

TARTU ÜLIKOOL  
Arvutiteaduse instituut  
Informaatika õppekava

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Development of supplementary learning materials on  
engaging games  
Bachelor's Thesis (9 ECTS)

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## **Development of supplementary learning materials on engaging games**

### **Abstract:**

This bachelor's thesis set out to create supplementary learning material for the University of Tartu course "Computer Game Development and Design" with the aim of broadening students' understanding of game engagement, the methods used to measure it and its neuroscientific background. An initial review revealed that the current course touches only briefly on player engagement and player profiles, focusing mainly on practical design techniques, so the new material was developed according to the ADDIE instructional-design model. During the analysis phase the existing resources were examined and ideas gathered for integrating the new topic; a questionnaire was then distributed to former students to gauge their knowledge of player engagement. In the closely linked design and development phases, research was surveyed to identify theoretical models - behavioural metrics, player taxonomies and dopaminergic mechanisms that best explain engagement. These findings were organised into supporting reading. The implementation and evaluation stages of ADDIE cannot be carried out until the course runs in the autumn and therefore belong to future work.

The project produced a 30-page material entitled "Engaging Games," which covers user-engagement metrics, player taxonomies based on Bartle and Quantic Foundry, and neuro-cognitive motivation loops such as dopaminergic pathways and the flow state.

**Keywords:** digital learning materials, ADDIE model, Computer Games

**CERCS:** P175 Informatics, systems theory

## **Lisamaterjalide väljatöötamine kaasahaaravatest arvutimängudest**

### **Lühikokkuvõte:**

Bakalaureusetöö eesmärk on luua täiendav õppematerjal Tartu Ülikooli kursusele “Arvutimängude loomine ja disain”, mis avardab tudengite arusaama mängude kaasahaaravusest, selle mõõtmisest ning kaasahaaravuse neuroteaduslikust tagapõhjast. Analüüsis selgus, et olemasolev kursus puudutab mängija kaasatust ja profiile vaid põgusalt, keskendudes peamiselt praktilistele disainivõtetele. Õppematerjalide koostamisel järgiti ADDIE mudelit. Esimene etapp hõlmas olemasolevate õppematerjalide analüüsi, ning ideede kogumist, kuidas uut temaatikat siduda. Loodi küsimustik kursuse läbinud üliõpilastele selgitamiseks välja kursuse läbinud üliõpilaste teadmised mängijate kaasatuse temaatikast. Teine ja kolmas etapp olid omavahel tihedalt seotud. Uuriti erinevatest allikatest ja teadustöödest millised teoreetilised mudelid – käitumuslikud mõõdikud, mängijaprofiilid ja dopamiinisüsteemi toimemehhanismid – selgitavad kaasatust kõige paremini. Struktureeriti need teadmised kursust toetavaks lisalugemiseks, loodi joonised ja tabelid. Neljandat ja viiendat etappi ADDIE mudelist polnud võimalik rakendada, sest kursus on sügisel - see jääb tulevikku.

Koostati 30-leheküljeline lugemismaterjal “Engaging Games”, mis käsitleb mängija kaasatuse mõõdikuid, mängijate taksonoomiat Bartle'i ja Quantic Foundry baasil ning neurokognitiivseid motivaatorite ahelaid nagu dopamiinisõlmed ja vooseisund.

**Võtmesõnad:** digitaalsed õppematerjalid, ADDIE mudel, Arvutimängud

**CERCS:** P175 Informaatika, süsteemiteooria;

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## Introduction

Over the past three decades digital games have evolved from a niche pastime into a defining cultural form that shapes leisure, social life and even education [1]. Success in contemporary game development therefore hinges not only on technical prowess but also on a nuanced understanding of human behaviour, motivation and the neuro-cognitive feedback loops that keep players immersed [2]. Games that calibrate reward pathways at the right cadence can sustain flow state and curb early churn [3].

The University of Tartu course “Computer Game Development and Design”[4] currently introduces player engagement and profiling only briefly, focusing mainly on practical design techniques. A needs analysis revealed that students lack a coherent theoretical knowledge of behavioural metrics, player-profiling theories and the neuroscientific mechanisms that underpin engagement. Additional material was proposed to the course supervisors, so that students could have deeper understanding on the player engagement.

