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Experience in Applying Active Learning Methods in Probability and Statistics at Gia Lai Medical College

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ABSTRACT:

Background: In health-professions education, Probability and Statistics supports the interpretation of quantitative information and the development of evidence-informed reasoning. Students may nevertheless master computational routines without understanding when, why, or how to use them in professional contexts.

Objective: This article systematises pedagogical experience in applying active learning at Gia Lai Medical College and develops a coherent instructional design framework linking health-related contexts, cognitive tasks, learning evidence, and feedback.

Methods: A qualitative descriptive synthesis combined a focused review of eight foundational publications, analysis of topics and learning activities in the course, and reflective accounts of classroom practice. The material was organised across difficulties in statistical reasoning, task formats, learning products, assessment, and implementation constraints.

Results: Five topic-to-context alignments, six complementary active-learning approaches, an illustrative 90-minute lesson sequence, and a weighted assessment rubric were consolidated. Four practical tensions emerged: professional relevance versus cognitive overload, collaboration versus uneven individual participation, computational efficiency versus conceptual understanding, and discussion time versus instructional closure. The proposed Context-Task-Evidence-Feedback (CTEF) framework connects these elements in a recurring design cycle. **Conclusion:** Active learning in introductory statistics should be judged by the reasoning learners can demonstrate, not by the number of techniques used. The CTEF framework is an instructional proposal derived from published literature and practitioner reflection; its effects on student achievement have not yet been empirically evaluated.

KEYWORDS: active learning, probability and statistics, health-professions education, statistical reasoning, formative assessment, instructional design

1. INTRODUCTION

For students preparing for careers in health services, the ability to read numerical information is closely related to learning, professional communication, and the interpretation of evidence. At the level of college education, Probability and Statistics should therefore be more than an isolated mathematics requirement. It offers a foundation for identifying variables, describing variation, evaluating claims, and recognising the limits of a conclusion based on sample data. These capabilities are relevant when learners encounter summaries of health indicators, test results, treatment durations, or published research in their subsequent training and professional practice.

However, introductory statistics often presents a difficult transition from everyday descriptions to formal concepts, mathematical notation, and reasoned interpretation. Learners may remember a formula without knowing when it is appropriate or may calculate a result correctly but draw a conclusion that the available data cannot justify. When teaching follows a repeated sequence of definition, formula, demonstration, and routine exercises, successful performance on familiar calculations may conceal fragile conceptual understanding. The perceived distance between statistical exercises and future work can further encourage an examination-oriented rather than an evidence-oriented approach to the subject.

Active learning is a potentially useful response because it requires learners to identify a problem, examine data, explain a choice, compare alternative solutions, and reconsider their reasoning. In a meta-analysis of 225 studies in science, technology, engineering, and mathematics, Freeman et al. (2014) reported an overall advantage for active learning. Theobald et al. (2020) further documented narrower achievement gaps for underrepresented groups in undergraduate STEM settings. Yet Deslauriers et al. (2019) showed that students engaging in cognitively demanding activities may feel that they have learnt less, even when direct measures indicate the opposite. These findings support attention to the quality of cognitive engagement, rather than assuming that classroom activity or student satisfaction alone establishes effectiveness.

In a medical-college course, this distinction is especially important. Working with a table of blood-pressure values or a screening-test scenario is not sufficient unless the activity requires a defensible statistical decision. Likewise, peer discussion is not automatically productive if one student performs the calculation for the whole group, and software use is not equivalent to understanding. The practical gap addressed in this paper concerns how an instructor can connect a specific difficulty in statistical reasoning with a relevant health-related task, an observable learning

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product, and feedback that informs the next teaching decision. The existing paper documents approaches and examples but does not provide a controlled experiment or a standardised student-outcome dataset.

The study addresses three research questions. RQ1: Which conceptual and interpretive obstacles should be prioritised when designing active-learning tasks for Probability and Statistics in a health-college context? RQ2: How can case-based learning, problem solving, collaborative learning, peer explanation, flipped learning, and data practice be matched to particular tasks and learning products? RQ3: How can these elements be integrated into a transparent instructional design and assessment framework? The contribution is a practice-oriented synthesis, culminating in a Context-Task-Evidence-Feedback (CTEF) framework. The framework is offered as an analytically grounded proposal for course planning, not as a model already validated through an intervention study.

