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National Student Survey

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Social science

Executive summary

This study examines the factors that influence student satisfaction with grades and assessments at higher education (HE) institutions in the United Kingdom. This was accomplished through the utilization of open-source data from the National Student Survey (NSS). Additionally, the research addresses a substantial void in the comprehension of the ways in which a variety of factors contribute to student satisfaction. It emphasizes the impartiality of the marking and assessment procedures. This research is founded on the growing significance of metrics in the assessment of higher education institutions, with a particular emphasis on student satisfaction. The NSS is a standardized assessment that is administered to students at universities in the United Kingdom. Furthermore, it has a substantial impact on university rankings and is essential for the quality of education and the decision-making process of students. The investigation expands upon prior research by investigating more complex determinants that are specifically associated with assessments and marks. The quantitative approach employed in the research is based on the NSS dataset, which comprises responses to approximately 26 queries across seven categories. It includes responses from approximately 446 institutions and half a million students. Descriptive statistics, correlation analysis, linear and logistic regression analysis, data filtering, data cleansing, and decision-making with missing values were implemented. Additionally, these were achieved by emphasizing Q11, which pertains to the course's marking and assessment. The purpose of these methods is to comprehend and identify the relationships between student satisfaction and a variety of factors. Furthermore, the results of the investigation suggest that even a minor enhancement in the perceived lucidity of the marking criteria and the availability of opportunities to demonstrate knowledge can have a significant impact. Their perception of the fairness of the evaluation procedure may be significantly affected by these improvements. Additionally, the analysis underscores the fact that UK university students generally experience a high level of satisfaction, with an average satisfaction level of 80%. In fact, some categories consistently exceed 95% satisfaction, indicative of widespread student contentment.

Keywords

Student satisfaction, marking criteria, assessment fairness, feedback quality, timeliness of feedback, teaching support, intellectual challenge, student accessibility, National Student Survey (NSS), higher education (HE), quantitative analysis, regression analysis.

الملخص

تبحث هذه الدراسة في العوامل التي تؤثر على رضا الطلاب عن الدرجات والتقييمات في مؤسسات التعليم العالي في المملكة المتحدة. وقد تم تحقيق ذلك من خلال الاستفادة من البيانات مفتوحة المصدر من المسح الوطني للطلاب (NSS). بالإضافة إلى ذلك، يعالج البحث فجوة كبيرة في فهم الطرق التي تساهم بها مجموعة متنوعة من العوامل في رضا الطلاب. ويؤكد على نزاهة إجراءات التصحيح والتقييم. ويستند هذا البحث إلى الأهمية المتزايدة للمقاييس في تقييم مؤسسات التعليم العالي، مع التركيز بشكل خاص على رضا الطلاب. إن المسح الوطني للطلاب هو تقييم موحد يتم إجراؤه للطلاب في الجامعات في المملكة المتحدة. وعلاوة على ذلك، فإن له تأثيرًا كبيرًا على تصنيفات الجامعات وهو ضروري لجودة التعليم وعملية اتخاذ القرار للطلاب. ويتوسع التحقيق في البحث السابق من خلال التحقيق في عوامل أكثر تعقيدًا مرتبطة بشكل خاص بالتقييمات والعلامات. ويستند النهج الكمي المستخدم في البحث إلى مجموعة بيانات المسح الوطني للطلاب، والتي تتألف من استجابات لحوالي 26 استفسارًا عبر سبع فئات. وقد شملت الدراسة استجابات من حوالي 446 مؤسسة ونصف مليون طالب. وتم تطبيق الإحصاءات الوصفية، وتحليل الارتباط، وتحليل الانحدار الخطي واللوجستي، وتصفية البيانات، وتنظيف البيانات، واتخاذ القرارات بالقيم المفقودة. بالإضافة إلى ذلك، تم تحقيق ذلك من خلال التأكيد على السؤال 11، الذي يتعلق بتصحيح الدورة وتقييمها. والغرض من هذه الأساليب هو فهم وتحديد العلاقات بين رضا الطلاب ومجموعة متنوعة من العوامل. وعلاوة على ذلك، تشير نتائج التحقيق إلى أن حتى التحسن الطفيف في الوضوح المتصور لمعايير التصحيح وتوافر الفرص لإظهار المعرفة يمكن أن يكون له تأثير كبير. وقد يتأثر تصورهم لعدالة إجراءات التقييم بشكل كبير بهذه التحسينات. بالإضافة إلى ذلك، يؤكد التحليل على حقيقة أن طلاب الجامعات في المملكة المتحدة يتمتعون عمومًا بمستوى عالٍ من الرضا، بمتوسط مستوى رضا يبلغ 80٪. في الواقع، تتجاوز بعض الفئات باستمرار 95٪ من الرضا، مما يدل على رضا الطلاب على نطاق واسع.

