

# **The Cultural Impact of Accessible Gaming Mechanics: A Study Comparing Nepalese and UK Computing Students**

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## **Abstract**

There are more international students enrolled on UK university courses, studying abroad than international students studying in the UK. UK courses are increasingly being delivered overseas by partner institutions. Course designers are working to develop engaging material that adds value cross culturally. Applying gaming style elements to courses is a method that has proven successful in motivating and engaging students in a range of disciplines. This paper examines whether the benefits of employing game mechanics are reproduced in different learning and geographical cultures, as cultural influences on students' learning styles may be underestimated. This is achieved through a comparison of the engagement and success of students studying the same two modules delivered in the UK and in Nepal. The game elements applied have been selected for their transferability and capacity to equip course designers with accessible tools that focus on low risk participation, instant feedback and encouraging small increments of improvement through iteration. These particular components could be seen to parallel traditional learning cultures seen in Asian education.

**Keywords:** Cultural, game mechanics, engagement, performance, increments of improvement.

## 1.0 Introduction

Increased costs of a university education and reduced demand from traditional groups, means many universities are striving for alternative sources of funding. “There are almost 460,000 foreign students studying overseas for the awards of English HEIs” [1]. Universities are moving towards a different model with more diverse income streams. Forming global partnerships and franchises with other intuitions, both nationally and internationally is a developing trend. Education With Others (EWO) can provide an interesting insight into the impact cultural environments, languages and teaching styles have on engagement and performance [2].

Healey’s [1] review of the Higher Education Statistics Agency (HESA) states that there are more international students enrolled on UK university courses studying abroad than in the UK. This paper reviews the behaviour of students on the same course, awarded by the same institution, delivered in different geographical and cultural locations. Four cohorts, from two continents are reviewed to determine if applying easily accessible gaming mechanics [3] impact on students’ engagement with non-accessed academic content and assessment performance and how this is affected by cultural factors. This is achieved by recording the results of regular student engagement in self-reviewed challenges and their correlating assessment grades, comparing the achievements from cohorts in the UK and Nepal. The data reviewed has been collected from level 4 and 5 computing students.

The endeavours to encourage students to engage with non-assessed activities which could have a significant bearing on their academic achievement, is a subject which perpetually stimulates academic debate [4]. Traditional and innovative reward and penalty [5] approaches can be combined to motivate students to develop a deeper level of learning and consequently achieve a higher level of performance. Reframing traditional and reliable techniques to best reach students from different cultures allows us to build on existing best practices. The instant immediate world that UK millennials have grown up in, can provide us with insight into relating HE to a new breed of learners. The widely held belief [6] is that incorporating game play elements has positive impacts on engagement and performance. This is investigated to assess if it traverses learning cultures, whilst being mindful of stereotyping Asian students as surface or rote learners [7]. This study aims to propose a transferrable approach for implementing simple game mechanics that are effective in different cultural learning environments. Framing academic content in a gaming model [3] may prove more successful in particular environments and cultures.

Time pressed course designers and practitioners still strive to cultivate engaged, resilient students. Designing and implementing engaging, complex games however is difficult, time consuming, and costly [8]. Consequently, the aim is to apply accessible gaming principles using readily available tools, in a popular virtual learning environment (VLE). The focus is on low risk participation, checked not judged, instant feedback and small increments of improvement, achieved through iteration, to encourage a self-driven progress. These methods forgo the time

consuming elements of aesthetics [6], which may be more culturally specific, in favour of low effort, high impact, inclusive components. Although still time consuming to create, once written they can be deployed by anyone using the VLE, enabling tutors engaged in education with others to transfer the themes easily.

The goal of the research is to define an effective transferable approach for imbedding simple game mechanics into module content which can have a meaningful impact on all students' academic performance in assessments, regardless of cultural setting. Analysis of the results aligns to the research goal by providing measurable evidence to support effective international module development and structuring.

## **2.0 Methodology**

### **2.1 Research Design and Approach**

The research goals are achieved through quantitative analysis of students' performance in reference to engagement and attainment. The research primarily looks at trends and evidence from the numeric data collated from the VLE. The tools are designed to be relevant to module learning outcomes and the assessment strategy.