2. LITERATURE REVIEW

2.1. Active learning as cognitive participation

Active learning should not be understood simply as increasing the number of classroom games, discussions, or interactive tools. Its defining feature is that learners undertake meaningful intellectual work and reflect on that work. Bonwell and Eison (1991) emphasise the combination of doing and thinking about what is being done, while Prince (2004) distinguishes the educational function of active participation from the outward appearance of a teaching technique. In a statistics lesson, this implies asking students not only to calculate a quantity but also to decide which quantity is relevant, justify the selection, and consider whether the result answers the original question.

The wider literature provides encouragement but also important qualifications. Freeman et al. (2014) and Theobald et al. (2020) establish that well-designed active learning can be associated with better outcomes in broader STEM education. Their evidence, however, does not constitute a direct evaluation of one course at Gia Lai Medical College. Deslauriers et al. (2019) additionally caution that the subjective feeling of ease is an unreliable proxy for learning when an instructional approach demands more effort. In the present setting, activities should therefore be judged through students' explanations and products rather than by visible enthusiasm alone.

From a constructivist perspective, statistical knowledge becomes useful when students can connect new concepts to a problem and revise misconceptions. For example, calculating a mean is a basic skill, whereas recognising when a few unusually long treatment durations make the median a more representative summary involves statistical judgement. A question that invites learners to compare both summaries creates an opportunity to expose reasoning that a routine computation might leave hidden.

2.2. Statistical reasoning and professional contextualisation

Garfield and Ben-Zvi (2008) describe statistical reasoning as attention to context, variation, sample-to-population relationships, and uncertainty. These features matter in health-related applications because numerical results depend on who was measured, how observations were obtained, and which inferential question is being asked. Students must gradually move from recognising a variable and performing a procedure to choosing a method, checking its appropriateness, and articulating the scope of the conclusion.

The Guidelines for Assessment and Instruction in Statistics Education (GAISE) recommend an emphasis on statistical thinking, use of data, conceptual understanding, active learning, appropriate technology, and assessment that supports learning (American Statistical Association, 2016). For students in a medical-college programme, suitable instructional material may include de-identified or publicly available examples involving age, blood pressure, treatment duration, body measurements, test results, or patient categories. Such examples provide a recognisable purpose for data analysis without requiring advanced clinical knowledge beyond the course.

A conditional-probability example illustrates the importance of conceptual precision. The probability of a positive test among people with a disease is not the same quantity as the probability of disease among people whose test result is positive. Learners who can distinguish these conditioning directions have achieved more than correct arithmetic; they have interpreted the statistical structure of a professional scenario. Similarly, an estimate computed from a sample cannot be presented as an error-free description of the entire population. Contextualisation should support these distinctions rather than add clinical details that distract from them.

2.3. Alignment of learning outcomes, tasks, and assessment

Constructive alignment requires a coherent relationship among intended learning outcomes, learning activities, and assessment (Biggs & Tang, 2011). If the outcome is the ability to interpret a statistical result, teaching and assessment cannot be limited to reproducing formulas. A reasonable progression moves from recognition and straightforward calculation towards selecting a method, explaining a result, evaluating alternative interpretations, and applying the reasoning in a new but manageable situation. This progression allows an instructor to distinguish conceptual misunderstanding from a computational error or an unjustified conclusion.

Different active-learning formats serve different functions within that progression. A case can motivate a statistical concept; problem solving can require a choice among possible procedures; collaborative work can distribute a multi-step data task; peer explanation can expose misconceptions; a concise flipped-classroom preparation can release time for guided application; and a spreadsheet can help visualise data or perform repeated calculations. Their usefulness depends on the cognitive demand and learning product attached to each activity, not on the label attached to the method.

Evidence of learning should be sufficiently diverse to represent the intended competence while remaining manageable for the teacher. A worksheet identifying variables shows whether students understand the task; a table or graph displays how they organise data; an explanation of a selected procedure reveals conceptual reasoning; and a short written conclusion demonstrates whether students can communicate without overstating the result. An assessment rubric makes these expectations visible and supports feedback on particular weaknesses, although any proposed weighting still requires subsequent testing for reliability and appropriateness.