A targeted literature and research material surveyed that informed this thesis was purposefully pragmatic, drawing on most widely used industry frameworks. Thesis focused on answering two main questions :

- 1) Which theoretical models - behavioural metrics, player profiles and the dopaminergic system’s operating principles - can best explain engagement?
- 2) How can this knowledge be structured into self-study material that complements the course’s practical assignments ?

The 30-page file titled “Engaging Games” was developed following the ADDIE model. It surveys a metrics toolbox for user engagement , maps Bartle’s [6] and Quantic Foundry’s [7] player profiles and their motivational spectrum and unpacks neuro-cognitive mechanisms such as dopamine loops and flow states. Reading material effectiveness is evaluated through a survey next year and adjusted if needed.

The thesis is organised as follows. Chapter 1 gives overview of the course and explores the need for additional materials. Chapter 2 details the methodology (ADDIE) used for research and creating the materials. Chapters 3 covers development of the materials. Chapter 4 present summary of the materials. Chapter 5 concludes and outlines avenues for future work.

## **Terminology**

**A/B test (split test)** - Controlled experiment in which a single variable (e.g. reward size) differs between two otherwise identical cohorts.

**ADDIE model** - [5]

**Churn** - The point at which a player stops returning (the complement of retention); often operationalised as 7 or 14 consecutive inactive days.

**DAU** - Daily Active Users

**Flow** - deeply immersive state that occurs when a player's skill level and the game's challenge are so perfectly balanced [3]

**KPI (Key Performance Indicator)** - Quantitative metric chosen to gauge success (e.g. Day 1 retention); KPIs vary by genre and business model.

**Live-ops** - Post-launch cadence of events, updates and offers designed to sustain engagement and monetisation over the game's lifespan.

**MAU** - Monthly Active Users

**Retention (Day-n, Week-n)** - The percentage of first-time users who launch the game again exactly n days (or weeks) later—industry's primary yard-stick for long-term engagement.

**Product-market fit** - is the moment when a product satisfies a clear, sizeable market need. Customers consistently choose, use and recommend the product over alternatives. Retention and monetisation metrics level off at healthy, durable plateaus, giving a foundation for scalable growth.

## **1. Course: "Arvutimängude loomine ja disain" (Computer Game Creation and Design)**

This section provides an overview of the University of Tartu course “Computer Game Creation and Design” based on information publicly available on its main lecture webpage[4] for the Fall 2024 iteration. It outlines the course's structure and content and discusses the need for additional materials.

### 1.1 Course's content and background

The following overview draws on information from the content of University of Tartu Study Information System [8] and the The CGVR Study Lab Youtube channel [9]. MTAT.03.263 Computer Game Development and Design is an autumn-semester course at the University of Tartu. It is taught in English and combines auditorium sessions and video recordings with independent, project-based work, giving students a comprehensive view of the digital-game production pipeline and practical experience with the Unity 3D engine. The aim of the course is to impart foundational knowledge of game-design principles, graphics rendering, physics simulation, game-specific artificial intelligence, audio design and cross-platform deployment, while emphasising teamwork and iterative development practices. As of the 2024/2025 academic year the course is compulsory or elective in the BSc and MSc Informatics programmes and in the micro-degree in Game Development; students from other curricula may take it as a free-choice subject.

## 1.2 Content and structure

The content of the course, corresponding to the 2024/2025 version, is organised in Tartu University infosystem in following blocks :

- Introduction to the course: development tools, version control, teamwork organisation.
- Unity fundamentals: scenes, GameObjects, components and prefabs.
- C# scripting: gameplay logic, event systems and input handling.
- Physics and collisions: rigid-body dynamics, triggers and character controllers.
- User interface design: Canvas system, layouts, interaction patterns.
- Cameras and lighting: camera rigs, post-processing, light baking.
- Materials and shaders: the rendering pipeline, visual style, particle systems.
- Animation: keyframing, blend trees, inverse kinematics.
- Audio systems: spatial sound, mixing, adaptive music.
- Game AI: path-finding, behaviour trees, decision making.
- Architecture and optimisation: entity-component patterns, profiling and performance.
- Networking and multiplayer basics: synchronisation, latency mitigation.
- Publishing, monetisation and analytics: platform requirements, revenue models.
- Project pitching, play-testing and iteration.
- Final project delivery, post-mortem analysis and course wrap-up.

