A Study to Measure the Potential Impact of Generative Artificial Intelligence on Academic Integrity

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Platform business models like Uber Ride or Airbnb Lodging enable innovative business models by operating digital platforms to connect providers and consumers of products and services in two-sided markets. A particular challenge with platform business models is designing an appropriate revenue model to capture value. This paper presents a taxonomy that classifies the different dimensions and characteristics of revenue models for platform business models. A proven taxonomy development method is used that includes a review of current literature related to platform business models. The taxonomy provides a comprehensive classification of platform revenue models and is applied to a real-life case. The results of this paper include a UML class model and a final taxonomy with 14 dimensions and 64 characteristics. The paper contributes to the design process of novel platform business models and expands the understanding of how digital platforms can generate revenues.

1   Introduction

Artificial Intelligence (AI) is now firmly rooted in our daily lives. It is in our intelligent home devices, healthcare diagnostic tools that scan our bodies, and the cars we drive or pass on the street. AI has enhanced the way we live, and it is doing the same where we work and study. Increasingly, organizations are adopting AI and using AI platforms and other technologies to develop, deploy, and maintain AI-powered products and services at enterprise scale (Anaconda, 2023). According to McKinsey (2023) the rate of enterprise AI adoption has exponentially increased, and one-third of organisations surveyed disclose using Generative Artificial Intelligence (GenAI) regularly in at least one business function.

A form of GenAI known as ChatGPT developed by OpenAI, and released publicly in November 2022, has become the fastest growing consumer application in history (Marr, 2023). Since it's release, the use of GenAI has rapidly expanded in the field of education, as additional tools have emerged including DALL-e, Midjourney, Claude, Jasper, Duet AI, Bearly AI, Gemini, Synthesia, FontyAI, Jenni, Quillbot, and a multitude of what are known as co-pilots integrated with existing software. Microsoft (2024) describe its co-pilot as "your everyday AI companion".

The ability of GenAI to perform complex tasks (Janakiram, 2022; Liu et al., 2023; McKinsey, 2023) in the field of education has caused mixed feelings among educators (García-Peñalvo, 2023; Halaweh, 2023; Hearn, 2022; Kohnke et al., 2023; Malinka et al., 2023; Rudolph and Tan, 2023; Sawahel, 2023). GenAI is capable of creating original essays, ideation, musical compositions, graphics, videos, slides, and software code, while also producing detailed quantitative and qualitative analysis. Thus, integrating GenAI with education raises concerns about assessment and evaluation, as traditional methods may become obsolete in the face of AI-generated solutions (Fowler, 2023; García-Peñalvo, 2023; Hockly, 2023; Lancaster, 2021; OpenAI 2023a). The most significant concern for GenAI in education, is its implications for academic integrity (Firat, 2023a & 2023b; Fowler, 2023; Hearn, 2022; Lancaster, 2021; Malinka et al., 2023; Roe and Perkins, 2022).

In this study, students applied GenAI to complete past assessments, adapted as research tests, with the goal of achieving a pass grade when graded by a university academic, undetected by GenAI writing detection tools. The formal objective of this

study is "to empirically test the impact of generative artificial intelligence on the academic integrity of university assessments". Two research hypotheses were developed to test the research objective:

- Hypothesis 1: Students can complete university assessments using GenAI undetected by AI writing detection tools.
- Hypothesis 2:Students can achieve a passing grade (>=40%) for university assessment submissions generated using AI when graded by a university academic.

The study was undertaken in the South East Technological University (SETU) in Ireland, between April and September 2023. This paper describes the design, deployment and results of the study.

2   Academic Integrity

Many definitions and descriptions of academic integrity exist in the literature and there are as many disparities as there are correlations. Arguably, academic integrity and compliance with such, is contextual, national (where national agreement exists), and essentially localised dependent on integration of national agreements into university governance policies. Launched in November 2019, the National Academic Integrity Network (NAIN) is a peer-driven network of academic and professional staff, student representatives and representative agencies from across the higher education landscape in Ireland. NAIN (2021) supports Irish higher education institutions in developing a common, national understanding of academic integrity and fostering a culture of academic integrity through enhancement activities and sharing of good practice. The South East Technological University (SETU), where the researcher works and the research was conducted, has fully adopted NAIN definitions and standards of academic integrity into its governance policies.

