi et al., 2020	3,348 medical students; Libya	Survey	Access and feasibility
Al Ghawail et al., 2021	Al Asmarya Islamic University	Questionnaire and interviews	Institutional barriers
Almehbat, 2025	50 secondary students; Qarabulli	Quasi-experiment	Libyan mathematics intervention
Roschelle et al., 2016	2,850 seventh-grade students; United States	Randomized trial	Homework and feedback
Bowen et al., 2014	United States university statistics courses	Randomized trial	Blended instruction
Bhagat & Chang, 2015	50 ninth-grade students; India	Teaching comparison	Geometry software
Acosta-Gonzaga & Walet, 2016	First-year STEM students; England	Survey and acceptance model	Mathematical assessment

The table contains studies, not independent estimates of one common outcome. School experiments cannot supply university attitude rates. Teacher opinions cannot replace student responses. Findings from medical education concern different learning tasks. These boundaries shape every interpretation below.

The conceptual sources are Davis (1989), Venkatesh et al. (2003), Hodges et al. (2020), and Snyder (2019). They guide definitions and interpretation. They do not add observations from Libyan mathematics students.

Direct evidence from Libyan mathematics students

Smeda et al. (2015) examined electronic-book acceptance across three Libyan universities. Their survey used technology acceptance constructs and structural equation modelling. Usefulness, ease of use, and attitude were prominent factors. These findings concern acceptance of electronic books, rather than all electronic coursework.

Figure 1 identifies the proposed relationships. Figure 2 shows the fitted model. The paper contains differences between numerical labels in its narrative and diagram. Accordingly, this review does not rank its individual path coefficients. Cross-sectional relationships also cannot establish which belief changed first.

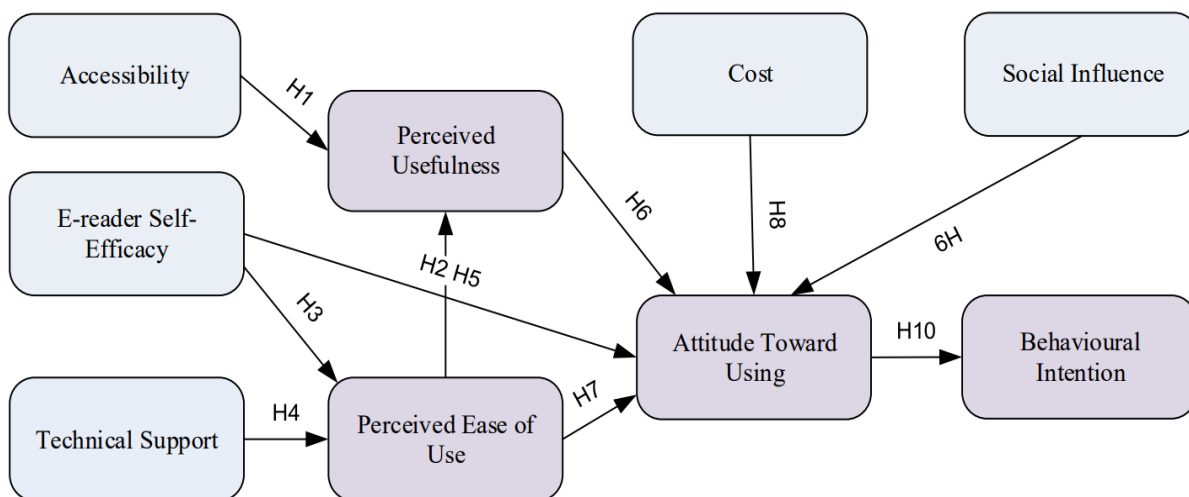


Figure 1 Proposed electronic-book acceptance model. Source: Smeda et al. (2015).