## 1.2 Proposal for Supplementary Reading Materials

The official *Game Development* course materials provide a clear, well-sequenced introduction to game creation - scenes and prefabs, C# scripting, physics, user-interface layout and basic project management. These foundations are indispensable for building technically sound prototypes; however, they do not cover one of the important aspects of games - user engagement. Topics such as player motivation models, behaviour-driven analytics and the psychology of reward fall outside the core syllabus simply because of time constraints and the course's tool-centric focus. To ensure that students can link mechanical skills with player-centred design insight, an additional reading material - "Engaging Games": Metrics, Profiles and Reward Loops in Game Design was proposed.

The material extends the existing lectures with three main topics that delve a bit deeper into the human side of play:

1. Measuring user engagement – why actionable metrics (e.g., DAU/MAU, retention, A/B testing) are the compass of iteration and how to instrument them in Unity projects.
2. Player-profile frameworks and their possible application – from Bartle's four types to the twelve-factor Quantic Foundry model, plus practical checklists for mapping mechanics to dominant motivations.
3. Neuro-cognitive mechanics of engagement – dopamine-based reward cycles, attentional salience cues and the flow channel, linked back to concrete design patterns.

An anonymous online survey was distributed to students enrolled in the 2024/2025 autumn-semester course “Computer Game Development and Design.” Its purpose is to gauge how well the existing course materials satisfy learner needs and to identify areas where supplementary content on analytics and player-centred design might be useful. In total 16 students participated in the survey. Survey had 8 items total and the answers distributed as follows:

- Degree programme and study level.
  - All of the participants were studying computer science, for their bachelor's degree.
- Main reason for choosing the course.
  - 6 students answered that they play games but have never built one and want to try their hand at basic games-making or get a broad understanding of the process.
  - 5 answered that they already dabble in game development or related jams and now want a deeper, more “professional” or tool-specific education (e.g. Unity, design best-practices).
  - 5 answered that the course simply looked interesting or aligns with a personal fascination for games, without a concrete skill-building goal stated.
- Previous exposure to game-analytics or UX-research coursework - only 2 people answered that they had previous exposure.
- Familiarity with the Unity engine on a four-point scale (none → multiple projects).
  - 12 answered “None”
  - 1 answered “Beginner - have watched basic tutorials”
  - 1 answered “Mid level- have developed 1-2 games”
  - 1 answered “Quite a pro - multiple projects. ”

Respondents rate each statement on a five-point scale (1 = “not at all,” 5 = “fully”):