الكلمات المفتاحيه:

رضا الطلاب، معايير التصحيح، عدالة التقييم، جودة التغذية الراجعة، توقيت التغذية الراجعة، دعم التدريس، التحدي الفكري، إمكانية وصول الطلاب، المسح الوطني للطلاب، التعليم العالي، التحليل الكمي، تحليل الانحدار.

The study definitions:

Student Satisfaction: The level of contentment among students with their educational experience, particularly in relation to marking, assessment, and academic support.
Marking Criteria: Standards and guidelines used by educators to assess and evaluate student work, ensuring fairness and transparency.
Assessment Fairness: The perception of justice and impartiality in how student work is evaluated, graded, and reviewed.
Feedback Quality: The effectiveness, clarity, and usefulness of information provided to students regarding their performance, aimed at helping them improve.
Timeliness of Feedback: The speed at which educators provide feedback to students after assessments, influencing student satisfaction and learning outcomes.
Teaching Support: Assistance and encouragement provided by teaching staff to help students understand course content and succeed academically.
Intellectual Challenge: The degree to which academic tasks stimulate critical thinking, problem-solving, and the application of knowledge.
Student Accessibility: The ease with which students can reach and communicate with teaching staff for clarification, guidance, or support.
National Student Survey (NSS): A standardized survey collecting feedback from final-year undergraduate students in the UK to evaluate their educational experiences.
Higher Education (HE): Post-secondary education provided by universities and other institutions, focusing on undergraduate and postgraduate studies.
Quantitative Analysis: The use of statistical and numerical methods to examine data, identify patterns, and draw conclusions.
Regression Analysis: A statistical technique used to determine relationships between variables, in this study, to identify factors influencing student satisfaction.

Introduction

The utilization of metrics to evaluate higher education (HE) institutions is becoming increasingly popular. Student satisfaction is a critical determinant of the quality of higher education and is of considerable significance in these evaluations. In the United Kingdom (UK), it is customary for senior university students to participate in a standardized assessment known as the National Student Survey (NSS) (Hazelkorn 2015, cited in Pollet and Shepherd 2022; Chung Sea Law 2010). It was initially implemented in 2005 and has a substantial impact on the ranking of universities in the United Kingdom (Douglas et al. 2015). The NSS fulfills a variety of functions, such as ensuring the integrity and accountability of education. Furthermore, it enhances the quality of teaching and learning and enables prospective students to make informed decisions when selecting top-tier educational offerings (ibid.). The objective of this survey is to assess the degree of satisfaction that students experience with their respective academic programs and universities. It encompasses inquiries regarding numerous aspects of the student experience. The inquiries are categorized into a variety of subcategories, including the quality of instruction, the availability of learning opportunities, and the efficacy of feedback mechanisms, among other factors (Hazelkorn 2015, cited in Pollet and Shepherd 2022; Chung Sea Law 2010). Furthermore, the degree of satisfaction that students derive from their higher education experience is contingent upon a variety of factors. Also critical are the library's services' level of convenience and the scope of its reference materials. Additionally, the prestige of the university, faculty attentiveness, opportunities for personal development, a focus on student needs, the general campus environment, the efficiency of the institution, and the prevalent social conditions are all significant factors (Salinda Weerasinghe et al. 2017). the entire class and the diverse student activities that constitute "academic life" throughout the institution.

Problem statement

Although the literature review has examined feedback perceptions in numerous studies, the broader landscape of determinants that influence student satisfaction with marks and assessments remains relatively unexplored (Humphries-Smith and Hunt 2015; Marie 2016). Foundational insights into the NSS's function in assessing satisfaction are provided by other studies. Nevertheless, a thorough comprehension of the complex determinants that are explicitly associated with marks and assessments is still lacking (Williams and Brennan 2003; Callender et al. 2014). Although the NSS and other quantitative studies have offered valuable insights, the current emphasis on undergraduate students' experiences has resulted in a substantial gap in the understanding of postgraduate student satisfaction.

Research aim

The objective of this research is to address this gap by pioneering a more comprehensive examination of the factors that influence student satisfaction with marks and assessments, utilizing insights from previous research. The emphasis is on the experiences of undergraduate and postgraduate students. The quantitative rigor of surveys is prioritized in the research. Additionally, it endeavors to verify quantitative data using specific models and investigate intricate student satisfaction patterns that are frequently disregarded by large-scale surveys.

Research question

What are the determinants of satisfaction with the marks and assessments of UK university students?

