

Title page

Wednesday, March 4, 2026 4:00 PM

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Task 1

Wednesday, March 4, 2026 4:01 PM



Task 2

Wednesday, March 4, 2026 4:01 PM

Q1. Aim and Objectives

To investigate and compare popular game development engines (Unity, Unreal Engine and Godot) in order to determine which tool most effectively supports student engagement and learning outcomes in Applied Computing higher education programmes.

OBJECTIVES:

1. To review existing literature on game development tools and their application in higher education computing programmes [9]
2. To identify and compare Unity, Unreal Engine and Godot based on performance, accessibility, learning curve and student outcomes
3. To collect quantitative data from students measuring engagement levels and academic performance when using different game development engines
4. To analyse the data statistically to identify which game development tool produces the most measurable improvement in student learning
5. To provide evidence-based recommendations for game development tool adoption within Applied Computing programmes

Q2. Research Philosophy

Research philosophy refers to the beliefs and values that shape how a researcher collects, analyses and uses data in a project [5].

Every researcher brings personal assumptions to their work, influenced by three key philosophical concepts: Ontology (the nature of reality), Epistemology (the nature of knowledge) and Axiology (the role of values in research) [4].

This project will adopt a Positivist research philosophy. Positivism assumes that reality is objective and can be measured through observable facts and numerical data [7].

This philosophy is appropriate for this project because the research focuses on measuring and comparing specific, observable outcomes - such as student performance scores, engagement rates and task completion times - when using different game development engines. These are quantifiable facts that exist independently of personal opinion [8].

Positivism aligns with quantitative data collection methods such as structured surveys with rating scales, performance tests and statistical analysis. This contrasts with Interpretivism, which focuses on subjective experiences and opinions and is more suited to qualitative studies [13].

Furthermore, a positivist approach allows for replication of this study by other researchers, which strengthens the reliability and validity of the findings. This is particularly important when making recommendations for educational tool adoption, as decisions should be based on measurable evidence rather than personal preference [11].

Q3. Search Tools and Research Databases

Before beginning research it is important to understand what is already known about a topic - the "known knowns" - and what remains uncertain - the "known unknowns" [5].

In this project, it is already known that game development engines such as Unity and Unreal Engine are widely used in education (known known). However, there is limited quantitative evidence comparing their specific impact on student learning outcomes in Applied Computing programmes (known unknown). This gap justifies the need for further research.

To explore this gap, the following databases will be used, as most published research uses between 4 and 8 databases [15]:

Identifying relevant literature requires a systematic approach to database selection (Booth et al., 2016) [13].

This project will draw on five key academic databases:

1. IEEE Xplore (ieeexplore.ieee.org) the leading repository for peer-reviewed computing and engineering research, making it the most relevant source for studies on game engines and educational technology

2. ACM Digital Library (dl.acm.org) a comprehensive archive of computer science publications, with extensive coverage of game-based learning and software development education
3. Google Scholar (scholar.google.com) a freely accessible search engine indexing academic journals, conference papers and theses across all disciplines
4. ScienceDirect (sciencedirect.com) a broad scientific database particularly strong in educational technology and human-computer interaction research
5. ERIC (eric.ed.gov) a dedicated education research database useful for locating studies on student engagement and technology-enhanced learning

Boolean search strategies will be used to refine results [5]:

"game development" AND "higher education"
AND "student engagement"

"Unity" OR "Unreal Engine" OR "Godot"
AND "learning outcomes"

"game-based learning" AND "computing"
AND "performance"

"game engines" AND "education"
NOT "primary school"

Quotation marks will be used for exact phrases. AND will narrow results, OR will broaden them, and NOT will exclude irrelevant terms. Date filters (2015-2024) will ensure currency of sources.

Additionally, titles and abstracts will be scanned first before reading full papers to efficiently identify the most relevant literature for this project.

Task 3

Wednesday, March 4, 2026 4:01 PM

Q1. Validity, Reliability, Generalisability and Ethics
Research quality depends on three core principles that must be addressed before data collection begins [10].

VALIDITY

A study is valid when its measurements genuinely reflect the phenomenon being investigated. For this project, validity will be strengthened by combining two data collection instruments - performance tests and structured surveys - so that findings are not dependent on a single source of evidence. Each instrument will be directly mapped to the specific objectives outlined in Task 2 [11].

RELIABILITY

A reliable study produces consistent results when repeated under the same conditions. To achieve this, every participant will complete identical practical tasks within the same time constraints, and all submissions will be evaluated using a pre-defined scoring rubric. This removes subjectivity from the marking process and ensures comparability across participants [12].

GENERALISABILITY

Generalisability describes the extent to which research conclusions can be extended beyond the immediate sample. Given that this study focuses on a specific cohort of Applied Computing students, the findings will be most applicable to similar university computing programmes. As Creswell (2014) notes, acknowledging the boundaries of a sample is itself a mark of research integrity [11].

ETHICAL CONSIDERATIONS

Research involving human participants requires careful attention to ethics throughout the entire process [11]:

- Voluntary participation: students will be clearly informed that involvement is entirely optional
- Confidentiality: all collected data will be anonymised before analysis
- Freedom to withdraw: participants may exit the study at any stage without providing a reason
- Secure storage: all data will be password protected and deleted after the project is complete

The Hawthorne Effect presents an additional challenge - Landsberger (1958) demonstrated that awareness

of being studied can alter participant behaviour and skew results [14]. This will be addressed by framing all tasks as routine coursework activities rather than formal research observations.