This study adopts the definition and principles of academic integrity established by NAIN (2021) as "the commitment to, and demonstration of, honest and moral behaviour in an academic setting". It requires that all interactions with higher education institutions in Ireland are approached with honesty including all documentation submitted to the institution for academic purposes. Furthermore, academic integrity involves "compliance with ethical and professional principles, standards and practices and a consistent system of values, that serves as guidance

for making decisions and taking actions in education, research and scholarship"
(NAIN, 2021). Maintaining academic integrity is critical to the reputation of higher
education, and to the recognition of a graduate's academic learning and resulting
qualifications (NAIN, 2021).

3 Generative Artificial Intelligence (GenAI)

Generative Artificial Intelligence (GenAI) transformer architectural models are
defined by their use of multi-layered neural networks (NNs), also known as
multimodal large language models (LLMs), trained using unsupervised and semi-
supervised statistical, machine and deep learning algorithms to perform a variety of
natural language processing (NLP) tasks, to identify patterns and structures within
massive petabyte-sized datasets to generate new and original artifacts. For example,
Generative Pre-Trained Transformer 4 (GPT4), commonly known as ChatGPT4, is
a multimodal large language AI model created by OpenAI, and it is the fourth in a
series of GPT foundation models (OpenAI, 2023b).

3.1 The Adoption of ChatGPT

Since November 2022, ChatGPT has become the fastest growing consumer
software application in history. Ofcom United Kingdom (Ofcom, 2023) reveals that
80% of British teenagers aged from 13-17 years old, and 40% of children between
the ages of 7-12 years old use GenAI tools and services for schoolwork or leisure.
ChatGPT is the most widely used GenAI service among internet users aged 16 and
over (Ofcom, 2023). Education featured strongly in the target audience interests of
ChatGPT site visitors (Similarweb, 2023) during the period of the study .

ChatGPT's journey from concept to influential GenAI model exemplifies this rapid
evolution of GenAI. This model has driven progress in GenAI development and
spurred transformation of work practices across a wide range of industries (Marr,
2023). Thus, given the disruptive impact of GenAI on business and indeed all facets
of life, it is critical that this technology becomes part of the educational experience
of students particularly as it heavily influences their future careers.

3.2   Enhancing Educational Praxis with GenAI

The ability of GenAI to perform complex tasks within the field of education has caused mixed feelings among educators as it disrupts existing educational praxis (Baidoo-Anu and Owusu Ansah, 2023). However, as studies are only emerging with respect to the uses and benefits of GenAI for education, it is not yet possible to assert a consensus among academics with specific reference to GenAI in education (Firat, 2023a). Nevertheless, emergent studies identify a number of benefits of GenAI which are applicable to ChatGPT:

- ChatGPT can be used to create intelligent tutoring systems capable of providing personalized assistance to students (Marr, 2023; Zhai, 2022).
- ChatGPT can be used in education, especially for autodidactic learners, because it can provide personalized learning support, tailor appropriate learning programs, and provide timely feedback (Firat, 2023a; Firat, 2023b).
- ChatGPT can be used to create chatbots and virtual language tutors simulating real-life conversations and providing instant feedback (Bédi et al., 2023; Božić and Poola, 2023; Firat, 2023a; Firat, 2023b; Hockly, 2023).
- ChatGPT can be used to help students improve their reading and writing skills. By analyzing a student's writing style, ChatGPT can suggest improvements and provide feedback on grammar, punctuation, and spelling errors (Bédi et al., 2023; Božić and Poola, 2023; Hockly, 2023).
- ChatGPT can be used to create personalized learning experiences. By analyzing a student's learning patterns and preferences, ChatGPT can recommend specific learning resources, such as articles, videos, and textbooks, that are tailored to their needs (An et al., 2023; Baidoo-Anu and Owusu Ansah, 2023; Božić and Poola, 2023; Wang, 2023; Zhai, 2022).
- ChatGPT can generate prompts for formative assessment activities providing ongoing feedback (Baidoo-Anu and Owusu Ansah., 2023).
- ChatGPT can be used to grade essays and other written assignments automatically. This can save teachers a lot of time and provide students with immediate feedback on their work (Božić and Poola, 2023; Zhai, 2022).
- ChatGPT can improve motivation, engagement, and learning outcomes (Baidoo-Anu and Owusu Ansah, 2023; Deng and Yu, 2023; Wang, 2022).
- ChatGPT to enhance participation and success for students from disadvantaged backgrounds (Sullivan et al., 2023).
- ChatGPT can be used to foster critical thinking (García-Peñalvo, 2023).
- ChatGPT can empower students to learn complex concepts in plain language (Sullivan et al., 2023).