Aim of the objective

The primary objective of this research is to explore the numerous facets of student happiness, surpassing conventional quantitative assessments. Our objective is to assess the efficacy of current quantitative metrics in capturing the full range of student satisfaction and to identify the determinants of student satisfaction.
Create a comprehensive model of student satisfaction that incorporates quantitative findings and provides actionable insights that may enable educational institutions to improve the student experien

Literature review

Background on National Student Survey (NSS)

The Higher Education Funding Council for England (HEFCE) sought to replace comprehensive subject reviews with data-driven insights to guide student decisions in 2000, motivated by public accountability and financial efficiency. The HEFCE formed a partnership with the UK government the following year in response to apprehensions regarding the absence of external oversight and self-governance (HEFCE 2001; HEFCE 2002). Consequently, the HEFCE focused on soliciting student feedback, conducting preliminary studies, and conducting experiments; the NSS was introduced in 2005. The goal was to conduct a comprehensive assessment of the perspectives of final-year undergraduate students. The survey was conducted among students in Northern Ireland, Wales, and England. Scotland implemented distinctive methodologies for gathering input, with specific institutions in Scotland participating in the HEFCE project (Douglas et al. 2015). The NSS outcomes and institutional data were accessible through the Teaching Quality Information website. The article by Williams and Brennan (2003) provides a thorough analysis of the NSS's development. The study delineates its preliminary trials' results and initial objectives. Additionally, it emphasizes the survey's importance in assessing the quality of higher education (ibid.). The NSS serves a variety of critical functions, including supplementing the academic experience in higher education institutions and informing the decisions of prospective students. Future iterations of the survey are anticipated to place a greater emphasis on the latter aspect. The NSS's instrumental role in improving the quality of academic experiences is of the uttermost importance, despite the fact that its objectives include public accountability. The NSS's efficacy is acknowledged by a variety of stakeholders, such as policymakers, individuals with institutional backgrounds, and student bodies (Callender et al. 2014). Nevertheless, there are varying perspectives on the extent of its influence. The NSS is employed by a variety of organizations to enhance the quality of education. They underscore the significance of maintaining the NSS's inherent strengths while also contemplating modifications to improve its usefulness and effectiveness in creating a more enriched academic environment (ibid.). The NSS is a substantial indicator of student satisfaction in higher education. Due to its influence on the Teaching Excellence Framework (TEF), university rankings, and the overall student experience, it has garnered attention (Gunn 2018).

Perceptions of feedback's significance

A study was conducted in 2015 to examine the perspectives of senior product design students at Wessex University regarding feedback (Humphries-Smith and Hunt 2015). The researchers were motivated by the course's subpar NSS ratings in the assessment and feedback categories. The intervention, which focused on modifying the feedback approach for an assessment called "Viva 1," exhibited its beneficial qualities. As evidenced by the post-intervention statistics of 81%, which is substantially higher than the 46% recorded in the 2014 NSS, the clarity of marking standards was significantly improved. However, this investigation was not without its constraints. The findings' generalizability may be limited by the inclusion of data from only 91% of a single student cohort, which may introduce potential biases. In order to overcome these constraints, it is imperative to employ a more diverse and extensive sample in future research endeavors. Additionally, the investigation illuminated the inadequacy of written comments when viewed in isolation. Dialogic feedback sessions have emerged as a promising alternative for engaging with students, as they not only involve the dispensation of feedback but also emphasize its comprehension and implementation (ibid.).
The study titled Student Views on the Value of Feedback meticulously examined the complexities of the NSS and the significance that students attach to feedback. This investigation implemented a qualitative and descriptive methodology to examine the significance of feedback among 79 students from various science departments at a research-intensive institution in the United Kingdom. The study's results demonstrated a variety of viewpoints regarding the significance of feedback. Although some students recognized the educational advantages of it, others associated it with factors such as pastoral care or motivation. The symbolic gesture of feedback's significance is evident in its conspicuous emergence. This is due to the fact that it represents an implicit accord between students and professors in response to the UK's fee system. Feedback is highly valued in the academic community; however, its actual utility to students remains uncertain. The study's results suggested that students may have underestimated the significance of feedback, as it found **a limited**

association between feedback satisfaction and overall contentment in the NSS and the presence of uncollected feedback. Nevertheless, it is important to acknowledge that students attributed substantial importance to feedback that provided actionable recommendations for future work. The research also underscored the importance of students having a thorough comprehension of the diverse benefits of feedback in order to effectively utilize it to further their academic growth (Marie 2016).

Significance of student satisfaction

The study "Determining Student Satisfaction: An Economic Analysis of the NSS" explores the importance of student satisfaction. It investigated the variables that influence student satisfaction, as demonstrated by the NSS total score. The study examined data from 121 institutions in the United Kingdom between 2007 and 2010. The study employed panel data analysis to identify discrepancies in scores among various disciplines and colleges, advising against the use of raw scores for ranking purposes. The study emphasized the importance of two primary criteria that significantly influence satisfaction levels: the employability of students and the ratio of students to staff. This underscores the importance of fostering employability skills and providing adequate student support in the field of higher education. Descriptive data is the primary focus of the literature on the NSS. As a result, this study made a valuable contribution by utilizing econometric analysis to illuminate the market signal of quality in HE. The study underscored the necessity of nurturing personal development, providing support to students, and cultivating skills that improve employability. However, the study acknowledged the potential for biases in the survey results, specifically the potential influence of instructors on excessively favorable assessments. The primary goal of this investigation was to emphasize the importance of the NSS as a method for assessing student satisfaction. Nevertheless, it also recognized the existence of alternative analytical methods, such as the examination of labor market outcomes or the consideration of higher education institutions as entities that provide a variety of products (Lenton 2015).