16 responses

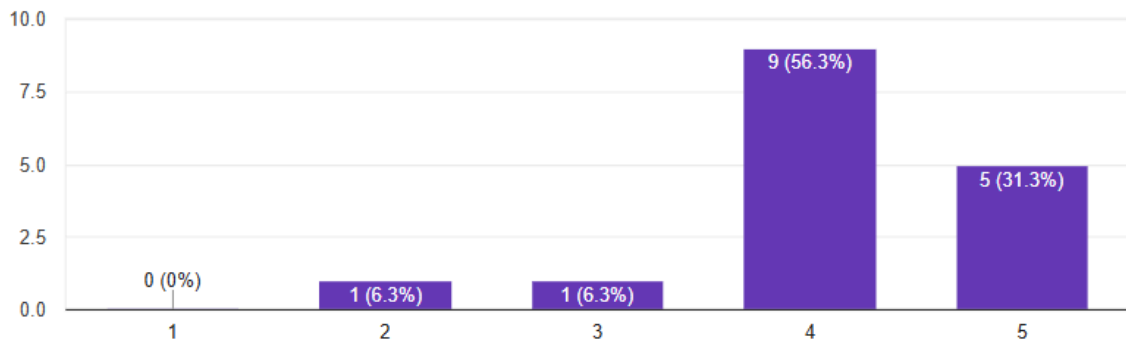


Figure 1. Depth of coverage of player-engagement theory

16 responses

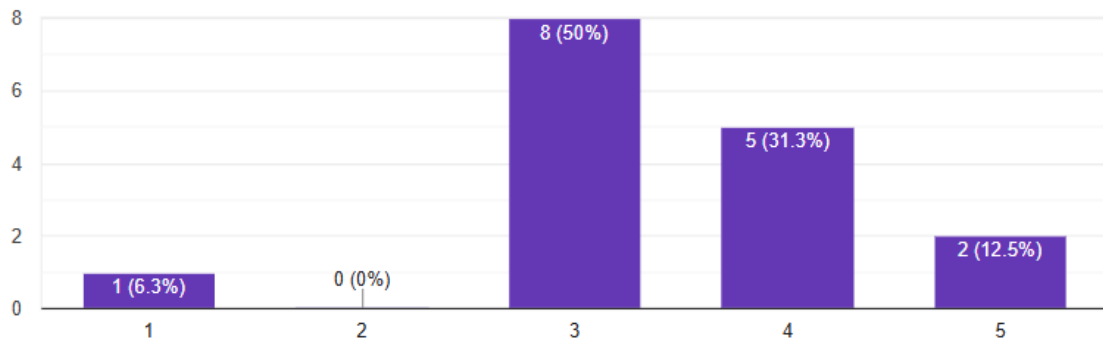


Figure 2. Ability, after the course, to choose appropriate analytics and engagement metrics.

16 responses

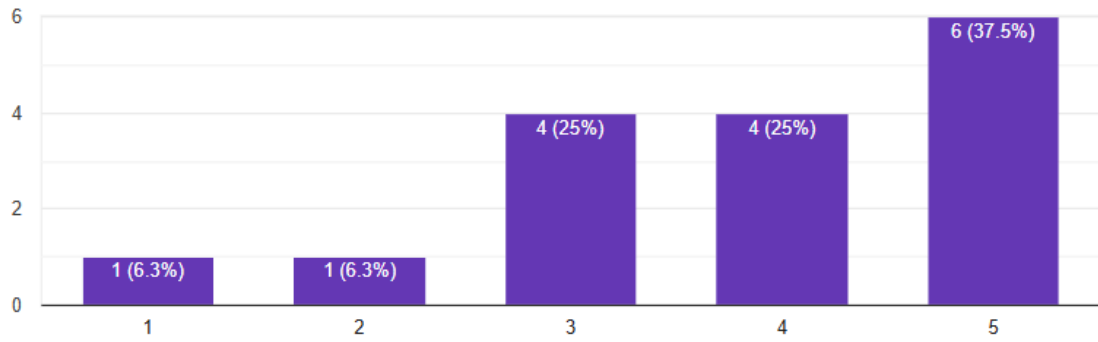


Figure 3. Desire for additional material on player types and motivation.

16 responses

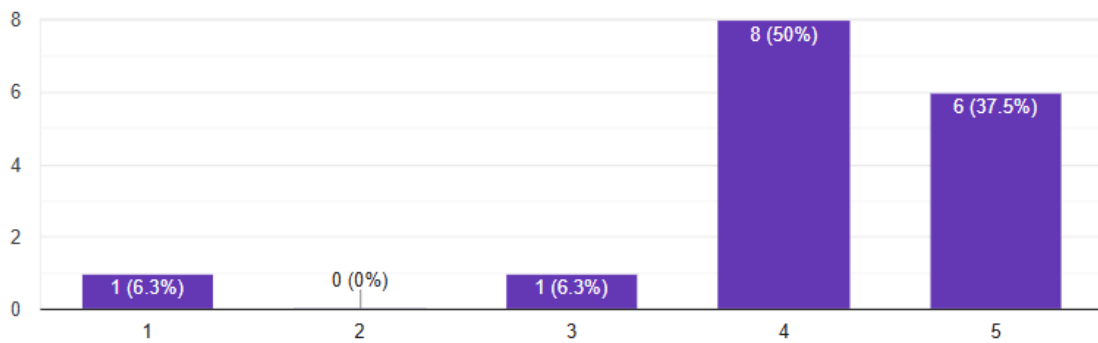


Figure 4: Relevance of neuro-cognitive reward-loop knowledge for improving game-play design.