From a strategic educational perspective, the emergence of GenAI compels academics to adapt teaching, learning and assessment practices to incorporate the new reality of living, working, and studying in a world where GenAI is widely available as open source software (Liu et al., 2023; García-Peñalvo, 2023; Rudolph et al., 2023; Sullivan et al., 2023). However, a common concern in academic literature pertains to the negative impact of GenAI on academic integrity.

3.3   Challenges Posed by GenAI for Academic Integrity

For academics, artificial intelligence (AI) has been a source of significant concern with respect to its impact on academic integrity for many years (Abd-Elaal et al, 2019; Amigud et al., 2016; Janakiram, 2022; Lancaster, 2021; Roe and Perkins, 2022). Outside of academia, the use, or indeed misuse, of AI has also raised concerns about ethics and integrity in other competitive settings (Roose, 2022). The threat of GenAI to academic integrity has also been raised in the media (Fowler, 2023; Quach, 2023; Weale, 2023). The emergence of publicly accessible GenAI, and ChatGPT in particular, has dramatically increased these concerns which cannot be dismissed easily (An et al., 2023; Amini-Salehi, 2023; Baidoo-Anu and Owusu Ansah, 2023; Malinka et al., 2023; Rosenblatt, 2023; Sullivan et al., 2023; Zhai, 2022). Professor Charles Terwiesch of University of Pennsylvania's Wharton School contends that ChatGPT has important implications for education – a conclusion arrived at when ChatGPT passed an MBA exam (Rosenblatt, 2023). Thus, GenAI poses a threat to academic integrity when used to bypass learning in what the European Network for Academic Integrity (ENAI, 2023) terms "unauthorised content generation".

While OpenAI, the creators of ChatGPT, developed a software tool in February 2023 to detect text generated by ChatGPT (Quach, 2023), it was withdrawn from the market as it was ineffective in July 2023 (Horwood, 2023). In April 2023, Turnitin embedded an AI writing detection tool in its Turnitin Feedback Studio (Caren, 2023). The Turnitin AI writing detection tool quickly established itself as a key tool for academics to detect ChatGPT generated essays, presentation slides, and narrative analyses. However, several reports in the media highlight that the Turnitin AI writing detection tool is fallible and can indeed generate false positives (Fowler, 2023).

The ability of GenAI to paraphrase texts and reduce plagiarism detection (Amini-Salehi, 2023) also raises concerns as it conceals that the work is not original and results in a distorted perception of the student's writing abilities. Wang (2023) found that students with higher metacognitive levels were better able to describe their goals and processes using GenAI prompt engineering and were better able to critically adapt GenAI solutions. By contrast, students with lower metacognitive levels rely more heavily on GenAI, rather than using it as a support tool. Thus, GenAI can provide some students with an advantage over others particularly if it is used to conceal plagiarism or used surreptitiously in the generation of an assessment solution. GenAI also raises concerns that students may outsource assessments to those capable of producing higher quality outputs (Zhai, 2022). Despite this important debate, very little literature has been published on GenAI in education and the student's voice is poorly represented in research (Sullivan et al., 2023).

4   Research Method

The study empirically tests the impact of GenAI on the academic integrity of university assessments. The implementation of the study is quite simple and easily replicated. The Principal Investigator (PI) first invited university academics to submit a sample of past assessments from 2020-2022. Past assessments were received from seven academics for nine modules including Fund Reporting and Risk Management; Personal, Professional and Academic Skills; Business Research and Communication Skills; Business Strategy; Global Business Ethics; Organisational Behaviour; Management Skills; Professional Development; and Behavioural Finance. The assessments include essays; spreadsheet analysis; industry and sectoral analysis reports; critical analysis of theories; presentation slides; reflective diaries; and discursive analysis. These past assessments were then adapted as research tests removing cover sheets and submission details/dates but preserving the original questions/instructions. Twenty-six (26) tests were generated from the assessments.

The PI then posted invitations on the university course management systems (CMS) for students to enroll in two GenAI research events in April and September 2023. The research events were hosted in the SETU digital business laboratory. Each student was assigned a research test on the CMS. Students were instructed that the goal of the GenAI research event was to challenge students to apply any GenAI of their choosing to complete the past assessments adapted as research tests, with the

goal of achieving a pass grade (>=40%) when graded by an academic, undetected by GenAI writing detection tools. While the original assessments gave students several weeks to complete their submissions, students only had two hours to complete the research tests. Once completed, students uploaded their solutions to a research folder in the CMS. The students were all 1st, 2nd and 3rd year business students. None of the students have received any training in the use of AI in SETU.