What factors contribute to student satisfaction? Bell and Brooks (2018) conducted an exhaustive examination of the NSS data. Their paper, A Discussion and Analysis of the UK's NSS, provides a more profound understanding of the intricate nature of student satisfaction. A dataset consisting of more than 140,000 undergraduate responses was employed in this investigation. The objective of the investigation was to emphasize the discrepancies in satisfaction levels among various academic fields. Additionally, it examined variations in student demographics and institutional classifications. The dataset's comprehensiveness facilitated a detailed analysis of satisfaction measures, emphasizing the substantial influence of teaching quality and course organization while relatively underplaying the effects of resources and assessment feedback. The study was still constrained by constraints, despite its substantial sample size and extensive breadth, which contribute to its generalizability and reliability. I believe that additional research is necessary in light of the study's exclusive focus on student perspectives and the potential for sample selection bias. The existing voids in knowledge can be resolved by incorporating qualitative research methods and including the viewpoints of postgraduate students, thereby achieving a comprehensive understanding of student satisfaction. Additionally, the implementation of longitudinal methodologies has the capacity to offer dynamic and valuable perspectives on the evolution of student satisfaction over the course of their academic studies. This method provides a diachronic perspective that enhances the synchronic insights obtained from the NSS data.

A 2020 study entitled "Capturing Student Satisfaction: A Case Study on the NSS" Results explore the requirements of students in STEM-related courses. The study conducted a comprehensive examination of the variables that influence student satisfaction in STEM disciplines. This was accomplished through a comprehensive statistical examination of the NSS results. The writers emphasize the importance of "organization and management" and "teaching." These factors underscore the critical role that academic reputation and service levels play in the recruitment and retention of students. Quantitative insights were obtained from the NSS, a widely recognized evaluative instrument, by analyzing a total of 250 responses per subject from each university. Nevertheless, the research was restricted in its scope, as it exclusively focused on STEM and disregarded other academic disciplines. Furthermore, the analysis neglected to consider potential constraints associated with the National Survey on Student Engagement, including the survey's restricted thematic focus and the potential for response biases. In order to improve the comprehensiveness of future research, it was suggested that qualitative research be conducted, such as the use of in-depth interviews or focus groups, to uncover the intricate experiences and insights of **students. Furthermore, blended methods that integrate quantitative and qualitative methodologies may contribute to the comprehension of student satisfaction in higher education (Sofroniou et al. 2020).**

In 2022, a study was conducted to examine the factors that contribute to the improvement of undergraduate student satisfaction in higher education. The role of relational pedagogy was evidently the primary focus. The study emphasized the importance of staff-student interactions that are characterized by approachability, empathy, and sensitivity through both interviews and focus groups that include the perspectives of both students and staff. The results suggested that the cultivation of relationships that are both cordial and trust-based could have a substantial impact on student satisfaction. Nevertheless, Bell's research was limited by its emphasis on a specific university in the United Kingdom, despite its insightful nature. The university is situated in England and has a student body of over 30,000. The majority of the students are undergraduates, with over 20,000 of them enrolled full-time and under the age of 25. In the 2019 National Student Survey (NSS), the university was ranked among the top 20 universities in the United Kingdom due to its exceptional undergraduate student satisfaction levels. Nevertheless, the study's findings are limited in their applicability due to the emphasis on a singular university. Additionally, the investigation focused exclusively on teaching behaviors, neglecting other significant factors that contribute to student satisfaction, such as extracurricular activities and campus amenities. The author suggested that multi-institutional studies that integrate quantitative and qualitative methodologies could be beneficial for the future advancement of our understanding of the experiences of higher education students (Bell 2022).

Explaining the data

Introduction

The annual NSS in the United Kingdom is a significant event that collects feedback from final-year undergraduate students about their university experiences. The NSS examines a variety of aspects of university life, including student satisfaction, teaching quality, and learning environments (Hazelkorn 2015, cited in Pollet and Shepherd 2022; Chung Sea Law 2010). Consequently, the NSS is a critical resource for comprehending higher education in the United Kingdom. The educational policy, teaching standards, and student experiences of the United Kingdom are influenced by NSS datasets (Douglas et al. 2015). This chapter in-depth analyzes the 2023 NSS dataset.

Data source

The investigation made use of the 2023 NSS dataset, which is open source (Office for Students 2023) and offers an exhaustive cross-section of student opinions from the United Kingdom. The data is accessible in CSV format and offers a concise overview of the feedback that students have submitted. Consequently, it is an exceptionally beneficial resource for policymakers, educators, and academics.