Q2. Research Strategies and Data Collection Methods

Based on the positivist philosophy identified in Task 2, this project will use quantitative data collection methods to gather measurable, objective data from participants [13].

PRIMARY DATA COLLECTION METHODS:

1. Structured Survey (Questionnaire)

A structured online survey with rating scales (1-5 Likert scale) will be distributed to Applied Computing students. The survey will measure engagement levels, ease of use and satisfaction with each game development engine. Likert scales allow numerical analysis of student responses [9].

2. Performance Tests

Students will complete standardised practical tasks using Unity, Unreal Engine and Godot. Task completion times and accuracy scores will be recorded and compared statistically to measure learning outcomes objectively [8].

SAMPLING STRATEGY:

As identified by Bryman (2016), quantitative research benefits from larger samples to ensure statistical significance [7].

This project will use:

- Random sampling - randomly selecting Applied Computing students to participate, ensuring the sample is representative and free from bias
- Stratified sampling - dividing participants by year of study to ensure results represent students at different levels of computing experience

PILOT DATA COLLECTION:

A pilot survey was designed and distributed to a small group of 3-5 participants to test the clarity and relevance of the questions before main data collection. Feedback received was used to improve the focus and wording of the questions.

See Appendix A for the pilot survey and feedback received.

Q3. Quantitative and Qualitative Analysis
There are two main types of data analysis: quantitative and qualitative [15].

QUANTITATIVE ANALYSIS

Quantitative analysis involves the use of numerical data and statistics to identify patterns and trends. As noted by Field (2018), there are two main types [10]:

1. Descriptive Statistics

Used to summarise and describe a dataset.

Examples include:

- Mean (average) calculating the average performance score of students using each game engine
- Frequency - counting how many students rated each engine as most engaging
- Standard deviation - measuring how spread out the results are around the mean

Descriptive stats provide a clear snapshot of the data that is easier to interpret than raw numbers [6].

2. Inferential Statistics

Used to make conclusions and predictions from data [5]. These help:

- Determine which game engine has the most significant effect on student performance
- Test whether differences between engines are statistically significant or due to chance

Inferential stats identify correlations:

- Positive correlation: as familiarity with a game engine increases, so does student performance
- Negative correlation: as task complexity increases, completion rates decrease
- Zero correlation: choice of operating system does not correlate with game engine performance

For this project, inferential statistics will be used to compare performance scores across the three game engines and identify which produces the most significant learning outcomes.

QUALITATIVE ANALYSIS

Although this project primarily uses

quantitative methods, qualitative analysis will also be considered for open-ended survey responses [16].

1. Thematic Analysis

A method used to identify patterns and themes in non-numerical data. As described by Braun and Clarke (2006), thematic analysis follows six steps and is effective for analysing open-ended responses [6]. This will be used to identify common themes in student opinions about game development tools.

2. Content Analysis

Involves categorising and coding qualitative responses to identify recurring concepts and ideas [13].

For this project, quantitative descriptive and inferential statistics will be the primary analysis methods, as they align with the positivist philosophy chosen in Task 2. By measuring and comparing student performance scores across Unity, Unreal Engine and Godot, statistical analysis will provide objective, evidence-based conclusions about which game development tool most effectively supports student learning outcomes [15]. Qualitative thematic analysis will provide additional supporting context by identifying common themes in student opinions about game development tools [16].

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Wednesday, March 4, 2026 4:01 PM

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APPENDIX A

Wednesday, March 4, 2026 4:01 PM

Appendix A: Pilot Survey and Feedback

Prior to the main data collection phase, a pilot survey was administered to a group of 2 Applied Computing students. The purpose of this pilot was to evaluate whether the survey questions were clearly worded, appropriately focused and suitable for the target audience. Responses and verbal feedback from participants were documented and used to revise the instrument before full deployment.

PILOT SURVEY: Game Development Tools and Student Learning in Higher Education

Thank you for taking part in this pilot survey. All responses are anonymous. This should take approximately 5 minutes.

Q1. Have you used any game development engines as part of your studies?

- ☐ Yes
- ☐ No
- ☐ I have used them independently

Q2. Which game development engines have you used? (tick all that apply)

- ☐ Unity
- ☐ Unreal Engine
- ☐ Godot
- ☐ Other: _____

Q3. How would you rate the ease of use of the game engine(s) you have used?

- ☐ Very easy
- ☐ Easy
- ☐ Neutral
- ☐ Difficult
- ☐ Very difficult

Q4. On a scale of 1-5, how much did using a game development engine improve your understanding of programming concepts?

- ☐ 1 - Not at all
- ☐ 2 - Slightly
- ☐ 3 - Moderately
- ☐ 4 - Significantly

[] 5 - Greatly

Q5. Do you feel that game development tools help make learning programming more engaging?

[] Strongly agree

[] Agree

[] Neutral

[] Disagree

[] Strongly disagree

Q6. What improvements would you suggest for how game development tools are taught in higher education?

[Open answer]

PILOT FEEDBACK SUMMARY

After distributing the pilot survey to 2 Applied Computing students, the following feedback was received:

Participant 1: Suggested adding a question specifically comparing the three engines against each other, not just rating them individually.

Participant 2: Positive overall - found the survey clear, relevant and quick to complete.

IMPROVEMENTS MADE AS A RESULT:

- A direct comparison question between Unity, Unreal Engine and Godot was added to the main survey
- Q4 scale labels were made more descriptive for clarity
- A question about technical barriers was added to the main survey

This pilot process helped improve the focus and clarity of the research instrument before main data collection.