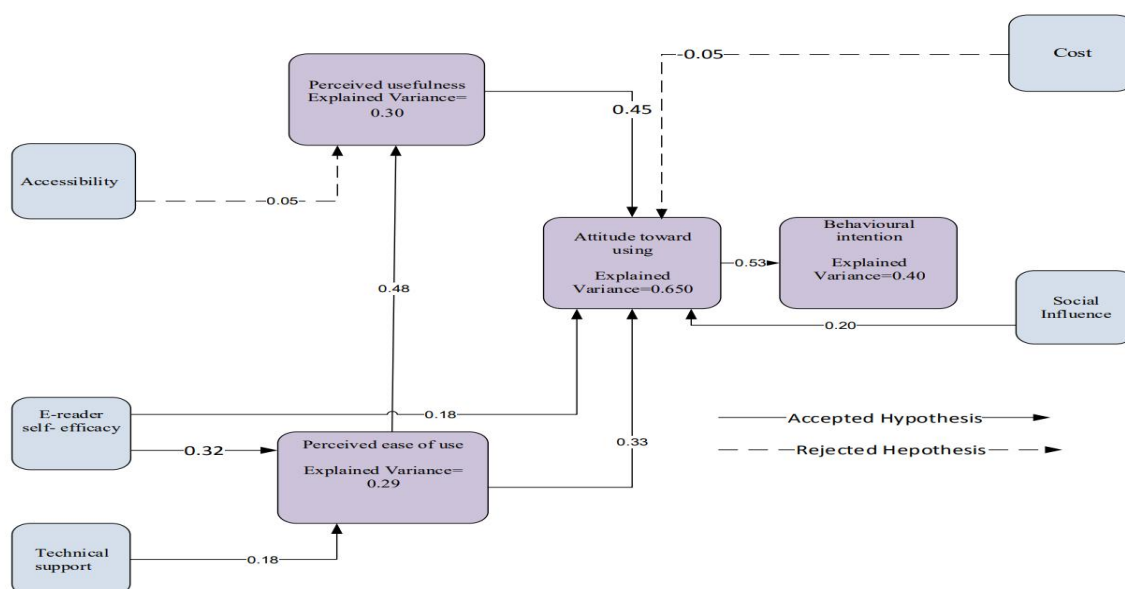


Figure 2 Reported electronic-book acceptance relationships. Source: Smeda et al. (2015).

For a future mathematics course, this evidence suggests testing concrete learning benefits. Students could evaluate whether a worked example clarified a difficult step. They could also report whether notation remained readable on their own devices. These questions would make perceived usefulness easier to interpret.

Resource format should be recorded separately. A scanned textbook, searchable document, and interactive exercise are different experiences. Combining them could hide the reasons behind a negative answer. A student may approve of digital materials while rejecting one poorly prepared file.

This distinction also affects interviews. Students should describe a recent task before discussing electronic learning generally. The interviewer can then connect opinions with a recognizable experience. Such questions are proposed methodological improvements, not findings from the reviewed sample.

Related evidence from engineering students

Rhema and Miliszewska (2014) reported generally favorable attitudes among engineering students. Their sample covered Tripoli and Al-Jabal Al-Gharbi. Attitudes correlated with technology skills and access. Reported correlations were 0.45 and 0.30, respectively. The response rate was 45%, which limits representativeness.

Their adjusted analysis did not establish gender or urban–regional attitude differences. Figure 3 displays descriptive group patterns. Figure 4 shows relationships among measured variables. These graphics concern engineering students and should retain that label.

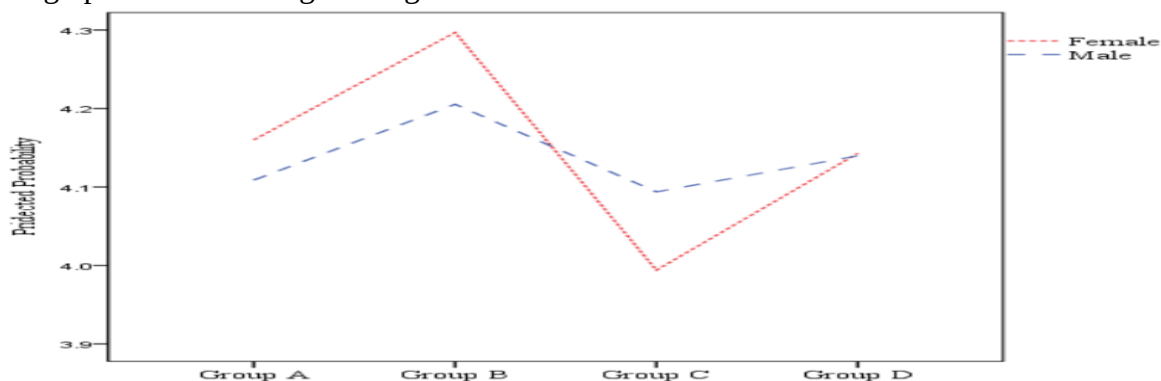


Figure 3 Engineering student attitudes by group and gender. Source: Rhema and Miliszewska (2014).