Data description

The 2023 NSS dataset is quite extensive. It incorporates a diverse array of attributes that serve as representations of the numerous aspects of student life. The dataset contains rows that represent the responses to the survey questions, which have been aggregated across a diverse array of subjects, providers, and study modalities. The survey comprises inquiries regarding numerous critical subjects. These encompass the quality of the instruction, the opportunities for learning, the evaluation and feedback, the academic support, the organization and management, the learning materials, the community, the student input, and overall satisfaction.

Data structure

The 2023 NSS dataset has been organized in a systematic manner. Distinct attributes of the survey data are represented by the columns. The principal columns of interest are as follows:

• 'PROVIDER_NAME', which represents the educational institutions (446 in total).
• 'MODE_OF_STUDY', which distinguishes between full-time, part-time, apprenticeship, and all modes of enrolment.
• The 'LEVEL_OF_STUDY' classification system categorizes undergraduate academic tiers as follows: all

levels, first degree, other undergraduate, and undergraduate with postgraduate.
• Subject-specific columns, designated by 'CAH_CODE' and 'CAH_NAME', are essential for understanding student input in specific academic disciplines. The 'CAH_CODE' is a CAH subject designation; the column provides exhaustive information regarding the respondents' academic fields.
• Columns such as 'PUB_RESPRATE', which denotes response rates, and various confidence intervals.
• "POPULATION," which keeps track of two distinct categories of individuals: those who are registered and those who are being taught.
• 'SUBJECT_LEVEL', which elucidates the distinction between levels, including: ¬ All subjects (Provider level). This study investigates the overall satisfaction ratings of pupils at a variety of educational institutions. It encompasses all levels of study and subject matter. This resource offers a thorough evaluation of institutional performance. As a result, it provides valuable insights, enabling a comprehensive comprehension of the subject matter. CAH level 1 (CAH1) (Broad subject categories). The results are categorized by study level and broad topic areas, offering a comprehensive understanding of student satisfaction in the main academic disciplines.
• CAH level 2 (CAH2) (Detailed subject categories). The data is categorized according to the degree of study and specific topic groups in this research, which is advantageous for identifying patterns within focused academic domains. Thus, a comprehensive analysis is conducted.
¬ CAH level 3 (CAH3) (The most detailed subject categories). By subdividing the results by educational level and niche topic area, this offers the most comprehensive overview, thereby distinguishing the strengths and weaknesses in specialized academic domains.
•Positivity metrics and response alternatives. The dataset encompasses both positive and negative responses. It prioritizes the positivity measure, which denotes the proportion of favorable feedback.
These indicators offer valuable insights into the survey findings' reliability and accuracy. The incorporation of these indicators is of the utmost importance in order to interpret the results efficiently. These indicators offer contextual information regarding student responses and emphasize regions that demonstrate significantly high or low levels of satisfaction.

Sampling and respondents

In 2023, the current investigation was conducted. The data for this investigation was obtained from a survey that was distributed to students at one of 446 educational institutions. The original dataset, which is publicly accessible, contains the complete list of institutions that were surveyed (Office for Students 2023). Table 1 provides a partial list of these institutions. In 2023, each survey query received a diverse array of student responses. Figure 1 illustrates that a substantial proportion of the student population at the various institutions represented responded to the survey. The total number of responses is 474,972. The survey instrument consisted of 26 unique questions and seven recurring themes, as illustrated in Table 2. It appeared that each of them was structured in accordance with a Likert scale, which is suitable for evaluating varying degrees of agreement or satisfaction.

Table 1: Institutions overview.

The total number of institutions is 446. These included:
• Association of British Dispensing Opticians.
• Abingdon and Witney College.
• AECC University College.
• Anglia Ruskin University Higher Education Corporation.
• Arts Educational School.
• Arts University Bournemouth.
• Askham Bryan College.
• Barnet & Southgate College.
• Barnsley College.
• Bath Spa University.

Show 50 entries Search:

Provider name	Level of study	Question	Population	Row	Provider.name	Level.of.study
UK	All undergraduates	Q01: How good are teaching staff at explaining things?	474972	1		
UK	All undergraduates	Q02: How often do teaching staff make the subject engaging?	474972	2		
UK	All undergraduates	Q03: How often is the course intellectually stimulating?	474972	3		
UK	All undergraduates	Q04: How often does your course challenge you to achieve your best work?	474972	4		
UK	All undergraduates	Q05: To what extent have you had the chance to explore ideas and concepts in depth?	474972	5		
		⋮	⋮			
UK	All undergraduates	Theme 3: Assessment and feedback	474972	29		
UK	All undergraduates	Theme 4: Academic support	474972	30		
UK	All undergraduates	Theme 5: Organisation and management	474972	31		
UK	All undergraduates	Theme 6: Learning resources	474972	32		
UK	All undergraduates	Theme 7: Student voice	474972	33		

Figure 1: Student population in the UK.