2.4. Conditions for implementation in health education

Active learning must be adapted to students' prior knowledge, time available, group size, and classroom resources. An overlong scenario with numerous clinical details can increase cognitive load without improving statistical understanding. Group tasks may enable mutual explanation but can also conceal unequal participation. Digital tools may free time from repetitive arithmetic but may hide errors of interpretation if the output is

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accepted uncritically. Instructors must also protect privacy when using health-related examples: publicly available material or suitably de-identified datasets are preferable to identifiable patient records.

These considerations suggest three design priorities. First, the health context must remain close enough to practice to motivate the problem but simple enough to keep the statistical concept central. Second, collaboration should create opportunities for explanation while requiring each student to produce some individual evidence. Third, technology should support the process of reasoning, not replace it. The present synthesis uses these priorities to examine the instructional experience reported for the Probability and Statistics course.

3. MATERIALS AND METHODS

3.1. Research design

The study employed a qualitative descriptive design combining a focused narrative review of published educational literature, analysis of course-content examples, and pedagogical reflection on teaching practice at Gia Lai Medical College. This design is appropriate for identifying recurring instructional issues, comparing classroom approaches, and producing a practice-oriented framework. It was not designed to estimate a treatment effect, establish causal relationships, or compare intervention and control groups. Accordingly, the results distinguish literature-supported principles, practitioner-reported observations, and proposed instructional tools.

3.2. Sources and scope of materials

The literature component drew on eight foundational publications: four journal articles examining active learning, achievement, or perceptions of learning (Prince, 2004; Freeman et al., 2014; Deslauriers et al., 2019; Theobald et al., 2020); two academic books addressing learning design and statistical reasoning (Garfield & Ben-Zvi, 2008; Biggs & Tang, 2011); and two influential reports or guidance documents concerning active learning and statistics education (Bonwell & Eison, 1991; American Statistical Association, 2016). This is a purposefully selected foundational set rather than an exhaustive systematic review; no PRISMA-style screening claim is made.

Two additional publications on applied higher education in Vietnam were consulted as contextual comparisons, not as part of the eight-source foundational synthesis. Tran (2024a) examines the relationship between course teaching and occupational skills in fashion-design education, while Tran (2024b) examines students' entrepreneurial skills and institutional support. Neither study evaluates learning in Probability and Statistics or the proposed CTEF framework.

The practice-based material consisted of course topics, activities, and examples considered in the pedagogical reflection: descriptive statistics, tables and charts, probability, conditional probability, estimation, and testing; familiar health-related contexts such as blood pressure, treatment duration, screening results, and patient composition; individual and group tasks; a suggested 90-minute sequence; and a proposed rubric for assessing data-analysis products. No participant counts, teaching dates, formal observation protocol, classroom transcripts, individual test scores, or comparison condition were compiled for this study. Consequently, it does not report numerical gains in achievement or participation.

3.3. Analytical procedure

A thematic synthesis was organised along four analytical fields: (1) the statistical topic and the difficulty learners may face; (2) the professional context and cognitive operation required; (3) the teaching approach and expected learning product; and (4) assessment criteria, feedback, and implementation constraints. The first stage mapped the course topics to realistic health-related examples and the statistical decisions those examples require. The second compared the reported approaches with principles of active learning, statistical reasoning, and constructive alignment. The third identified recurring tensions in planning and delivering active-learning lessons.

Finally, the relationships among the four fields were expressed as the Context-Task-Evidence-Feedback (CTEF) framework. Context identifies a meaningful statistical question; Task specifies what a student must decide or explain; Evidence identifies a product that makes thinking visible; and Feedback uses that product to correct errors and refine subsequent work. The tables and framework are interpretive summaries and teaching-design proposals. They are not descriptive statistics derived from a newly collected participant dataset.

3.4. Credibility and methodological boundaries

Analytical credibility was supported by relating the teaching descriptions to the eight cited educational publications and by keeping the status of each claim explicit. Principles from external research were used to interpret local teaching experience, not to attribute measured effects to Gia Lai Medical College. Practitioner observations were treated as professionally relevant but non-standardised evidence. The proposed lesson sequence, rubric, and CTEF framework therefore require empirical assessment before claims can be made about their effectiveness, transferability, or measurement reliability.

4. RESULTS

4.1. Cognitive obstacles and health-related learning contexts

The synthesis identifies a recurring challenge in introductory Probability and Statistics: the transition from performing a familiar calculation to using statistical concepts as tools for describing and reasoning about data. Conditional probability, random variables, summary measures, estimation, and statistical tests require learners to interpret quantities as well as manipulate formulas. In the practitioner account, students may select a formula without being able to explain the choice, or complete an operation correctly while drawing a conclusion wider than the evidence allows. The instructional problem is therefore not solved merely by assigning more exercises.