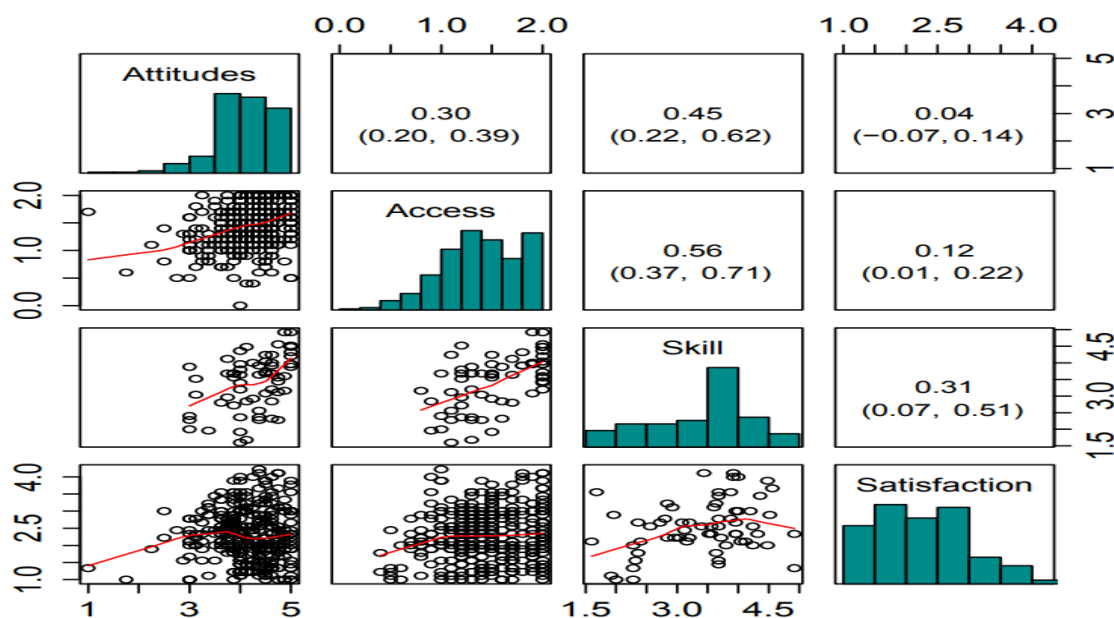


Figure 4 Relationships among attitudes, access, skills, and satisfaction. Source: Rhema and Miliszewska (2014).

The study raises a practical measurement issue for mathematics departments. General confidence with computers may differ from confidence with mathematical software. A student may use messaging comfortably but struggle to enter fractions. Another may produce correct handwritten work yet face difficulty uploading a clear photograph.

A local questionnaire should therefore ask about specific tasks. Opening course material, entering expressions, and submitting solutions deserve separate items. A short practice exercise could check whether self-reported confidence matches task completion. This would help distinguish training needs from dislike of the teaching method.

Group comparisons require similar care. Differences in device access or course requirements could explain apparent differences between demographic groups. Researchers should investigate these conditions before proposing different teaching arrangements. Small subgroups should not support broad claims about gender or place of residence.

Evidence specific to Bani Walid

Getton (2025) studied female physics students at Bani Waleed University. The abstract reports 80% positive attitudes. However, the results table reports 13 high, three moderate, and

four low scores. These counts total 20 students. The corresponding percentages are 65%, 15%, and 20%.

The abstract appears to combine high and moderate categories. That interpretation should not become an 80% estimate for mathematics students. The sample is small and discipline-specific. This review therefore retains the reported categories and treats the study as limited local context.

Table 3 Local evidence and interpretation limits

Evidence	What it supports	What it cannot establish
Getton, 2025	A local physics attitude study exists. Its table reports three score categories.	University mathematics attitudes or a citywide acceptance rate.
Masoud et al., 2024	A study written by Bani Walid affiliated authors examined Tripoli participants.	Evidence collected from Bani Walid students.
Local mathematics gap	No directly matching university mathematics study was verified in this search.	A claim that no such study exists anywhere.

Masoud et al. (2024) reported associations between adoption, student attitudes, and community acceptance. The reported correlations were 0.62 and 0.57. Participants came from the University of Tripoli, despite the authors' Bani Walid affiliation. The paper offers national context rather than a local estimate.

The local research problem is consequently specific. Current mathematics students need to be asked about actual coursework in their own institution. The research should identify the course, semester, platform, and learning activity. It should also record whether participation was required.

A local survey would become less useful if it simply repeated general technology questions. The missing evidence concerns mathematical tasks under local teaching conditions. Responses should explain what students can access, what they can complete, and what helps them understand. Interviews should include dissatisfied students and students who rarely participate.

The evidence also calls for cautious reporting. Score categories need clear definitions before data collection. Moderate scores should remain visible unless a defensible analysis specifies another grouping. Any combined category should be explained in both the abstract and results. Readers should be able to reproduce every reported percentage.

Access and institutional conditions

Alsoufi et al. (2020) surveyed medical students across Libya during the pandemic. Although 93.1% owned smartphones, 64.7% disagreed that electronic learning could be implemented easily. These findings illustrate the difference between device ownership and educational feasibility. They do not measure mathematics attitudes. Figure 5 identifies the study's institutional distribution.