Table 2: Description of the questions and themes with a focus on Q11.

Question	Description
Q01	How good are teaching staff at explaining things?
Q02	How often do teaching staff make the subject engaging?
Q03	How often is the course intellectually stimulating?
Q04	How often does your course challenge you to achieve your best work?
Q05	To what extent have you had the chance to explore ideas and concepts in depth?
Q06	How well does your course introduce subjects and skills in a way that builds on what you have already learned?
Q07	To what extent have you had the chance to bring together information and ideas from different topics?
Q08	To what extent does your course have the right balance of directed and independent study?
Q09	How well has your course developed your knowledge and skills that you think you will need for your future?
Q10	How clear were the marking criteria used to assess your work?
Q11	How fair has the marking and assessment been on your course?
Q12	How well have assessments allowed you to demonstrate what you have learned?
Q13	How often have you received assessment feedback on time?
Q14	How often does feedback help you to improve your work?
Q15	How easy was it to contact teaching staff when you needed to?
Q16	How well have teaching staff supported your learning?
Q17	How well organised is your course?
Q18	How well were any changes to teaching on your course communicated?
Q19	How well have the IT resources and facilities supported your learning?
Q20	How well have the library resources (e.g., books, online services and learning spaces) supported your learning?
Q21	How easy is it to access subject specific resources (e.g., equipment, facilities, software) when you need them?
Q22	To what extent do you get the right opportunities to give feedback on your course?
Q23	To what extent are students' opinions about the course valued by staff?
Q24	How clear is it that students' feedback on the course is acted on?
Q25	How well does the students' union (association or guild) represent students' academic interests?
Q26	How well communicated was information about your university/college's mental wellbeing support services?
Theme 1	Teaching on my course
Theme 2	Learning opportunities
Theme 3	Assessment and feedback
Theme 4	Academic support
Theme 5	Organisation and management
Theme 6	Learning resources
Theme 7	Student voice

Methodology

Research design and software

The objective of this study is to determine the factors that influence the satisfaction of university students in the United Kingdom with their grades and assessments. The quantitative research approach was implemented due to the nature of the data and the research query. This method enables a methodical examination of potential determinants and their correlation with student satisfaction. RStudio, an open-source Integrated Development Environment (IDE) for R, is the software utilized. RStudio integrates the console, source editing, and graphics into a single, user-friendly interface. Consequently, it is beneficial to both novice and advanced R users. Additionally, it is compatible with Linux, Mac, and Windows. Additionally, RStudio provides a server version that enables web-based access to R sessions on remote systems (RStudio Team 2020).