The survey indicated that students are eager but mostly inexperienced. They appreciate current coverage of engagement theory (Figure 1), yet want more concrete analytics skills and deeper dives into player motivation and neuro-cognitive reward systems (Figure 3 & 4). Aligning practical labs with these interests should raise both competence and confidence. While students value the theoretical engagement material (high satisfaction), fewer than half feel sure which metrics matter to their own games (Figure 2) which is kind of conflicting information, as the course does not cover much. Eight out of ten students start from zero knowledge about Unity or game design. 63 % explicitly ask for more coverage of player typologies & motivation frameworks (Figure 3). High agreement (88 %) that this would help their design (Figure 4) - so material on reward prediction error, variable-ratio schedules, and flow states - tied to gameplay loop examples - would meet this demand.

## **2. Principles for Developing Learning Materials**

This chapter introduces the ADDIE model, which is used to guarantee that the learning resources are both high-quality and well structured.

### **2.1 The ADDIE Model for Learning-Material Design**

The ADDIE model is a widely adopted template for planning learning resources and is suitable for a variety of instructional formats [5,10]. It comprises five inter-linked phases whose English titles form the acronym:

- Analysis
- Design
- Development
- Implementation
- Evaluation

Analysis is the pivotal stage; completing it before any drafting begins saves time and streamlines the subsequent work [5]. It involves

- Learner and context analysis – establishing students' prior knowledge and experience so that new content can be planned and existing material adapted;
- Content analysis – selecting the topics to be covered;
- Learning-objective analysis – formulating precise learning objectives.

During the Design phase an action plan is drawn up on the basis of the analysis. Attention centres on the course architecture and sequencing, the choice of presentation format and the strategy for delivering the materials, all with a view to helping students grasp the target concepts [5,10].

In the Development phase the learning resources are produced in line with the first two phases. The work can be subdivided into (i) drafting, (ii) composing and (iii) reviewing the materials. By the end of this phase the new resources are ready for learners [10].

During the Implementation phase the completed learning resources are delivered to students and actively used in the instructional process [5]. A key concern at this stage is to support learners and exchange feedback on their progress in a timely manner.

The Evaluation phase gathers evidence on the quality and effectiveness of the materials. Two complementary approaches can be employed :

- External evaluation – feedback and judgements are provided by individuals who are not directly involved in the course, for example subject-matter experts from outside the university;
- Internal evaluation – feedback is collected from the learners themselves, typically through questionnaires or by observing the learning process.

The popularity of the ADDIE model stems from its adherence to good design principles and from its universal, structured workflow [5,11,12]. Although instructional resources can, in principle, be developed without explicitly following ADDIE, applying the model helps to keep quality consistently high and supports a rich, diversified learning experience [5,12].

### 3. Development of Learning Materials

This chapter describes how the supplementary resources for the *Game Development* course were created. The workflow followed the stages of the ADDIE model, with the Implementation phase postponed because the thesis was developed during 2024/2025 Spring Semester, but the course was in 2024/2025 Autumn Semester.

#### 3.1 Analysis

Under the ADDIE framework, development begins with an Analysis phase that covers (i) learner-and-context analysis, (ii) content analysis and (iii) learning-objective analysis [5,10].

- Learner and context analysis - A survey of students enrolled in *Game Development* was carried out to gather feedback on the existing resources and to identify if additional depth on player engagement would be beneficial.
- Content analysis - The current lecture videos and slides were reviewed; the sequence and scope of the new chapters were drafted.
- Learning-objective analysis - target outcomes were reformulated so that technical competence (Unity workflows, C# scripting, basic UI) could be linked to higher-order goals such as analysing player motivations and instrumenting engagement metrics.

Game industry comprises overwhelming number of titles competing for player attention [1], consequently, engagement and retention have become the main indicators for commercial viability. Because players are the main source of value for studios, it is essential to expose Game Design students to analytical and motivational frameworks that explain why audiences stay or leave.