### **2.2 Research Methods for Data Collection**

The Nepalese partnership with Northampton is well established and has been running in its current format for four years. The modules in Nepal mirror those in the UK, with very closely aligned content and identical assessments. The tutor in Nepal delivers both the level 4 and 5 modules. The authors of this paper wrote the modules and deliver them in the UK. The level 4 module is a prerequisite for the level 5, and must be passed before enrolling on the level 5 module. The four test groups were made up of 166 level 4 and 87 level 5 UK based computing students and 108 level 4 and 99 level 5 Nepal based computing students. One notable difference is the duration of face-to-face contact time in Nepal, who have three hours per week, compared to the UK who have two hours.

Data is collated from end of topic challenges, released online, along with other module resources, in advance of the end of term, time constrained assessment (TCA). Each challenge contains 10-20 questions reviewing the material covered in that topic. The questions include but are not limited to multiple choice, multiple answers, hot spots, code completion, matching, reordering and short answer style questions. Challenges are designed to test both knowledge and understanding, not just memory. This facilitates comparison of "cultural differences between Western and Asian conceptualisations of memorising" [9] and the practice of 'memorising with understanding'.

The challenges are marked literally by the VLE with regular expressions allowing for variations in free text answers and are scored based on correctness and good practice. They are designed to provide instant feedback [6] relating to performance

on each question (a score). To discourage passive learning, they purposefully do not reveal the solution, how to improve the outcome, or where any errors were made. They are written to simulate key components of assessment requirements and address the learning outcomes of the module.

The same six, end of topic, online challenges were completed by both level 4 cohorts and the same ten challenges completed at level 5. Level 4 students are directed to complete the challenges and given time at the end of a face-to-face class to attempt the challenges. Nepal level 5 students are treated the same as level 4 students. The UK level 5 students were encouraged to complete the challenges in their own time and only those who completed the timetabled practical activities asked to attempt the challenge in class. All cohorts are encouraged to repeat the challenges frequently to improve their results, adhering to the concept that gamifying rewards effort, not winning [10]. Students can start a test and return to it later, these are categorised as 'In Progress'. At the point of collecting the data the 'In Progress' tests were manually submitted by the tutor. The results from the challenges were collected using the highest mark achieved by the student across all their attempts on a challenge, as a percentage. The results from each cohort are collected in terms of:

- The proportion of the cohort attempting the challenges (engagement)
- The proportion of pass marks (>40%) by cohort in the challenges (achievement)
- The level attained by the cohort in challenges (performance)

At the end of the first term, all cohorts sat a TCA compiled of 35 - 45 questions in the same format as the challenges and marked in accordance with the original process. For ease of comparison the TCA results were collected as a percentage, rather than a grade. Grades have also been used for comparisons but simplified to the absolute grade; A  $\geq$  70%, B  $\geq$  60%, C  $\geq$  50%, D  $\geq$  40%, F > 0% and non-submissions categorised as G. Results from each cohort are collected in terms of:

- Proportion of cohort attempting the TCA (engagement)
- Proportion of pass marks (>40%) by cohort in the TCA (achievement)
- Level attained by the cohort in the TCA (performance)

The results from the challenges are correlated with those of the TCA. The results are cross referenced and analysed as follows:

- Comparison of challenge engagement with TCA engagement by cohort
- Comparison of challenge achievement (pass/fail) with TCA achievement by cohort
- Comparison of challenge performance (grade) with TCA performance by cohort

## 2.3 Justification of Research Approach

The cohort sizes for computing students at the University of Northampton and the partnership with Nepal facilitate good datasets. The structure and straightforward approach allows for a clear and measurable comparison of results. The modules delivered to each cohort are reviewed and validated based on the University's procedures and ensure a consistent level of assessment. The consistency in academic content, assessment and tutors, helps to preserve comparability in the two cultural environments, affording additional reliability in the results.

## 3.0 Results

The datasets from Nepal and the UK are 108 and 166 student cohorts respectively for level 4 and 99 and 87 for level 5, a combined dataset of 460 students.

### 3.1 Challenges

Table 1: The percentage of cohort completing all challenges

	Level 4	Level 5
<b>Nepal</b>	75%	73%
<b>UK</b>	65%	36%

Table 1 shows that Nepal has a notably higher engagement with the challenges than the UK, particularly at level 5. Nepalese students were 10% more likely to complete all the challenges at level 4 and nearly 40% more likely to complete all the challenges at level 5. 25% and 27% of Nepalese students and 35% and 64% of UK students are not engaging fully with non-assessed content.