A second difficulty concerns perceived professional relevance. Tasks based on blood pressure, treatment duration, screening tests, or distributions of patient characteristics can make the question more recognisable to health-college students. Such examples should use clear data, remain within the learners' existing professional knowledge, and focus on a precise statistical issue. Table 1 maps the documented topics to typical conceptual obstacles, plausible learning contexts, and the competence each task is intended to support.

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Table 1. Course topics, conceptual obstacles, healthcare contexts, and intended competencies

Course topic	Common learning obstacle	Illustrative healthcare context	Intended competence
Descriptive statistics	Confusing measures of centre and spread	Age, blood pressure, treatment duration	Select and interpret appropriate summaries
Tables and graphs	Selecting an unsuitable display	Patient composition, case counts	Represent data without misleading readers
Probability	Difficulty turning a scenario into events	Risk and screening-test outcomes	Model events and relationships
Conditional probability	Reversing the direction of conditioning	Sensitivity and specificity	Interpret conditional statements correctly
Estimation and testing	Confusing sample and population	Comparisons of health indicators	Explain results and uncertainty cautiously

Source: Synthesis of the course content and teaching experience described by the author.

Across these topics, the common requirement is movement between a question, a statistical representation, and a defensible conclusion. For descriptive statistics, the student must determine which summary best represents the observations. For graphs, the choice of display must serve the data and question. Conditional probability requires explicit attention to the conditioning event. Estimation and testing further require a clear distinction between sample evidence and population-level claims. This mapping provides a basis for deciding what students should actually do during an active-learning activity.

4.2. Matching active-learning approaches to cognitive tasks

Case-based teaching can be used to establish the need for a concept before introducing its formula. A dataset showing treatment durations with a few unusually large observations, for example, prompts comparison between the mean and median as alternative descriptions. A screening example accompanied by a two-way table or probability tree can clarify the difference between the probability of testing positive conditional on disease and the probability of disease conditional on a positive result. In each case, the statistical question determines the task and not the other way around.

The teaching account describes a four-part classroom activity: the instructor introduces the situation and required product; each student first interprets the information and records an initial answer; learners then exchange and revise ideas in a group; and the instructor compares approaches, identifies common errors, and consolidates the key principle. An individual attempt before group discussion is especially useful for maintaining accountability and revealing misconceptions that might otherwise be hidden by the strongest group member.

Collaboration is appropriate for tasks with multiple steps, such as cleaning an elementary dataset, constructing a frequency table, selecting a chart, computing a measure, and drafting a short interpretation. Roles for coordination, computation, verification, note-taking, and presentation may be distributed and rotated to discourage fixed patterns in which only one or two students do the substantive work. For brief conceptual questions, a think-pair-share sequence may be more efficient than an extended group exercise. Table 2 summarises the six complementary methods described in the teaching experience.

Table 2. Active-learning approaches, appropriate content, and observable products

Teaching approach	Suitable topic or task	Observable learning product
Healthcare case-based learning	Descriptive statistics; conditional probability	Case-analysis worksheet
Problem-based learning	Probability; selecting a statistical method	Justified solution or decision
Collaborative learning	Tables, charts, descriptive indicators	Spreadsheet or group report
Peer explanation	Conceptual questions and common misconceptions	Reasoned written or oral answer
Flipped learning	Basic concepts and introductory procedures	Preparation notes; short readiness check
Technology-supported data practice	Processing and visualising a dataset	Data file, chart, and interpretation

Source: Synthesis of the author's reported teaching practice.

The methods differ mainly in the cognitive work they elicit and the evidence they produce. Problem solving should result in a defensible choice; peer explanation should make the logic of an answer visible; and digital practice should culminate in an interpretation of what the spreadsheet or chart demonstrates. This task-oriented alignment reduces the risk of treating methodological variety as an end in itself.

4.3. Lesson sequence and competency-oriented assessment

In the flipped-learning element, preparation is most useful when it is concise and targeted: one central idea, a short example, and a few self-check questions. Transferring a long lecture into a video does not, by itself, change the learner's role. A readiness check at the beginning of class, for example with three to five short questions, can identify the concepts that need additional explanation and preserve face-to-face time for reasoning with data.