Two (2) of the twenty-six (26) research tests submitted were spoiled and inadmissible in the analysis. The valid research tests (24) were processed using GenAI writing detection software to determine an AI writing detection score. The PI then distributed the research tests for grading to the academics who volunteered the original past assessment samples. The grading schemes and the approaches to grading used by the academics were precisely the same as for the original assessments in 2022-2022. The academics were not provided with the GenAI writing detection scores prior to grading the tests to minimise bias when they were being graded. Of the 24 valid research tests, 3 were not graded by the academic who provided the original assessment due to time constraints. The results of the data analysis are confined to 21 valid tests from the GenAI research events as detailed in Table 1.

Once the 21 research tests were graded by the academics, the PI held informal interviews lasting 40 minutes to 1 hour, with each academic to discuss their experiences of the research tests, the grades they awarded, and their thoughts on the challenges of GenAI for academic integrity. The PI considers this research methodology an appropriate and easily replicated benchmarking test of GenAI and GenAI writing detection tools, so that as academics, we can establish a clear understanding of the challenges GenAI poses for academic integrity.

Table 1: Analysis of Valid Test Submissions

Test No.	Year	Event	Gender	AI Writing Detection Score	Academic Grade
1	3	Apr-23	M	73%	Not Graded
2	3	Apr-23	M	77%	60%
3	3	Apr-23	M	88%	40%
4	3	Apr-23	M	88%	60%
5	3	Apr-23	M	89%	35%
6	3	Apr-23	M	92%	40%
7	3	Apr-23	M	99%	Not Graded
8	3	Apr-23	M	100%	41%
9	3	Apr-23	M	100%	25%
10	1	Sep-23	M	0%	32%
11	2	Sep-23	M	0%	58%
12	1	Sep-23	F	0%	40%
13	1	Sep-23	M	0%	50%
14	2	Sep-23	M	10%	60%
15	2	Sep-23	F	14%	58%
16	1	Sep-23	F	30%	Not Graded
17	1	Sep-23	F	34%	50%
18	1	Sep-23	M	43%	19%
19	3	Sep-23	M	46%	60%
20	3	Sep-23	M	54%	45%
21	1	Sep-23	M	56%	40%
22	1	Sep-23	M	89%	35%
23	3	Sep-23	M	91%	57%
24	3	Sep-23	M	46%	0%

Source: Own

5   Findings

The findings reveal that both research hypotheses were validated: (1) students can complete university assessments using GenAI undetected by AI writing detection tools, and (2) students can achieve a passing grade (>=40) for university assessment submissions generated using AI when graded by a university academic?

The AI writing detection tool vendor advises that low AI writing detection scores (less than 20% GenAI writing detection) have a higher likelihood of being false positives and are thus insufficient grounds to raise an academic integrity enquiry. In this study, the AI writing detection tool was successful in detecting high AI writing detection scores (>20%) in 75% (18/24) of the research tests. Thus, these tests would have warranted investigation for possible breaches of academic integrity.

However, the analysis also shows that 25% (6/24) of the research tests achieved an AI writing detection score of 14% or less, and would not have been flagged to the academic, and would not have been investigated for breaches of academic integrity. Analysis of these six (6) research tests, reveals that four (4) achieved a 0% AI writing detection score, while two research tests yielded 10% and 14% AI writing detection scores. Three (3) of these research tests were submitted by first year students and three (3) were submitted by second year students. None of the third year students submitted research tests that achieved no/low AI writing detection scores.

Five (5) of the six (6) research tests with no/low AI writing detection scores received a passing grade (>-40%) from the academic who provided the past assessment. This equates to 23.8% of all tests graded (n=21). The average grade for tests achieving a no/low AI writing detection score and achieving a pass grade from an academic was 53%, with 60% the highest grade and 40% the lowest grade. It is notable that one other research test submitted by a first year student achieved a 0% detection rate but only achieved a 32% grade from the academic. Thus, although the test received a fail grade, GenAI content was not detected by the AI writing detection tool. It is important to highlight that the five (5) (23.8%) research tests with no/low AI writing detection scores that achieved a pass grade were not attributable to a specific academic, module or submission type as they were evenly dispersed.