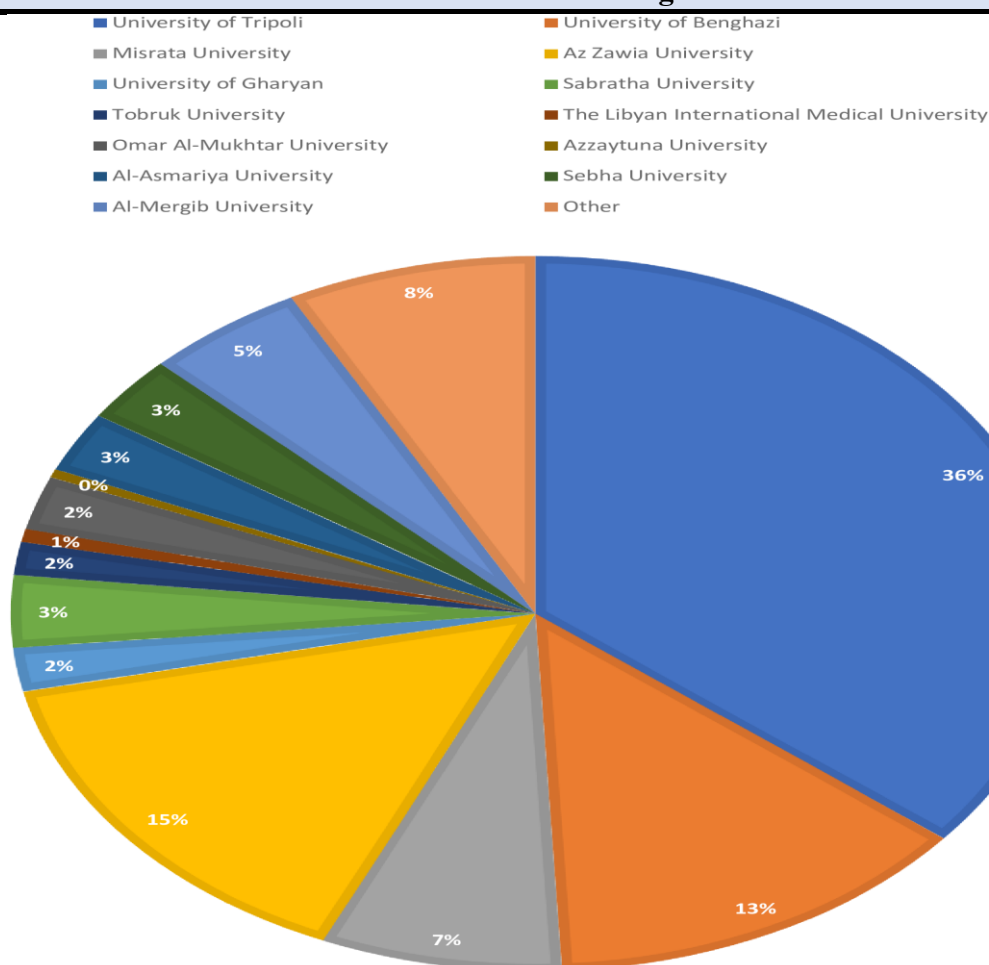


Figure 5 Institutional distribution of a Libyan medical student sample. Source: Alsoufi et al. (2020).

Al Ghawail et al. (2021) reported limited infrastructure, knowledge, and financial support at Al Asmarya Islamic University. Participants nevertheless expressed interest in electronic learning. The archived report is treated as supporting institutional evidence. It does not provide a Bani Walid mathematics estimate.

These studies motivate a distinction between willingness and opportunity. For the proposed local investigation, access should mean completing a defined learning task. Ownership alone would be insufficient. Researchers could ask whether students can download materials, view notation, and submit solutions within normal deadlines.

Hodges et al. (2020) distinguish planned online learning from emergency remote teaching. This distinction matters when interpreting pandemic surveys. A hurried replacement for classroom teaching may lack the preparation of a designed course. Its reception should not define every later digital teaching approach.

A local questionnaire should record the conditions surrounding each experience. Scheduled online teaching and emergency class replacement should appear as different categories. Required live attendance should also be separated from downloadable study material. These choices would help explain apparently conflicting opinions.

Institutional support should be measured through observable services. Examples include accessible practice sessions, timely technical help, and alternative submission routes. Students could report whether they sought help and whether the problem was resolved. These answers would be more useful than asking whether support is generally good.

No current network availability or electricity reliability rate is assumed for Bani Walid. Such rates require recent local measurement. The proposed study would record disruptions during

the actual teaching period. That record would connect access problems with missed activities without assuming their cause.

Published experiments in mathematics coursework

Online homework and feedback

Roschelle et al. (2016) tested online mathematics homework with teacher training in a randomized school trial. The analysis covered 43 schools and 2,850 students. The adjusted achievement effect was Hedges's $g = 0.18$. This represents a standardized difference, not an 18% score increase.

The intervention combined a platform with teaching support. Its effect cannot be assigned to software alone. Figure 6 shows a report teachers used to review errors. Figure 7 displays outcomes by prior achievement. Neither figure measures Libyan students' attitudes.