Spreadsheet applications are used as aids to rather than substitutes for understanding statistical concepts. Initial hand calculations may help students see the structure of a formula and identify computational steps. Later, software can reduce repetitive work and support visualisation.

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Whatever tool is used, the learner should still ask whether the selected measure is appropriate, whether a graph could mislead, and whether the written claim is supported by the observations. This principle also informs the sequence of lesson activities.

Table 3 presents an illustrative 90-minute lesson organisation based on the teaching reflection. The times are illustrative planning allocations, not measured durations across observed classes and not a rigid structure for every topic. The sequence reserves explicit time for individual thinking, group work, critique, and instructor-led consolidation.

Table 3. Illustrative 90-minute active-learning lesson sequence

Stage	Duration	Principal activity
Problem orientation	10 minutes	Read the data, make a prediction, and define the question
Prior-knowledge check	15 minutes	Individual response followed by pair discussion
Group task	35 minutes	Calculate, choose an approach, and justify the decision
Presentation and critique	20 minutes	Report, question, compare, and evaluate solutions
Consolidation	10 minutes	Write a contextual conclusion and complete an exit ticket
Total	90 minutes	

Source: Author's proposed lesson design based on pedagogical experience.

The assessment approach likewise shifts attention from the final numerical answer to how the learner reaches and explains it. Evidence may include a readiness check, a worksheet, a short individual response, a group product, an oral explanation, or an exit ticket. For a group submission, the shared output can be complemented by an individual question or brief personal justification. Table 4 presents a proposed weighted rubric; its weights are illustrative and have not been psychometrically validated.

Table 4. Proposed rubric for assessing a student data-analysis product

Assessment criterion	Proposed weight
Identify the problem and variables	20%
Select an appropriate method	25%
Compute and present data accurately	25%
Interpret the result in context	20%
Collaborate and communicate the analysis	10%
Total	100%

Source: Author's proposed rubric; weights are not empirically validated.

The rubric assigns a combined 65% to problem identification, method selection, and interpretation. It thereby makes visible that conceptual and interpretive work matters alongside arithmetic. In practice, feedback should distinguish four forms of error: misunderstanding the question, choosing an unsuitable method, making a procedural mistake, and asserting more than the data permit. This diagnostic distinction is more useful than marking an entire response simply correct or incorrect.

4.4. Reported observations and recurring implementation tensions

The author's classroom reflections indicate that learners often appear more willing to engage when an activity involves recognisable health-related data, such as test outcomes or basic measures of health. Requests to explain the meaning of a number can generate discussion different from requests to report a calculation alone. A requirement to write a plain-language conclusion may prompt students to check their own understanding. Peer critique can also expose the difference between correct arithmetic and appropriate inference, particularly when learners consider sample limitations, association versus causation, or statistical versus clinical significance. These are practitioner-reported patterns and should not be interpreted as quantified improvements.

The same account identifies practical constraints. Group work can become imbalanced when a confident learner performs most of the calculations. Preparing healthcare scenarios may take more time than preparing routine exercises, because cases should be statistically relevant, professionally plausible, and based on de-identified or publicly accessible data. Discussion can overrun the planned period, leaving insufficient time for the teacher to correct misconceptions and consolidate core concepts. The analysis therefore suggests using shorter tasks with a defined product and a visible closing stage.

Four tensions summarise these challenges. First, increasing professional realism can also increase unnecessary clinical complexity. Second, collaboration can provide more explanations but can conceal weak individual participation. Third, software can accelerate calculations while weakening conceptual scrutiny if introduced too early or used without interpretive prompts. Fourth, richer discussion can reduce the time available for consolidation and feedback. These are design trade-offs rather than arguments for abandoning any of the methods. They highlight the need to relate each activity to observable learning evidence and a planned response to that evidence.

4.5. A Context-Task-Evidence-Feedback instructional design framework

The qualitative synthesis is expressed as the Context-Task-Evidence-Feedback (CTEF) framework. Context provides a professional reason to examine statistical data; Task specifies the reasoning students must undertake; Evidence makes that reasoning observable through a worksheet, table, graph, explanation, or other product; and Feedback identifies misconceptions and supports revision. The four elements are not separate teaching fashions but interdependent conditions for coherent lesson planning. The last element informs the selection and adjustment of later contexts and tasks.

