Visualising the University Degree Journey

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Visualising the University Degree Journey

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Abstract

In UK Higher Education, examiners are placed in a privileged position, able to apply adjustments to grades and confer awards in line with institutional regulations. Most frequently, examiners utilise dense tabulations of marks that blend into one another. This paper proposes an objective visual approach and prototype system, which can be used to chart students' journeys through their programme and visually reason about their performance. We also present the evaluation, made during a trial within the School of Computer Science at Bangor University. The results of the evaluation are favourable.

CCS Concepts

•***Human-centered computing*** → *visualisation systems and tools;* •***Applied computing*** → *Education;*

1. Introduction

Almost all academic assessment relies on the subjective judgements of the educator; there are, however, notable exceptions such as in mathematics. Educators continuously strive to reduce the impact of this necessary evil. They employ rubrics, mark schemes, multiple-choice assessment, and other mechanisms in the pursuit of an objective, individual grade for each student [CMM03].

Besides, lecturers are obliged to make Higher Education (HE) ever more inclusive and accessible. This task includes making adjustments for Specific Learning Difficulties and disability. In the UK examiners are granted broad powers to make these changes during progression (end-of-year) and award (end-of-programme) mark confirmations [Bro04]. Despite best efforts, there can also be academic missteps during delivery or assessment. There can also be exceptional circumstances, such as pastoral crises, that also require mitigation.

Without any systemic support from tools, each examiner must follow a similar, but not identical, process to their colleagues. They must assimilate the data being presented, reason around it, apply (sometimes abstract) regulations, to arrive at a final grade. While disagreement, with correct intent, is healthy; this individual process will vary in focus, effort, and conviction [YBW00].

This paper sets out a prototype design and method for a system to support examiners when making adjustments and confirming grades. A system does not merely need to show the current state of affairs, but also offer guidance and advice to the examiners. This goal will require building in institutional regulations, departmental policy, and local customs. While this intelligence will limit the applicability of the prototype, the method and design should be abstract enough to transfer.

2. Related Work

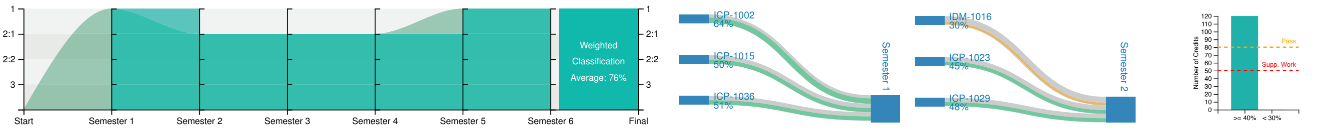
Implementing visualisations is not new within the Learning Analytics field. There are dashboards [VDK*13], organisational visualisations [LPdlFV*12], activity, and path visualisations [FBE*13]. However, these efforts focus on describing the current state, rather than assisting with the summative awarding/progression decisions. Previous reviews of the state of learning analytics [BV17, SRTV*17, BKA*18] find that the questions being asked of analytics systems do not lend themselves to more advanced visualisation or interaction techniques.

There is a move toward progress tracking within Learning Analytics applications. Examples include Mastery Grids created by Loboda et al. [LGHB14] and Study Paths created by Busler and Semmler [BS17]. Most visualisation remains basic, using bar charts to show achievement [Duv11] on an assessment-by-assessment basis. A University of Tennessee student proposed in their thesis [DeC14] a method of tying some elements of a course and student data together. DeCotes' method, however, focuses on unifying student cohorts rather than individual achievement.

3. Our Use-Case

Administrators will diligently produce pages of spreadsheets/tables containing each student's marks for that academic period for the examiners. As the number of students, programmes, modules, and combinations expand, so do these reports. Absorbing this information, combining it with any exceptional circumstances, then applying all relevant regulations [Sto04] can place a significant burden on the examiners.