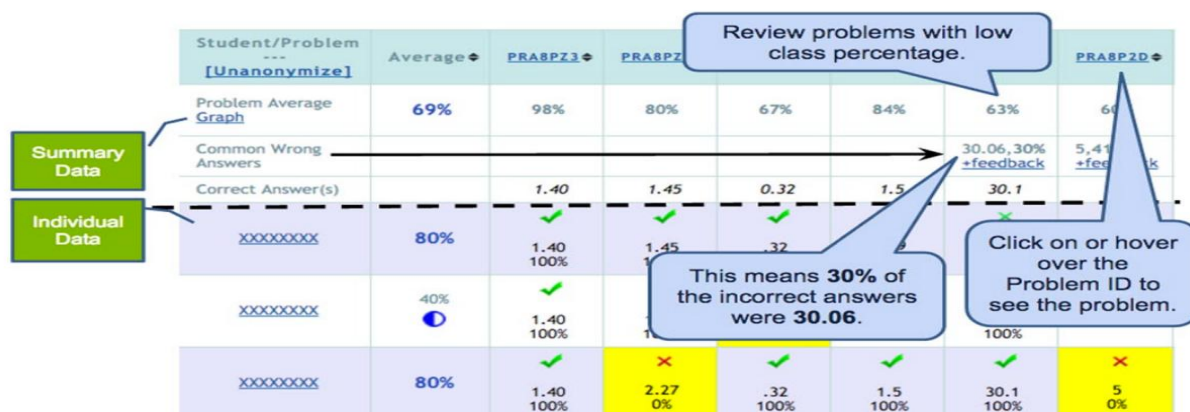


Figure 6 Teacher report for reviewing mathematics homework errors. Source: Roschelle et al. (2016).

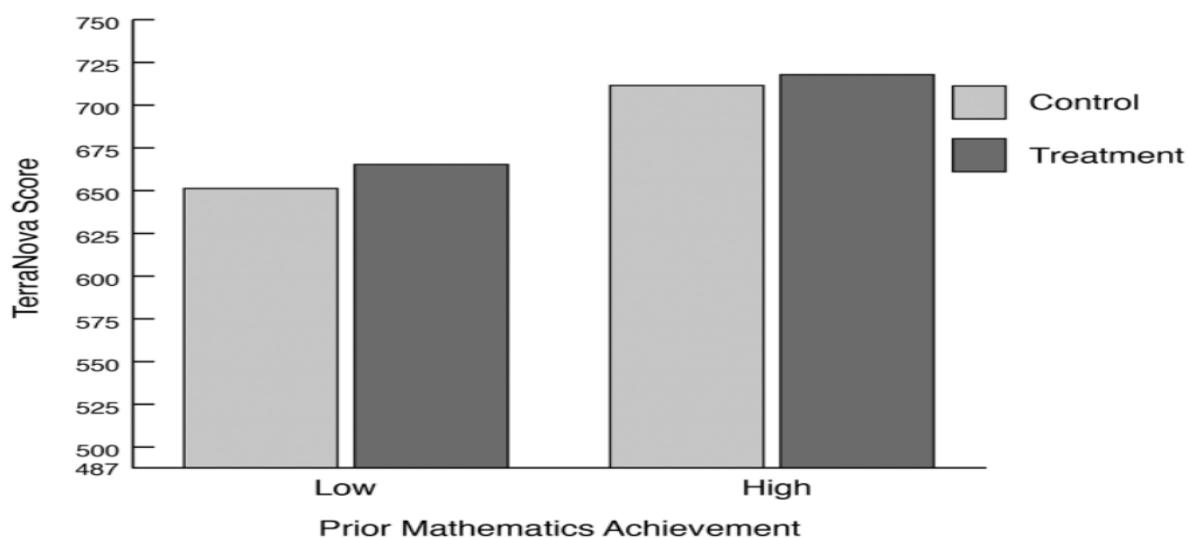


Figure 7 Homework trial outcomes by prior mathematics achievement. Source: Roschelle et al. (2016).

This trial suggests a testable teaching mechanism for local work. Teachers could use recurring errors to choose the next classroom explanation. A later assessment could then examine whether students correct those errors independently. Attitude questions would ask whether that feedback felt useful and fair.

The proposed adaptation requires equivalent learning goals across groups. Otherwise, a difference might reflect extra practice or teacher attention. Recording feedback frequency would help describe the actual intervention. Recording student exposure would clarify whether the planned activities were delivered.

Blended instruction and visual mathematics

Bowen et al. (2014) randomly assigned university statistics students to hybrid or conventional instruction across six campuses. The hybrid format combined online work with weekly face-to-face support. The study reported broadly comparable learning outcomes. This does not prove that every blended course will produce equivalent results.

Bhagat and Chang (2015) compared geometry teaching with and without GeoGebra among 50 students in India. Each group contained 25 students. The reported post-test results favored the software-supported group. The institutional abstract supports this narrow conclusion. It does not establish local university attitudes or sustained effects.

A more geographically relevant intervention appears in Almeihat (2025). Fifty secondary students in Qarabulli participated in a mathematics quasi-experiment. The two groups each contained 25 students. Creative-thinking outcomes favored the electronic-learning group. The measured abilities included fluency, originality, and flexibility. The study concerns school mathematics, rather than university students' acceptance.