Table 2: The percentage of cohort who passed the challenges on average

	Level 4	Level 5
<b>Nepal</b>	93%	86%
<b>UK</b>	77%	49%

There was a marked difference in those achieving an average of over 40% in the challenges, as shown in table 2. At level 4 Nepal have a 16% higher pass rate in the challenges than the UK cohort. At level 4 only 7% of the Nepal cohort failed the challenges on average compared to 23% of UK students. This is more apparent at level 5 where although pass rates are lower in Nepal than level 4 they are 37% higher than their UK counter parts.

Table 3: The percentage spread of grades achieved by each cohort in challenges

Level	4	5	4	5	4	5	4	5	4	5	4	5
%	A	A	B	B	C	C	D	D	F	F	G	G
<b>Nepal</b>	76	74	7	6	5	3	4	3	7	13	1	1
<b>UK</b>	27	25	12	6	15	9	13	9	25	31	8	20

At level 4 and 5 roughly  $\frac{3}{4}$  of all students in Nepal achieved an A grade in the challenges, compared to just over a  $\frac{1}{4}$  of level 4 and 5 UK students (table 3). Nepal and the UK saw a 6% increase in fail grades from level 4 to level 5. However, at level 4 only 7% of the Nepalese students failed the challenges overall, whereas 25% of UK students attempted and failed the challenges. There is also an obvious disparity in the number of G grades at level 5, which is 19% higher in the UK than Nepal, this is smaller at level 4 with a 7% gap.

### 3.2 TCA

Tables 4: The percentage of cohort attempting the TCA

	Level 4	Level 5
<b>Nepal</b>	99%	100%
<b>UK</b>	96%	92%

The percentage of students attempting the TCA shown in table 4, are high for all cohorts. Nepal have very low levels of non-engagement with assessments, with 100% engagement by level 5. The UK non-engagement grades for the TCA are higher than Nepal, showing 3% and 8% fewer attending but still represents a good engagement with the assessment.

Table 5: The percentage of each cohort passing the TCA on average

	Level 4	Level 5
<b>Nepal</b>	94%	96%
<b>UK</b>	67%	76%

Table 5 shows that Nepal has a very high and consistent basic pass rate, between 20% and 27% higher than the UK.

Table 6: The percentage spread of TCA grades achieved by each cohort

Level	4	5	4	5	4	5	4	5	4	5	4	5
%	A	A	B	B	C	C	D	D	F	F	G	G
<b>Nepal</b>	27	78	27	13	25	1	15	4	6	4	1	0
<b>UK</b>	55	32	12	17	5	15	5	11	19	16	4	8

Table 6 shows that at level 4 the percentage of students achieving an A grade in the TCA in the UK is almost double that of the Nepalese students. Conversely, at level 5 it is 46% higher for Nepal. At level 4 the difference in performance is reduced when considering students receiving ‘good grades’ (A+B grades). All cohorts achieve 50% or more good grades in the TCA. At level 4 the UK good grades are more than 10% higher than Nepal but at level 5, Nepal have almost double the amount of A+B grades.

### 3.3 Relationship between challenges and TCA

Table 7: Correlation between average challenge and TCA results

	Level 4	Level 5
<b>Nepal</b>	0.44	0.58
<b>UK</b>	0.73	0.62

The Nepal cohort has moderate correlation between the performance in the challenges and the TCA, which is slightly higher at level 5. This is illustrated in table 7. The UK shows a strong correlation which is higher at level 4.

### 3.4 Attendance

In Nepal most of the students have above 70% attendance. 63% of UK level 4 students attend 70% or more of the time but at level 5 it dropped to 37%.

## 4.0 Discussion

### 4.1 Engagement

The Nepalese cohort displayed high engagement with the non-assessed academic content (table 1), demonstrating approximately  $\frac{3}{4}$  of all students completing all the challenges at level 4 and 5. Nepal are more likely to complete all the challenges than the UK students. The distinction in engagement may be due to cultural differences in teaching and learning styles. The additional focus on face-to-face contact in the

Nepalese institution, enables time to be dedicated to engaging with the challenges. Although taken from a study on the Indian education system, Gopalan [11] noted a huge reliance on examination scores as a measure of success which predominantly fuels motivation. Similarly, less value is given to critical thinking skills and self-learning.