The initial concept for the supplementary reader was intentionally narrow: describe how engagement manifests at the neural level - dopamine-mediated reward prediction, salience signalling, flow, and so on. A brief scoping meeting with the supervisor and course lecturer confirmed that the topic was interesting and aligned with the course's learning outcomes. Yet, once the literature review began in earnest, two critical gaps became obvious.

1. Missing bridge from theory to practice.

Neuro-cognitive explanations illuminate why players feel enjoyment or compulsion, but they say little about how a game designers can detect, quantify, or iterate on those feelings inside a live build. Without concrete instrumentation guidelines, students would be left with elegant diagrams of the mesolimbic pathway - but no way to decide whether their tutorial, difficulty curve, or reward cadence is actually working.

2. Player diversity and product-market fit.

Modern game development is rarely a one-size-fits-all endeavour. Reaching product-market fit requires matching a distinct motivational profile to a mechanics bundle that satisfies it better than competing titles. That, in turn, demands a reliable engagement metrics to reveal behavioural patterns and a vocabulary for who the behaviours belong to. Focusing solely on neuroscience would skip over both halves of this puzzle.

Given these shortcomings, the scope was widened along three complementary topics

1. Measurement and how to capture engagement in numbers.

This part would include instrumentation, events, DAU/MAU and retention benchmarks [14]

2. Player profiles - who are we building for and what motivates them.

Bartle's four archetypes [6]; Yee's Gamer Motivation Model and the twelve-factor Quantic Foundry survey [7].

3. Neurocognition - why do those numbers trend up or down.

Flow theory [3]; Dopamine.[15]

Only after readers can measure behaviour and interpret it in terms of audience segments does it make sense to fold in the neuroscientific mechanisms that underlie the observed patterns.

Extensive literature mapping therefore preceded actual writing. Practical play-testing tools event logging stubs in Unity, KPI worksheets and a reusable A/B-test checklist—were embedded directly alongside conceptual expositions. Classic theories such as Csikszentmihalyi’s flow model [3], Bartle’s taxonomy [6] and Yee’s empirical motivation factors [7] supply the interpretive lens, while instrumentation patterns and split-testing procedures [14] give students a means to validate hypotheses in their own projects. The result is a coherent material that starts with data in practice, moves through who the data describe, and culminates in why the data take the shape they do - closing the gap between analytics dashboards and neural circuitry.

### **3.2 Design**

The Design phase translated the broad needs discovered in the Analysis stage into a concrete instructional blueprint for the supplementary reading “Engaging Games”. Work proceeded as there was time, with no specific schedule and ended with reviews from the supervisor, two students and a field expert Marc Gimeno[13].

The core theory was packaged as a PDF file with internal hyperlinks and an automatically generated table of contents. Content drafting took place in Google Docs for real-time collaboration; self-created diagrams were created in Photoshop.

Content was then chunked into four thematic modules that progress from conceptual to applied:

Why Metrics Matter - foundational vocabulary;

Player Typologies - Bartle → Quantic Foundry;

Neuro-cognitive Reward Loops - dopamine, flow, goals;

From Insight to Design Decision - KPI worksheet

By the end of Development the new learning package was complete. It comprises concise textual explanations accompanied by diagrams, a self-tests, engaging supplement to the existing Game Development course materials.

Because the materials could not be piloted within the thesis timeframe, the Implementation stage of the ADDIE cycle remains outstanding. The new content will be rolled out in autumn 2025/2026 course offering, after which a second round of student feedback will be collected to complete the Evaluation stage and inform an updated edition.

## 4. Conclusion, Future Use, Further Development and Limitations

### 4.1 Conclusion

This thesis set out to broaden the “Computer Game Development and Design” course with a concise, theory-driven learning material that explains why and how games keep players engaged.

Using the ADDIE framework:

- Analysis confirmed a gap between the existing tool-centred syllabus and students’ wish for deeper understanding of engagement; a survey of 16 learners substantiated the need.
- Design & Development produced *Engaging Games* (30 pp.) - four modules that connect industry metrics, player-type taxonomies and neuro-cognitive reward loops.
- Implementation & Evaluation are scheduled for the next course iteration; hence their findings lie beyond this thesis.