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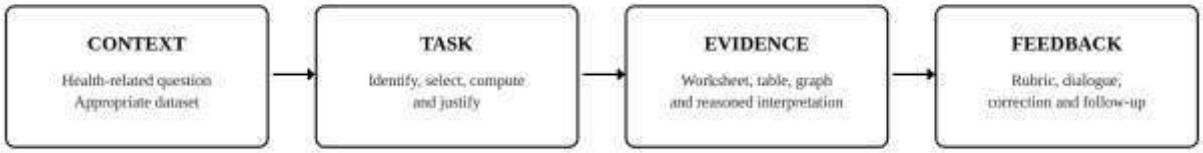


Figure 1. The proposed Context-Task-Evidence-Feedback framework for active learning in Probability and Statistics
Source: Author's proposed synthesis of course content and teaching experience.

Table 5. Operational content and review questions for the CTEF framework

Component	Key design question	Illustrative activity or output	Observable sign
Context	Which health-related question makes this concept necessary?	A clear, de-identified case involving blood pressure, tests, treatment time, or patient composition	The setting is relevant and the data are appropriate for the lesson
Task	What must each student select, calculate, explain, or critique?	Identify variables; select a summary or method; compute and justify	Reasoning accompanies the numerical result
Evidence	Which product shows what the student understands?	Worksheet, table, graph, spreadsheet, or short contextual conclusion	The product allows checking of method, computation, and interpretation
Feedback	Where did the reasoning fail and what should be revised?	Teacher comments, peer critique, exit ticket, and corrected answer	The error and its correction can be described explicitly

Source: Author's synthesis and proposal; the components have not been empirically validated.

CTEF evaluates the fit between components rather than the number of techniques used in a period. A focused lesson with one substantial task and clear evidence may better serve a learning outcome than several disconnected activities. The framework can be used to review lesson plans, prepare a bank of tasks at different levels of difficulty, or check that assessment prompts require more than a computational answer. Its present contribution is a structured design language, not a demonstrated causal explanation for gains in achievement.

5. DISCUSSION

5.1. From calculation practice to statistical reasoning

The findings reinforce the distinction between teaching students to reproduce procedures and helping them reason with data. The literature on statistical reasoning emphasises variation, contextual judgement, and the limits of inference (Garfield & Ben-Zvi, 2008), while GAISE recommends teaching with meaningful data and active engagement (American Statistical Association, 2016). At Gia Lai Medical College, a health-related scenario becomes educationally valuable when it leads the student to explain why a procedure is selected, what result it yields, and which conclusion can legitimately follow. The proposed CTEF framework gives this principle a concrete instructional sequence.

This approach also clarifies how the course can support broader professional capability without claiming to teach clinical decision-making. A simple example about a screening test or blood-pressure values should primarily develop statistical interpretation, not require students to make diagnostic judgements beyond their training. The question of professional relevance is therefore inseparable from the question of cognitive scope: the health context motivates the problem, while the statistics learning outcome determines the decision that is assessed.

5.2. Collaboration, learner agency, and individual accountability

The reported experience suggests that cooperative activities are most credible when all students have an identifiable role in reasoning. An individual response before peer discussion can expose initial misconceptions; rotating roles can reduce dependence on a single competent member; and a brief personal explanation after group work can provide evidence that each learner has engaged. This is consistent with the wider emphasis on substantive rather than superficial participation in active learning (Bonwell & Eison, 1991; Prince, 2004).

The tension between collaboration and accountability need not be resolved by choosing either individual or group work exclusively. Each form can perform a different function in the same learning episode. A first individual attempt establishes a baseline for reflection; dialogue tests and expands interpretations; a group product enables an integrated response; and a final individual explanation makes the learning personally accountable. The CTEF framework accommodates these stages because the Task and Evidence elements can specify both shared and individual outputs.

5.3. Appropriate technology use and data responsibility

Digital tools are useful where they make repeated computation more efficient or allow a class to compare alternative representations of the same dataset. Yet the interpretation of an automatically produced mean, graph, or test result remains an intellectual responsibility. Technology should follow a clearly framed question and should be accompanied by checks of variable type, method suitability, possible misleading visualisation, and limits of inference. This position aligns with the conceptual and technology-use priorities set out in the GAISE recommendations (American Statistical Association, 2016).