Table 4 What the intervention evidence contributes

Study	Practical contribution	Transfer limit
Roschelle et al., 2016	Test feedback linked to real homework errors.	School setting; combined platform and training.
Bowen et al., 2014	Compare blended and classroom course delivery.	Different institutional and national conditions.
Bhagat & Chang, 2015	Use visual exploration in geometry.	Small school sample; narrow content.
Almeihat, 2025	Examine multiple forms of mathematical thinking.	Qarabulli school sample; quasi-experimental design.

These studies support practical experiments rather than a universal recommendation. Their interventions differ in content, teaching support, and learner age. Combining their results into one local expected effect would be unjustified. They instead identify features worth testing under clearly described conditions.

A local experiment should begin with one course unit. This would make the learning tasks and teaching time easier to compare. An algebra unit could test feedback on symbolic errors. A geometry unit could test visual reasoning. The selected unit should follow the department's actual curriculum.

The intervention should not be judged only by an immediate quiz. Students should solve a later task without platform assistance. This would distinguish successful interaction with software from retained understanding. Interviews could then explain why some students preferred one format despite similar test performance.

Mathematical assessment and student attitudes

Acosta-Gonzaga and Walet (2016) studied attitudes towards online mathematical assessment among first-year STEM students. Their analysis emphasized attitude, enjoyment, confidence, and support. Students had experience with mathematical answers and feedback. The public manuscript also illustrates feedback for a symbolic integration task.

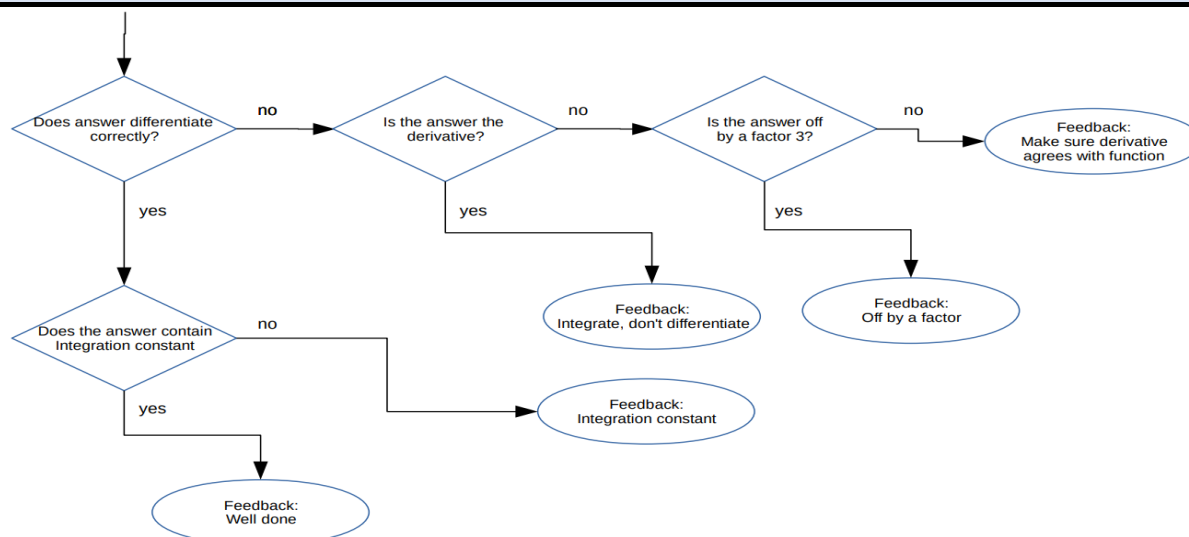


Figure 8 Feedback branches for a symbolic mathematics question. Source: Acosta-Gonzaga and Walet (2016).

The example in Figure 8 makes the coursework problem concrete. A system can respond differently to different mathematical errors. Such feedback could be assessed through students' actual corrections. The diagram remains an external example, not a validated Arabic-language instrument.

For Bani Walid coursework, answer entry deserves direct observation. Some systems require syntax that differs from handwritten notation. An incorrect entry may therefore reflect interface difficulty rather than mathematical misunderstanding. Researchers should record these problems separately from conceptual errors.

Students should be allowed to explain how they obtained an answer. A correct final value can conceal weak reasoning. Conversely, a minor typing error can conceal a sound method. Supplementary handwritten work or a short oral explanation would help interpret both cases.

Feedback quality also requires a precise definition. A message stating that an answer is wrong provides little diagnostic information. A useful prompt directs attention towards a specific step without immediately supplying the complete solution. The proposed pilot would compare students' responses to these forms of support.

Attitude measures should refer to the feedback students actually received. Questions could ask whether comments helped locate errors or encouraged another attempt. Separate questions should address frustration and perceived fairness. These proposed questions need local testing before they become a research scale.

The eight figure placeholders identify research graphics already available from scholarly sources. They contain source links and exact figure locations. No stock photographs or image-library material is proposed. Public availability does not itself grant republication rights. Final figure insertion must follow each source's reuse terms or documented permission.