The work answers the two guiding questions as follows:

- Which models best explain engagement?  
DAU/MAU, retention, A/B testing; Bartle’s four types and Quantic Foundry’s twelve motivations; dopaminergic reward prediction and flow.
- How can this be structured for self-study?  
A PDF with internal links, diagrams and self-checks.

## 4.2 Future use (Implementation & Evaluation)

Autumn 2025/26 deployment plan

1. Roll-out. The PDF will be uploaded to the page “ Computer Game Development and Design” and promoted by lecturers.
2. Formative check. During the course a five-item survey (Mentimeter) will gauge clarity and perceived usefulness.
3. Supervisor debrief. The lecturer will review the feedback and assignment quality for indications that the material helped students choose and justify KPIs in their projects.
4. Revision cycle. Feedback will feed into v1.1 of Engaging Games in January 2026.

## 4.3 Limitations

- Deferred deployment. Effectiveness, workload balance and technical compatibility have not yet been validated in a live classroom.
- Small, convenience sample. The needs-analysis survey captured 16 students from a single cohort; findings may not generalise to future intakes.
- Scope restriction. The material focuses on three frameworks; other engagement models (e.g. Octalysis, COM-B) were excluded for brevity.
- Static medium. A PDF cannot track learner progress or embed true interactivity; richer formats (e-book, SCORM) were outside the project time-box.

## 5 Summary

The thesis created Engaging Games, a 30-page supplementary learning material that equips University of Tartu game-development students with a coherent introduction to engagement metrics, player-type taxonomies and neuro-cognitive reward loops. Guided by the ADDIE model, the project:

- Identified a content gap via literature review and a survey of 16 learners;
- Designed a four-module structure
- Developed a media-rich, internally hyper-linked PDF.
- Scheduled implementation and evaluation for the next autumn semester.

Pending classroom deployment and larger-scale evaluation, the material stands as a prototype that addresses an acknowledged weakness in the current syllabus and offers a roadmap for further data-driven refinement.

## References

[1]	Entertainment Software Association <a href="https://www.theesa.com/resources/essential-facts-about-the-us-video-game-industry/2024-data/">https://www.theesa.com/resources/essential-facts-about-the-us-video-game-industry/2024-data/</a> (12.05.2025)
[2]	Bavelier, D., & Green, C. S. (2019) Enhancing Attentional Control: Lessons from Action Video Games p147 <a href="https://www.cell.com/action/showPdf?pii=S0896-6273%2819%2930833-5">https://www.cell.com/action/showPdf?pii=S0896-6273%2819%2930833-5</a> (12.05.2025)
[3]	Csikszentmihalyi, M. (1990). Flow: The Psychology of Optimal Experience. Harper & Row. <a href="https://www.researchgate.net/publication/224927532_Flow_The_Psychology_of_Optimal_Experience">https://www.researchgate.net/publication/224927532_Flow_The_Psychology_of_Optimal_Experience</a> (12.05.2025)
[4]	Arvutimängude loomine ja disain (MTAT.03.263) <a href="https://courses.cs.ut.ee/2024/gamedev/fall/Main/Lectures">https://courses.cs.ut.ee/2024/gamedev/fall/Main/Lectures</a> (13.05.2025)
[5]	Aldoobie N. ADDIE Model. American International Journal of Contemporary Research Vol. 5, No. 6, pp. 68-72, 2015. <a href="http://www.ajcrnet.com/journals/Vol_5_No_6_December_2015/10.pdf">http://www.ajcrnet.com/journals/Vol_5_No_6_December_2015/10.pdf</a> (14.05.2025)
[6]	Bartle, R. (1996). Hearts, Clubs, Diamonds, Spades: Players Who Suit MUDs. Journal of MUD Research. <a href="https://mud.co.uk/richard/hcds.htm">https://mud.co.uk/richard/hcds.htm</a> (10.05.2025)
[7]	Yee, N (2019) Gamer Motivation Model <a href="https://quanticfoundry.com/wp-content/uploads/2019/04/Gamer-Motivation-Model-Reference.pdf">https://quanticfoundry.com/wp-content/uploads/2019/04/Gamer-Motivation-Model-Reference.pdf</a> (01.04.2025)
[8]	Tartu University Information system <a href="https://ois2.ut.ee/#/courses/MTAT.03.263/version/52fe0bb4-a72e-84a4-5d16-af7f35063524/details">https://ois2.ut.ee/#/courses/MTAT.03.263/version/52fe0bb4-a72e-84a4-5d16-af7f35063524/details</a> (13.05.2025)
[9]	The CGVR Study Lab Youtube channel <a href="https://www.youtube.com/@cgvrlab903">https://www.youtube.com/@cgvrlab903</a> (13.05.2025)
[10]	Bates T. Is the ADDIE model appropriate for teaching in a digital age? Online Learning and Distance Education Resources, 2014. <a href="https://www.tonybates.ca/2014/09/09/is-the-addie-model-appropriate-for-teaching-in-a-digital-age/">https://www.tonybates.ca/2014/09/09/is-the-addie-model-appropriate-for-teaching-in-a-digital-age/</a> (13.05.2025)
[11]	Kurt S. ADDIE model: Instructional design. Educational Technology, 2017. <a href="https://educationaltechnology.net/the-addie-model-instructional-design/">https://educationaltechnology.net/the-addie-model-instructional-design/</a> (14.05.2025)
[12]	Wengroff J. What is ADDIE? Cognota, 2019. <a href="https://cognota.com/blog/what-is-addie/">https://cognota.com/blog/what-is-addie/</a> (14.05.2025)