Initial data filtering and understanding

In 2023, 474,972 students from 446 educational institutions responded to 26 Likert-scale queries across seven categories, as illustrated in Tables 1 and 2 and Figure 1, as reported by the Office for Students (2023). The survey encompassed a significant portion of the student populations at various universities.
The initial stage involved the importation of the data and the application of an initial filter to focus on respondents who were classified as "registered" in the POPULATION column. The analysis's consistency and relevance were ensured by the implementation of this filtering mechanism. Consequently, unique values were extracted for various categorical variables, including educational providers, study modalities, study levels, and subject information. This procedure enabled a thorough comprehension of the dataset's heterogeneity and scope. The data prior to its cleaning is depicted in Figure 2.

```
> head(df,10)
    NUM_POPULATION UKPRN PROVIDER_NAME MODE_OF_STUDY LEVEL_OF_STUDY SUBJECT_LEVEL CAH_CODE              CAH_NAME QUESTION_NUMBER NUMBER_RESPONSES
 1:   1 Registered    UK            UK     All modes     All levels          CAH1    CAH01 Medicine and dentistry            Q01            7842.7
 2:   1 Registered    UK            UK     All modes     All levels          CAH1    CAH01 Medicine and dentistry            Q02            7838.7
 3:   1 Registered    UK            UK     All modes     All levels          CAH1    CAH01 Medicine and dentistry            Q03            7855.4
 4:   1 Registered    UK            UK     All modes     All levels          CAH1    CAH01 Medicine and dentistry            Q04            7833.7
 5:   1 Registered    UK            UK     All modes     All levels          CAH1    CAH01 Medicine and dentistry            Q05            7817.7
 6:   1 Registered    UK            UK     All modes     All levels          CAH1    CAH01 Medicine and dentistry            Q06            7849.7
 7:   1 Registered    UK            UK     All modes     All levels          CAH1    CAH01 Medicine and dentistry            Q07            7798.8
 8:   1 Registered    UK            UK     All modes     All levels          CAH1    CAH01 Medicine and dentistry            Q08            7848.7
 9:   1 Registered    UK            UK     All modes     All levels          CAH1    CAH01 Medicine and dentistry            Q09            7854.8
10:   1 Registered    UK            UK     All modes     All levels          CAH1    CAH01 Medicine and dentistry            Q10            7825.7
    NUMBER_POPULATION SUPPRESSION_REASON OPTION1 OPTION2 OPTION3 OPTION4 OPTION5 NOT_APPLICABLE POSITIVITY_MEASURE STANDARD_DEVIATION BENCHMARK DIFFERENCE
 1:           10170.4                  2241.42 4727.73  692.63  180.90      NA          21.00              88.9                NA        NA         NA
 2:           10170.4                  1620.69 4727.90 1257.59  232.50      NA          25.00              81.0                NA        NA         NA
 3:           10170.4                  4322.14 2878.18  501.53  153.50      NA           8.33              91.7                NA        NA         NA
 4:           10170.4                  3296.23 3078.62 1112.03  346.80      NA          30.00              81.4                NA        NA         NA
 5:           10170.4                  2736.27 3399.41 1434.10  247.90      NA          46.00              78.5                NA        NA         NA
 6:           10170.4                  3367.62 3244.24  987.59  250.23      NA          14.00              84.2                NA        NA         NA
 7:           10170.4                  3778.54 2957.75  902.16  160.33      NA          64.90              86.4                NA        NA         NA
 8:           10170.4                  2517.18 2758.44 1682.16  890.90      NA          15.00              67.2                NA        NA         NA
 9:           10170.4                  3798.42 3210.34  673.69  172.33      NA           8.90              89.2                NA        NA         NA
10:           10170.4                  1904.51 3171.71 1886.06  863.40      NA          38.00              64.9                NA        NA         NA
    CONTR_BENCHMARK MATERIALLY_BELOW_BENCH INLINE_WITH_BENCH MATERIALLY_ABOVE_BENCH DIFFERENCE_LOWERCI99 DIFFERENCE_LOWERCI97 DIFFERENCE_LOWERCI95
 1:              NA                     NA                NA                     NA                  NA                  NA                  NA
 2:              NA                     NA                NA                     NA                  NA                  NA                  NA
 3:              NA                     NA                NA                     NA                  NA                  NA                  NA
 4:              NA                     NA                NA                     NA                  NA                  NA                  NA
 5:              NA                     NA                NA                     NA                  NA                  NA                  NA
 6:              NA                     NA                NA                     NA                  NA                  NA                  NA
 7:              NA                     NA                NA                     NA                  NA                  NA                  NA
 8:              NA                     NA                NA                     NA                  NA                  NA                  NA
 9:              NA                     NA                NA                     NA                  NA                  NA                  NA
10:              NA                     NA                NA                     NA                  NA                  NA                  NA
    DIFFERENCE_LOWERCI92 DIFFERENCE_LOWERCI90 DIFFERENCE_LOWERCI87 DIFFERENCE_LOWERCI85 DIFFERENCE_LOWERCI82 DIFFERENCE_LOWERCI80 DIFFERENCE_LOWERCI77
```

Figure 2: Unclean data preview.

Data cleaning

Figure 3 illustrates that the POSITIVITY_MEASURE column contained eight absent values. These

products were excluded due to their low count in comparison to the entire dataset. The study would not be significantly affected by the elimination of missing data, as it was assumed to be random.

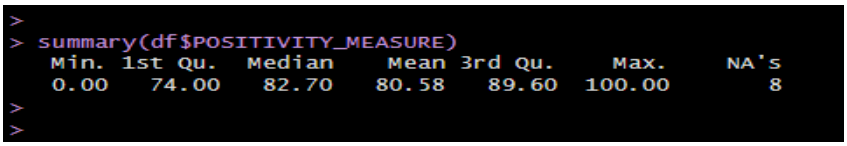

Figure 3: NA values in the dataset.

Descriptive statistics

UK-level overview

This study provided a comprehensive understanding of the emotion that is currently prevalent in the United Kingdom regarding the equity of marking and evaluation before conducting further analysis. The positivity metric was the primary quantitative indicator employed in this investigation. This data is presented in a table that analyzes the distribution of positivity measures across different levels of research.

Provider-class level analysis

An analysis was conducted at the level of individual service providers in order to obtain detailed and specific information. The more refined dataset, prov_base, offered a more profound comprehension of the courses and individual providers, with a particular emphasis on the sentiment regarding the impartiality of grading and marking. Subsequently, a comprehensive summary is produced, which includes specific statistics regarding the positivity measure. The data is further categorized according to the level of study and the number of participants. The mean, median, range, standard deviation, quantiles, skewness, and kurtosis were computed for regression analysis in this study. Table 3 and Figure 4 illustrate that certain research queries have biased positive or negative distributions that were obtained using QUESTION_NUMBER. Figure 5 illustrates the positivity measures by provider.

Table 3: Descriptive statistics by question.