Data responsibility is particularly important in health-professions education. Illustrative datasets should be drawn from accessible sources or appropriately de-identified before being used for learning. Students should also practise stating what a dataset cannot establish. An observed statistical association is not automatically a causal effect, and a statistically significant difference is not necessarily important in professional or

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clinical terms. These distinctions can be treated as required features of the concluding statement in a learning product and can be reinforced through the assessment rubric.

5.4. Practical implications for Gia Lai Medical College

At the lesson level, a shared bank of contextualised tasks could be organised by increasing cognitive demand: recognition, explanation, application, and critique. Each task should include a learning outcome, a bounded dataset or problem, an individual or collaborative response requirement, and minimal criteria for feedback. For instance, an early descriptive-statistics task might ask students to choose between the mean and median; a more advanced version might present two alternative interpretations and ask which is defensible. Such progression helps preserve consistency even when teachers vary the active-learning format.

At the assessment level, course planning should include items requiring students to interpret a chart, justify a selected measure, compare two proposed analyses, identify a faulty inference, or write a cautious explanation in ordinary language. Readiness checks, exit tickets, and short written justifications can provide formative evidence without creating a heavy additional examination system. The role of an explicit rubric is not merely to allocate points but to tell the learner whether the primary problem concerns conceptual identification, method choice, calculation, or interpretation.

At the institutional level, sustained implementation depends on teacher development, teaching materials, and access to suitable tools. Collaboration among mathematics lecturers, health-discipline teachers, and relevant professional practitioners can help ensure that scenarios are authentic without making unnecessary clinical demands. A shared repository could contain de-identified teaching datasets, brief conceptual questions, sample errors, worksheets, short preparation materials, and rubrics. Periodic review could then identify activities that generate useful evidence and remove those that consume time without advancing the intended learning outcome.

Some parallels can be drawn with other applied higher-education settings in Vietnam. In discussing the teaching of garment-construction techniques to fashion-design students, Tran (2024a) emphasises the link between subject content and practical occupational skills. In a separate study of university student entrepreneurship, Tran (2024b) identifies skills gaps and institutional support as relevant challenges. These studies address different disciplines and do not demonstrate the effectiveness of active learning in statistics; they serve only to contextualise the importance of professional relevance and teaching support when considering implementation at Gia Lai Medical College.

5.5. Limitations and future research

Three limitations define the status of the present findings. First, the literature component is a focused set of eight foundational works, not a complete or systematic search of all relevant scholarship. Second, local classroom observations are recorded through pedagogical reflection rather than a formal protocol with participant counts, measured outcomes, teaching dates, or a comparison group. Third, the CTEF framework, 90-minute lesson sequence, and rubric are proposals; their feasibility, reliability, and comparative effectiveness have not been established with independent data. Accordingly, no causal or quantitative effect is claimed.

Future research could apply CTEF to several Probability and Statistics topics and document its implementation through a common observation protocol, student work samples, and pre- and post-course measures of interpretation and method selection. Where feasible, comparison across similar course groups could help distinguish instructional effects from cohort or teacher differences. Independent scoring of student explanations could be used to investigate rubric consistency. Student feedback and short interviews could add evidence on perceived relevance and difficulty. Such studies would make it possible to move from a transparent pedagogical proposal to an evaluated instructional model.

6. CONCLUSION

The application of active learning in Probability and Statistics at Gia Lai Medical College is best understood as the deliberate design of opportunities for statistical reasoning in professionally recognisable settings. The synthesis of course content and teaching experience identifies several priorities: selecting health-related data without unnecessary clinical complexity, asking students to justify methods and conclusions, balancing collaboration with individual responsibility, using software in support of conceptual understanding, and protecting time for feedback and consolidation. A successful lesson is not defined by the number of interactive techniques it contains, but by the reasoning that learners can demonstrate.

The tables in this study translate these priorities into relationships among content, methods, lesson sequencing, and assessment. The proposed CTEF framework integrates Context, Task, Evidence, and Feedback into a coherent and iterative design process. Its immediate value is as a practical tool for planning and reviewing teaching, rather than as an empirically validated intervention. Further research using systematic classroom data, consistent assessment instruments, and appropriate comparisons is needed before conclusions can be drawn about its effects on student outcomes. The long-term objective is to enable learners not only to calculate accurately but also to interpret and communicate statistical information responsibly in health-related study and professional practice.

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