Interpretation of the evidence

Learning value and ease of use

Davis (1989) provides a basis for distinguishing perceived usefulness from perceived ease of use. The first concerns expected benefit. The second concerns effort required to use a system. Both concepts help organize questions about mathematics coursework. Their original measures require adaptation and testing before local educational use.

This review interprets usefulness at the level of a learning task. A student might consider an explanation useful because it clarifies a missing algebraic step. That judgment differs from enjoying the video or finding the website attractive. The local study should keep these judgments separate.

Ease of use also has several possible sources. Instructions may be unclear, symbols may display poorly, or submission may require too many steps. Students should identify the source of difficulty. Otherwise, a low ease score gives teachers little guidance about what needs changing.

Support and continued participation

Venkatesh et al. (2003) connect technology use with expected performance, effort, social influence, and facilitating conditions. Their model widens attention beyond individual preference. It offers useful categories for examining why willing students may still struggle to participate. Its workplace origins limit direct transfer to mathematics classrooms.

For the proposed study, support should include both mathematical help and technical help. A working platform does not guarantee an understandable explanation. Likewise, good explanations cannot help students who cannot reach the material. Recording both forms of support would improve interpretation.

Social influence should not be assumed to mean approval. Students might participate because classmates expect them to contribute. They might also use a platform only because a teacher requires it. Interview questions should distinguish encouragement, obligation, and personal preference.

Attitudes and achievement

The combined evidence supports investigating attitudes alongside learning outcomes. It does not justify treating one as a substitute for the other. This is the central interpretation of the review. A local course evaluation should therefore report both, even when their patterns differ.

Four outcome combinations are possible. Students may like an activity and learn well. They may dislike it yet improve. They may enjoy it without measurable improvement. They may experience both dissatisfaction and weak performance. Each combination requires a different teaching response.

For example, good learning with negative attitudes might indicate excessive workload or confusing instructions. Positive attitudes with weak learning might indicate entertaining but shallow tasks. These are possible explanations to investigate, not established findings. Interviews and coursework examples could help distinguish them.

Implications for mathematics coursework

The following teaching arrangements are proposals derived from the evidence review. They have not been tested in Bani Walid. Their purpose is to make a small local pilot practical and interpretable. The department should adapt them to its curriculum and available resources.

Each unit should begin with a short statement of the mathematical goal. A worked example should explain why each major step is valid. Students should then attempt a similar problem with a changed condition. A final question should require an explanation, not only a number. Digital materials should remain readable on the devices students actually use. Long equations need layout checks. Files should preserve mathematical symbols when downloaded. Where possible, the same explanation should be available as text and a short recording. Students should know which version contains the required content.

A weekly task could follow a consistent sequence. Students first attempt a problem independently. They then receive a hint or comment. They submit a revision explaining their change. The teacher reviews recurring difficulties during the next class. Researchers record each stage without assuming that every click represents learning.

Consider a hypothetical task involving the derivative of a composite function. Students would provide both the derivative and their reasoning. Feedback would identify a missing chain-rule factor without supplying the full answer. A later problem would change the inner function. Independent success would provide stronger evidence than a corrected submission alone.

This example is an original teaching proposal. It is not a report of a completed experiment. The same structure could be adapted to equations, probability, or geometric arguments. The teacher should choose tasks that match the planned course outcomes.

Students with access difficulties need an equivalent route to complete required work. Printed tasks or downloadable files could preserve the mathematical objective. Alternative submission should record the same reasoning and receive comparable feedback. Otherwise, differences in access could become differences in assessment opportunity.

Teachers also need preparation time. Before the pilot, they should test the student view and answer-entry process. They should agree how to respond to common errors. Shared marking examples would reduce differences between instructors. Support requests should be logged using anonymous categories.

Bukhatwa et al. (2023) found favorable mathematics teacher attitudes in Benghazi private secondary schools. Their results also associated training participation with attitude differences. The study concerns teachers and cannot establish student effects. It supports including teacher preparation as a condition to examine, rather than an assumed cause of success.

Implementation should begin modestly. A small unit allows the department to identify avoidable problems before expanding digital requirements. The first decision should concern whether students can complete the tasks fairly. Expansion should depend on observed learning, student feedback, and the workload required to maintain support.

Proposed Bani Walid research protocol

Population and recruitment

A future study should recruit students enrolled in identified university mathematics courses in Bani Walid. Researchers should first obtain an accurate course roster. The roster would define the eligible population and available class groups. No population size or expected response rate is assumed here.

If the eligible population is small, a census invitation may be practical. Otherwise, sampling should represent course level and teaching group. Sample size should follow the primary analysis and a prospective power calculation. A conventional target copied from another study would be unsuitable.

Recruitment should reach students through both classroom and digital routes. An online-only invitation could miss students with the greatest access problems. Participation should remain voluntary and separate from course assessment. Teachers should not see identifiable attitude responses before grades are finalized.