It is interesting to note how the same challenges could be presented as either game play or exam rote, as a means of engaging various learning cultures. If Giridharadas's [12] observations of Indian education are widespread in Asia, rote memorization remains the standard pedagogy, which could account for the levels of engagement, congruent of the teaching style. Raymond's [13] research found that Asian students tend to be dependent learners relying on their teachers but also noted that Asian students are less hesitant to ask questions in class. This, coupled with perseverance being rated as a virtue [13] in Asia, would provide explanations for the increased engagement with the challenges, over the UK students, rather than any intrinsic motivation [10] provoked by gamification.

In uncertainty avoidance cultures seen in Asia, engaging with preparatory activities may be seen as a way of minimising uncertainty in the TCA. At level 4 both Nepal and UK students are given time to complete challenges in class. Level 5 UK students are encouraged to complete challenges in their own time, which clearly has a significant impact on engagement (table 1). At level 4, 25-33% of students are not engaging fully with non-assessed content but at level 5 this is close to a staggering 2/3 in the UK. It is disappointing that students are not completing all the challenges, particularly where cohorts are explicitly directed to complete the challenges and given time in class, which is more restricted in the UK institution. However, this may provide some indication of other significant factors specifically attendance. Although not part of this study directly it is reasonable to assume that attendance has an impact on engagement with academic content and consequently achievement. The Nepalese tutor reported good attendance with most students achieving over 70% attendance, whereas only around 40% of students achieved this in the UK level 5 cohort. There is evidence to suggest that the level 5 cohort attendance is uncharacteristically low for that module, the same cohort had low attendance in the level 4 module the previous year. Attendance for the level 4 UK students showed that about 65% of students were attending more than 70% of the time. It could be inferred from this that engagement with the activities is related to attendance and derived from that, the requirement of having to do them in class, not the gaming components, that is eliciting the improvements.

It is commonly accepted that students are less likely to engage with content that is not assessed [14]. It is therefore reasonable to expect, the percentage of students engaging in the TCA is higher with all the cohorts, than engagement with content. Nepal demonstrate very low levels of non-engagement with assessments (1%) see table 4. The cultural research suggested [11] that worth was gained from achievement in exams, and in order to succeed, you have to attend, which could prompt the exceptionally high level of engagement with the TCA in Nepal. The



engagement with the TCA relative to the challenges is consistent in all cohorts. As with the challenges, in the UK non-engagement grades for the TCA are higher than the Nepalese students, but still represent a strong engagement with the assessment.

## 4.2 Achievement

Overall, the level of achievement (scoring on average above 40%) in the challenges is higher than the level of engagement. This suggests that a proportion of students are passing the challenges on average despite not completing them all, consequently achieving significantly higher grades when they do engage.

Nepal's 10% higher rate of engagement with content (table 1) returns a 15% higher pass rate with the challenges (table 2) and a significant 30% higher pass rate in the TCA (table 5) than the basic pass rate in the UK TCA at level 4. At level 5 a 40% increase in engagement with the challenges in Nepal converted to an almost equivalent improvement in achievement with an 86% pass rate in the challenges and a further 10% increase in pass rate in the TCA. This represents a meaningful difference. The same content and assessment are delivered which indicates that even small increments of improved engagement in academic content can have a valuable effect on results. Causality is not clear, but it can be inferred that cultural differences may have impacted on achievement levels. If the cultural differences in conceptualising memory [9] are considered for Nepal, progressing from level 4, where they achieved well and applied memory with understanding would provide a solid grounding [15] for the level 5 module.