This work focuses on specific cases during the normal progression and awarding Board of Examiners meetings. These



(a) Overview (b) Detail View (c) Regulation View

Figure 1: Reduced view of the Student Journey Tool, showing the constiutent, correlated views.

are where students are within borderline conditions, or where special circumstances exist that may warrant further consideration from the examiners. In these cases, mentally manipulating the tabular data can lead to confusion. For example; where one examiner will miscalculate the number of credits at pass level and another examiner corrects them. Depending on the discipline of the chairperson of the meeting, these complications can be time-consuming and distracting.

4. Algorithm and Visualisation Design

The system was broken into three distinct pieces to aid the design process, an overview view, a detail view, and a regulation view. The regulation view is an extra aid for examiners to see and apply the relevant regulations without needing to resort to the documentation and manual calculations. All of our decisions are based on commonly held best practices, derived from case studies in Information Visualisation and Scientific Visualisation texts [Ber83, Few12, McC12, Mei13, Yau11].

The Overview View is intended to show the student's entire programme and progression within that programme. Therefore the principal element is time. In this view, the design choices will be restricted to chart and visualisation types appropriate for temporal data. With a temporal view, time usually occupies the categorical (horizontal) axis. The vertical or value axis would then display the average degree classification for the student at that point in their studies. The user can select an academic year to focus on by clicking/touching on this timeline.

The Regulation View is concerned with the number of credits achieved by the student. There are three categories (under most UK HE rules); Above Pass ($\geq$40%), Condonable (30-39%), and Fail (<30%). For this reason, there is no other logical choice than a simple column chart. We have chosen to use two bars, one for Above Pass (using a green colour) and the other for Fail (coloured red). We have added the threshold levels as dashed horizontal threshold lines for further visual reference.

The Detail View uses a Sankey diagram as the base visualisation, showing the component modules within the academic year selected. The height of the individual module bars is representative of their academic credit value. The bar acts as a vertical gauge, the full height representing 100% and the coloured portion the student's actual mark. In order to raise awareness of borderline cases. The design includes five colours representing categories of achievement. Green represents a standard pass, gold (as pictured for module IDM-1016 in Fig. 1b) indicates a condonable fail, and red a definite fail. A bright yellow, and orange colour indicates a score within a 2% borderline of a pass and condonable fail respectively. The board should consider these cases for extra attention.

The full resolution version of the tool also includes annotations showing special circumstance categorisations for each incident alongside the semester in which they occurred. It also includes a text annotation giving the per-regulations outcome for each student if the board decides to make no adjustments.

An anonymous, static version of this tool can be found at `https://research.shadowraider.com/journey`.

5. Evaluation

A preliminary evaluation was completed using the standard System Usability Scale (SUS) [B*96]. A total of 16 examiners, familiar with the institutions practices but not all regulations, were surveyed. Testing of the scale (using over 500 trials) has established that the average score is 68 [Sau11].

The Student Journey visualisation scored an average of 79.65 / 100 on the SUS. This score places it on the Good/Excellent boundary [BKM08]. Examining those results ranking the tool below average ($n = 5$), the average score was 63 / 100. These responses place the tool in the marginal section of the scale. Respondents were also given the opportunity to provide free-form comments. A positive comment states that this tool was able to show the situation with a student which matched, almost exactly, examiners intuitions. Most of the negative-leaning remarks were request for additional training/materials rather than suggestions or complaints.

We will look to improve the tool further, including the addition of a 'cohort overview'. This view would provide an icon for every student, allowing examiners to visually identify cases for consideration. At present examiners would need to either view all students individually or use the tabular reports. We believe that the addition of this visualisation would raise the tool's utility by supporting the decision of whether to consider a case at all.

6. Conclusion

We have shown a possible objective visual aid can be produced, to assist examiners when making decisions on student performance. This prototype tool has proven usable, and popular with those evaluating it in the pilot study. A wider study will be needed to ensure the tool meets or can meet the needs of a wider audience. The visuals produce appear to correlate well with intuitive impression of students held by the examiners. This work provides a sound foundation to produce further enhancements and associated work.

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