Sequence of data collection

The first stage would document normal coursework and access conditions. Students would complete a baseline questionnaire and a short mathematics assessment. They would also attempt a simple platform task. This would identify interface problems before the teaching comparison begins.

The second stage would deliver a defined mathematics unit. Where feasible, several class groups would receive randomly assigned teaching formats. Both formats would cover equivalent content, practice, and learning time. If random assignment is impossible, a matched comparison could be used. Any remaining selection differences would limit causal interpretation.

An illustrative pilot could run for six teaching weeks. This duration is proposed, not derived from local enrollment or semester information. Weekly records would capture task completion, support use, and access interruptions. Researchers would document changes to the planned intervention as they occur.

The final stage would repeat the attitude measure and assess the taught mathematics. A delayed assessment would examine retained understanding after the immediate teaching period. Interviews would include students with different attitude changes and participation

patterns. Selection would deliberately include students who struggled or stopped using the platform.

Ethics and research transparency

Local ethics approval and institutional permission should precede recruitment. Participants should receive a clear information sheet and consent form. Refusal should not affect teaching access, marks, or academic standing. The team should explain how coursework records will be linked with survey responses.

Identifying information should remain separate from analysis files. Reports should avoid combinations that reveal students in small groups. The study protocol, questionnaire, and analysis plan should be dated before data collection. Any later changes should be reported with reasons. No ethics approval or participant consent is claimed for this proposed study.

Measurement and analysis plan

The proposed instrument would measure several related constructs. Table 5 gives original draft items and separate observed outcomes. These items are starting points, not a validated scale. Students should evaluate them through cognitive interviews before the main study.

Table 5 Proposed measures for a future local study

Construct	Example item or measure	Purpose
Attitude	I like using this platform for mathematics coursework.	Overall evaluation
Learning value	The feedback helps me understand my mathematical errors.	Perceived benefit
Ease of use	I can enter mathematical answers without unnecessary difficulty.	Interface demands
Confidence	I can complete the required digital tasks without technical help.	Task confidence
Access	Number of required tasks disrupted by access problems.	Opportunity to participate
Intention	I would choose similar activities in a future mathematics course.	Future preference
Participation	Completed tasks divided by assigned tasks.	Observed engagement
Achievement	Independently marked solutions and delayed test scores.	Demonstrated learning

Agreement items could use five ordered response categories. Access events and test scores need their own measurement formats. Combining everything into one total would obscure their meanings. Arabic wording should be reviewed by subject specialists and tested with students. Translation should preserve mathematical meaning and ordinary local understanding.

The analysis would describe response distributions before comparing averages. Scale reliability and item behavior would be examined before forming composite scores. Researchers should report missing responses and reasons for withdrawal where known. Complete-case analysis alone could misrepresent students with access difficulties.

For the teaching comparison, the primary model should estimate post-intervention differences while accounting for baseline scores. Class-level assignment requires analysis that accounts for clustering. With only one class per condition, teacher and treatment effects could remain inseparable. Such a design should be presented as exploratory.

Results should include effect estimates and confidence intervals. A small p value does not show educational importance. A non-significant result does not prove equivalence. Attitude and achievement should have separately defined primary or secondary roles. Subgroup analyses should be limited and specified in advance.

Interviews would be analyzed for explanations linked to actual coursework experiences. The coding record should preserve contradictory accounts. Findings could then connect changes in scores with reported usability, feedback, and access. Agreement between data sources would strengthen interpretation. Disagreement should remain visible and become a research finding.

Limitations and conclusions

Limits of the evidence

This review has several limits. Its focused web search cannot guarantee complete coverage. Some studies were available only through abstracts or institutional summaries. Arabic PDF

extraction was imperfect in places. Numerical claims were therefore restricted to clearly readable material. Source inconsistencies were retained rather than silently corrected.

The empirical literature also differs in age, discipline, and teaching context. Older findings may not describe current tools or access. Several studies rely on self-reported attitudes. Others measure achievement without measuring attitudes. Their results cannot produce a pooled estimate for Bani Walid mathematics students.

The local research gap remains unresolved by this paper. No new questionnaire was distributed. No students were recruited. No participant-level dataset was reanalyzed. The proposed local protocol is a contribution to research design, not evidence that the proposed approach will succeed.

Conclusion

Published research provides a defensible starting point for studying electronic mathematics coursework in Libya. Direct disciplinary evidence concerns electronic-book acceptance. Local Bani Walid evidence concerns physics students and requires careful interpretation. Supporting studies identify feedback, visual learning, support, and access as issues worth examining.

The available findings do not establish the attitudes of Bani Walid university mathematics students. They also do not establish a local causal effect on achievement. A useful next study should connect specific coursework experiences with separate measures of attitudes and learning. It should include students facing access difficulties and document the teaching conditions carefully.

The immediate recommendation is a limited, accessible, and evaluated course pilot. Its value should be judged through mathematical understanding, student experience, and practical participation. Expansion should follow evidence collected under local conditions. The present review supplies the questions and study structure needed for that work.

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