## 4.3 Performance

The majority of students in Nepal achieve a top grade overall in the challenges at level 4 and 5 with  $\frac{3}{4}$  of all students in the Nepalese cohort achieving an A grade, compared to roughly  $\frac{1}{4}$  of UK students (see table 3). Conversely the percentage of students achieving an A grade in the TCA is much higher in the UK level 4 cohort when compared to the Nepal cohort (see table 6). At level 4 the UK TCA A grades are almost double that of the Nepal cohort. The difference in performance is reduced when considering students receiving 'good grades' (A+B grades). Although both level 4 cohorts achieved over 50% good grades in the TCA, the UK still has a 13% higher rate of good grades. However, at level 5 Nepal considerably exceeds their level 4 performance and the UK, with a striking 78% achieving A grades. The cultural preference to "seek understanding through the deep approach" [15] which underpins 'memorising with understanding' might be a contributing factor of the Nepalese students' improvement in the second year.

The performance in the Nepal level 4 cohort is considerably higher in the challenges than in the TCA for "good" grades and fails. This may be explained by cultural learning and language differences. The TCA by definition, is time constrained. The greater success in the challenges over the TCA could be a consequence of traditional learning styles. Tutor led contact time is more valued in Nepal than the UK and therefore students are given time, and encouraged to, repeat the challenges during

class. This may result in some levels of ‘knowing’ the answers to the exact question rather than understanding them. Consequently, at level 4 when it comes to the TCA Nepal are unable to apply their skills, beyond the basics. However, this appears to change as students progress into level 5, where they demonstrate development as learners and apply knowledge and understanding to succeed in the challenges and assessment. At level 5 in Nepal, 78% of all students achieved an A grade and 91% achieved good grades (see table 6). It is interesting to see that the level 5 Nepal cohort appear to have learnt from their mistakes in level 4 and improved their application skills, to apply their challenge experiences to the TCA assessments.

The UK sees general improvement in achievement and performance from challenges to TCA grades at level 4 and 5. 28% improvement in good grades and a 6% reduction in fails, despite the 4% reduction in G grades for level 4 and 11% improvement in good grades at level 5 (see table 6). However, both these improvements impacted on the pass grades (C+D). Oddly at level 4 the change in C+D grades is the opposite in the UK to Nepal, with a notable drop in pass grades from challenges to TCA in the UK. The improvement in TCA grades in the UK level 4 and 5 may be attributable to increased level of engagement in the TCA compared to the challenges.

## 5.0 Conclusions

There is a good correlation between the performance in the challenges in the UK and their performance in the TCA at both level 4 and 5. It is notable that although there is moderate to good correlation in Nepal, the strong correlation seen in the UK between challenge and TCA performance is not as significant in Nepal, even though the content and approaches are the same. This is interesting, but it does not show causality.

The cultural research [7, 9, 11, 13, 15] suggests that the style of the assessment has an impact on the way students revise and learn from it. It proposes that students adapt their learning styles in response to the assessment demands. The nature of these challenges and TCAs may lend themselves to promoting success for students who incorporate ‘memorising with understanding’ in their learning style, and those students familiar with this process are more successful.

The findings suggest that adding gaming mechanics to courses is a successful way to engage students and improve performance across cultures. It is likely that they are successful in the Nepalese cohorts due to their parity with traditionally accepted and preferred learning styles rather than their inherent gaming nature. Proposed strategies for engaging Asian learners [13] recommend the use of prompt feedback and review, both of which are core components of gamification. This suggests a natural allegiance between some gaming mechanics and cultural learning styles dominant in Asia. At its core, gamification is underpinned by repetition and mimics rote learning, affording instant feedback and small increments of improvement through iteration.

## 6.0 Impact

At a practical level the research has developed simple and structured challenges, that work in different cultures for ostensibly different reasons. The challenges form stepping stones which provide a clear line of sight between module content and assessments and have been shown to support students in their corresponding assessment, irrespective of culture. This is achieved using accessible, transferable tools to provide maximum return on effort for tutors designing EWO and local content. Consideration is given to the motivational influences of student participation with the challenges either from gaming or the need to succeed. It is also noted that engagement is clearly impacted by requirements in class and the corresponding impact of increased contact time on the outcomes. Although educators strive for independent students, we can notably improve their performance in exam style assessments by explicitly directing their preparatory efforts.

## 7.0 Further Study

This paper forms the foundation for a body of research looking at the application of game mechanics. The next stage is to incorporate the results of the problem-based assessment which requires greater independence of thought and higher levels of critical thinking. Additional gaming tools such as badges and leader boards will also be implemented to consider their impact on engagement and performance.

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