

Improving the CS Curriculum of a Top-Down Videogames BA

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ABSTRACT

We present a targeted curricular improvement on an interdisciplinary Videogames Bachelor of Arts, to be implemented in the 2022/23 academic year. The aim is to solve student adaptation issues with the program's interdisciplinarity that were heightened by the COVID-19 pandemic.

CCS CONCEPTS

• **Applied computing** → **Computer games; Education**; • **Software and its engineering** → **General programming languages**.

KEYWORDS

computer games, undergraduate degree, CS curriculum

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1 CONTEXT AND MOTIVATION

The Videogames Bachelor of Arts (BA) at Lusófona University is a three-year *evenly interdisciplinary* degree open to students with diverse academic backgrounds, such as Sciences, Arts, and Humanities [3]. The term *evenly interdisciplinary* was coined in this context by Mateas and Whitehead [4] to describe undergraduate Game Development (GD) degrees offering a balanced mix of Computer Science (CS), Art, and Design subjects. While such programs have solid CS foundations, they are typically more limited in this regard than technology-focused degrees [4].

Lusófona's Videogames BA opened in the 2009/10 academic year, and like several game development programs at the time, based its CS contents and faculty on/from existing CS programs—often with

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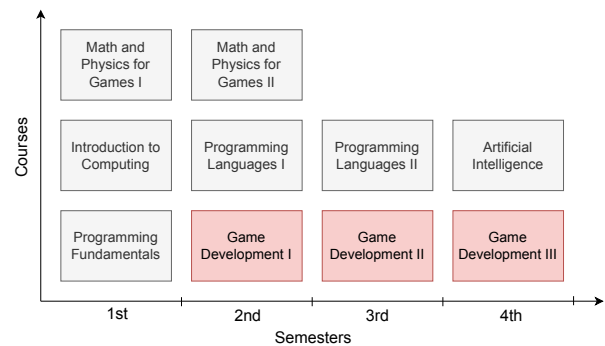


Figure 1: The current CS (light gray) and GD (light red) curriculum of Lusófona's Videogames BA first and second year (details in [3]). For brevity, remaining courses are not shown.

some disconnect from GD courses during the program's first years. In the 2017/18 academic year, the CS curriculum was redesigned using a top-down approach, where the game engine used for GD—Unity [5]—informed the CS curriculum design decisions (Figure 1). This led to a noticeable improvement in the student's technical capabilities, objectively assessed by the quality of their game projects in the GD course units [3]. Other teacher-led initiatives have since continued to improve teaching and learning in CS topics. Some examples of this ongoing work include, but are not limited to, Math and Physics for Games [1] and Artificial Intelligence (AI) [2].

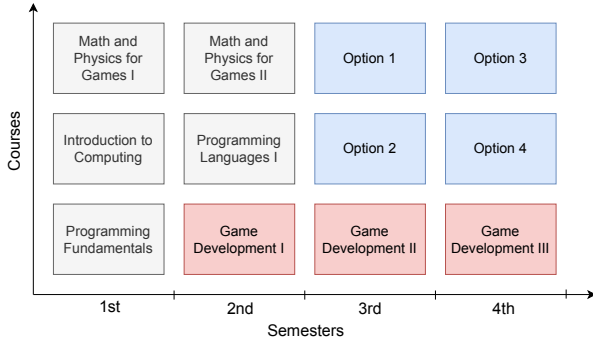
Unfortunately, and despite our best efforts, a minority of students, mainly coming from non-tech backgrounds, continued to struggle with more complex CS topics, in particular those exposed during the second year in the Programming Languages II (PL2) and AI courses. In any case, given its reduced incidence, the issue was manageable and the overall impact on the BA was not significant.

The COVID pandemic arrived in March 2020, forcing students and teachers into remote classes. Even though both groups generally had little to no experience with this type of lecturing, the abrupt change had a relatively small impact on the learning outcomes during the final months of the 2019/20 academic year. However, confinements and remote classes continued throughout 2020/21, leading to evident negative repercussions in freshman students, who during their first year in University barely met their colleagues and teachers. The CS learning outcomes were especially alarming,

Table 1: Optional second year courses in the updated curriculum. These can slot into Options 1–4 (shown in Fig. 2), according to the respective semesters in which they are lectured.

Semester	Computer Science options	Art & Design options
3rd	Programming Languages II	3D Modeling and Animation I
3rd	Computer Graphics*	Layout and Environment Design*
4th	Artificial Intelligence	3D Modeling and Animation II
4th	Network Systems for Games*	Character Design and Motion Capture*

*New courses to be introduced in the updated 2022/23 curriculum.

**Figure 2: Updated first and second year curriculum of Lusófona's Videogames BA, to be introduced in the 2022/23 academic year. CS courses are shown in light gray, GD courses in light red, and optional courses—presented in Table 1—in light blue. For brevity, remaining courses are not shown.**

with direct consequences on the quality of the games developed in GD courses and in the number of dropouts. Since many of these students now finished their second year in University, the existing but previously manageable issues with PL2 and AI became major problems. Further, while there have been essentially no confinements during the 2021/22 academic year, the situation with first-year students was still much more problematic than pre-COVID. Notwithstanding other types of intervention, we decided to turn these issues into an opportunity for improving the BA's curriculum.

2 CURRICULUM CHANGES FOR 2022/23

After several discussions, including with current and former students, as well as industry stakeholders, three major conclusions were reached: 1) the BA's identity and much of its appeal to students is rooted in its interdisciplinarity; 2) the second-year CS courses, PL2 and AI, are not essential for prospective game developers who want to focus their careers in areas such as game design, art, or production—i.e., the first-year CS courses provide a strong enough base for them to understand and interact with their programmer colleagues; and, 3) most CS-focused students muddle through several art-oriented subjects without much benefit to their future careers.

In light of these conclusions, we decided to: i) create four optional course slots in the second year, as shown in Figure 2; ii) turn PL2 and AI, as well as two art-oriented courses, into second-year slot options; and, iii) create four new specialized courses, two CS plus two Art and/or Design, as presented in Table 1. The goal is for students to

focus on their preferences while avoiding advanced topics outside of their intended specialization. This also minimizes a common criticism of evenly interdisciplinary degrees, namely their lack of depth in any given area [4]. With respect to CS, students will be able to learn rendering techniques and shaders, as well as how to create online multiplayer games in the new Computer Graphics and Network Systems for Games courses, respectively—areas in which the BA is currently lacking.

The new plan was presented to students enrolled in 2021/22 courses in the beginning of the second semester. All attending students provided positive feedback, agreeing the proposed change will improve the BA, while offering more flexibility in their specialization. Some students showed interest in mixing courses from both tracks. Therefore, while students will be suggested to completely follow a track, i.e., either selecting all four CS options or all four Art & Design options, we will allow mixing courses.

3 CONCLUDING REMARKS

We believe the presented changes will improve student learning outcomes, and aim to report them in a future full paper. Until then, the ongoing work of improving Lusófona's Videogames BA will continue either with specific course activities [1, 2] or with more global improvements [3].

We hope that the issues, discussions, and solutions put forward in this short paper resonate with teachers and curriculum designers in GD programs, helping them in making their own decisions if/when confronted with similar problems.

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