[13]	Marc Gimeno <a href="https://www.linkedin.com/in/marcgimeno/">https://www.linkedin.com/in/marcgimeno/</a> (14.05.2025)
[14]	Drachen, A., Canossa, A., & Yannakakis, G. N. (2013). Game analytics—The Basics pp. 13–40. Springer. <a href="https://cmps-people.ok.ubc.ca/bowenhui/game/readings/ch2-game-metrics.pdf">https://cmps-people.ok.ubc.ca/bowenhui/game/readings/ch2-game-metrics.pdf</a> (01.04.2025)
[15]	Walton, M., Bouret S (2019) What Is the Relationship between Dopamine and Effort? Trends in Neurosciences <a href="https://www.sciencedirect.com/science/article/pii/S0166223618302728">https://www.sciencedirect.com/science/article/pii/S0166223618302728</a> (10.05.2025)

## Appendices

### Appendix 1 – Survey to students enrolled in the 2024/2025 autumn-semester course “Computer Game Development and Design.”

Dear student,

You are invited to take part in a short survey that supports my Bachelor’s thesis “Engaging Games: Player-Centred Design and Analytics” at the University of Tartu.

Purpose. Your answers will help me to understand how well the current course materials meet your needs- especially in areas such as player motivation, engagement analytics and the psychology of reward and will guide the creation of supplementary material.

What participation involves. The form contains 8 questions and should take around 2-3 minutes to complete. There are no right or wrong answers; please respond as honestly as you can.

Voluntary and confidential. Participation is voluntary. All responses are recorded anonymously and will be reported only in aggregated form in the thesis.

#	Question	Response format
1	Which programme and degree are you studying?	<i>Open-ended</i>
2	Why did you choose the “Computer Game Development & Design” course?	<i>Open-ended</i>

**3 Before this course, how familiar were you with the Unity engine?**

Single-choice:

- Not at all
- Beginner - have watched basic tutorials
- Mid-level - have developed 1–2 projects
- Quite a pro - multiple projects

**4 I have previously taken a class that covered game analytics or UX research.**

Yes

**5 Player-engagement theory (e.g. motivation models, reward loops) is covered in enough depth.**

Likert 1–5

(1 = Not at all 5 = Covered in enough depth)

**6 I know which analytics and engagement metrics are relevant to my game projects after finishing the course.**

Likert 1–5

(1 = Not at all 5 = Absolutely)

**7 I would like more material on player types and what motivates them.**

Likert 1–5

(1 = No, I don't think it's relevant 5 = Absolutely)

**8 I believe understanding neuro-cognitive aspects of reward would help me design better gameplay loops.**

Likert 1–5

(1 = No, I don't think it's relevant 5 = Absolutely)

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### **Development of supplementary learning materials on engaging games**

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