The AI writing detection rate decreased significantly from 90% to just 37% between GenAI Research Event 1 in April 2023 and GenAI Research Event 2 in September 2023. It is also important to highlight that the five (5) research tests (23.8%) that achieved no/low AI writing detection scores were submitted during AI Research Event 2. This may be an indication of how well GenAI has been adopted and mastered by students since its launch in November 2022, and the PI holding AI Research Event 1 in April 2023 and AI Research Event 2 in September 2023.

In this study, students were free to choose and use whatever GenAI tools they could find to complete the research tests. While most of the students only used ChatGPT, several of the students reveal they used multiple GenAI tools. In this study, GenAI struggled to work with spreadsheet analysis. None of the research tests passed when graded by the academic. Initially trained on data to September 2021, ChatGPT's training set is continuously upgraded and it is now integrated with Microsoft Bing. Initially, ChatGPT only handled text based prompts, but it now incorporates image-based prompts. Integration with MSOffice now enables spreadsheets to incorporate micro-app AI agents capable of extracting, cleaning and analysing tables of data (OpenAI, 2023b). Hence, GenAI poses an ever-greater challenge to academic integrity if ongoing advancements are not considered as assessments are being set.

5.1   Insights from One to One Interviews with University Academics

Following the collection and analysis of all AI writing detection scores and research test grades, the PI held informal meetings with each participant academic. Concern about AI is pervasive among academics, and some academics and academic managers appear to have adopted a head in the sand approach to the impact of AI on their teaching and learning strategies and indeed the impact of AI on the entire education system. The participant academics contend that as GenAI improves, and as students increasingly engage with it, academics will have to be subject matter experts to detect GenAI content. However, a counter-argument could be that with the evolution of GenAI, it may in fact replace the need for any academic or indeed graduate to be a subject matter expert. Participant academics were concerned that students can use GenAI to create a bibliography to accompany GenAI text, and that some or indeed all the bibliography may not be authentic. Participant academics are concerned they do not have the resources or time to follow every reference to verify if it is authentic, or indeed relevant to the text. Participant academics believe that fundamental questions need to be asked about what we are teaching, why we are teaching it, how we are teaching it, and what careers we are preparing graduates to enter. Students commencing university in 2023-2024 will emerge from degree programmes to an employment landscape transformed by AI, and much of what they are learning could be redundant if roles are supplanted by AI. Thus, participant academics contend that a bigger conversation must occur about the impact of AI on education beyond that of its impact on academic integrity.

6   Limitations

While the study objective was completed as per the research funding proposal, the study encountered several limitations which impacted its potential output including low levels of academic engagement and a lack of support for the study by some senior managers. Participant academics may have been exposed to bias when grading the research tests as they knew the tests were generated using AI.

7   Conclusions and Future Studies

The study provides empirical evidence of the ease at which students can use GenAI to produce viable solutions for university assessments while circumventing AI writing detection tools and academic integrity rules. Twenty five percent (25%) of the research tests achieved an AI writing detection score of 14% or less, meaning they significantly fall below the minimum threshold (20%) to be investigated for breaches of academic integrity in SETU or indeed perhaps many universities.

The study provides evidence that students ability to conceal unauthorised generation of content using GenAI rapidly improves with use and exposure, as AI writing detection fell significantly from 90% to just 37% between GenAI Research Event 1 in April 2023 and GenAI Research Event 2 in September 2023. While the study, did not distinguish between student use of the different GenAI tools at their disposal, it became evident that the ability to detect unauthorised AI generated content and artifacts are further compounded by the use of multiple GenAI tools and manual human editing of AI generated output. Unquestionably, the challenges for academic integrity will increase exponentially as GenAI tools become more sophisticated and as additional GenAI tools emerge. This needs further study as GenAI tools emerge.

This study provides tangible evidence that AI and GenAI in particular, is disrupting education and potentially undermining academic integrity. It is clear than many forms of traditional assessments are no longer viable. Future studies, aligned with Bloom's Taxonomy could further explore GenAI's impact on teaching, learning and assessment. It is imperative that the global education system adapts to meet the disruptive challenges and opportunities of AI. It is essential that policy makers, researchers, educators, and technology experts work together to ensure AI can be

used safely and constructively to improve education and support teaching, learning, and assessment while maintaining academic integrity.

However, it is important to state that although students can use GenAI to circumvent academic integrity, it doesn't automatically mean that they will. My experience is that students are predominantly honest, upstanding and protective of their own and their universities integrity.

Acknowledgements

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