Descriptive Statistics by Question

Descriptive statistics of positivity measures by question by CAH3 subject groups

	Mean	S.D	Min	25th	50th	75th	Max	Skewness	Kurtosis
Q01	89.1	8.0	21.4	85.9	89.1	89.1	99.5	−2.0	9.3
Q02	80.3	11.4	25.0	73.6	80.3	80.3	99.4	−0.9	4.0
Q03	83.5	9.9	23.1	78.5	83.5	83.5	99.3	−1.2	5.3
Q04	83.4	8.7	29.4	78.6	83.4	83.4	99.3	−0.9	4.5
Q05	82.1	9.5	8.3	76.9	82.1	82.1	99.4	−1.1	5.5
Q06	83.0	9.9	27.3	77.8	83.0	83.0	99.3	−1.2	5.5
Q07	82.3	9.1	33.3	77.5	82.3	82.3	99.5	−1.0	4.7
Q08	76.4	11.3	5.9	70.0	76.4	76.4	98.1	−0.8	4.1
Q09	80.7	10.7	17.6	74.6	80.7	80.7	99.7	−1.0	5.0
Q10	76.1	12.1	17.6	69.2	76.1	76.1	99.2	−0.8	3.7
Q11	80.8	10.4	25.0	75.0	80.8	80.8	98.8	−0.9	4.3
Q12	80.6	10.3	23.5	74.6	80.6	80.6	99.3	−0.9	4.3
Q13	77.6	15.7	0.0	69.0	77.6	77.6	99.5	−1.1	4.3
Q14	72.4	13.9	9.1	63.3	72.4	72.4	98.5	−0.5	3.0
Q15	82.6	11.3	17.8	77.6	82.6	82.6	99.6	−1.4	5.9
Q16	83.5	9.7	25.0	78.6	83.5	83.5	99.4	−1.2	5.4
Q17	71.1	17.9	0.0	61.5	71.1	71.1	99.4	−1.0	3.7
Q18	73.6	15.1	2.9	65.9	73.6	73.6	99.5	−1.1	4.3
Q22	80.6	10.4	0.0	75.0	80.6	80.6	99.5	−1.2	5.5
Q23	74.9	12.9	6.7	67.3	74.9	74.9	98.9	−0.8	4.1
Q24	61.5	16.3	0.0	50.0	61.5	61.5	99.2	−0.2	2.8

Source: Own calculation based on National Study Survey (NSS), 2023 which was open source (Office for Students 2023).

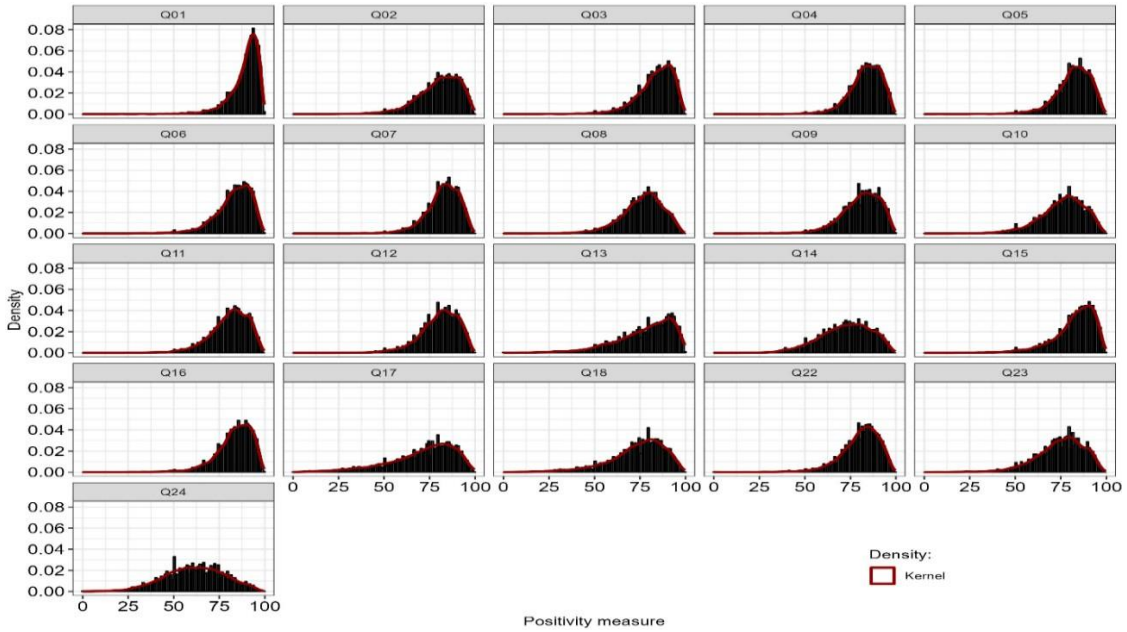

Figure 4: Histograms by question.

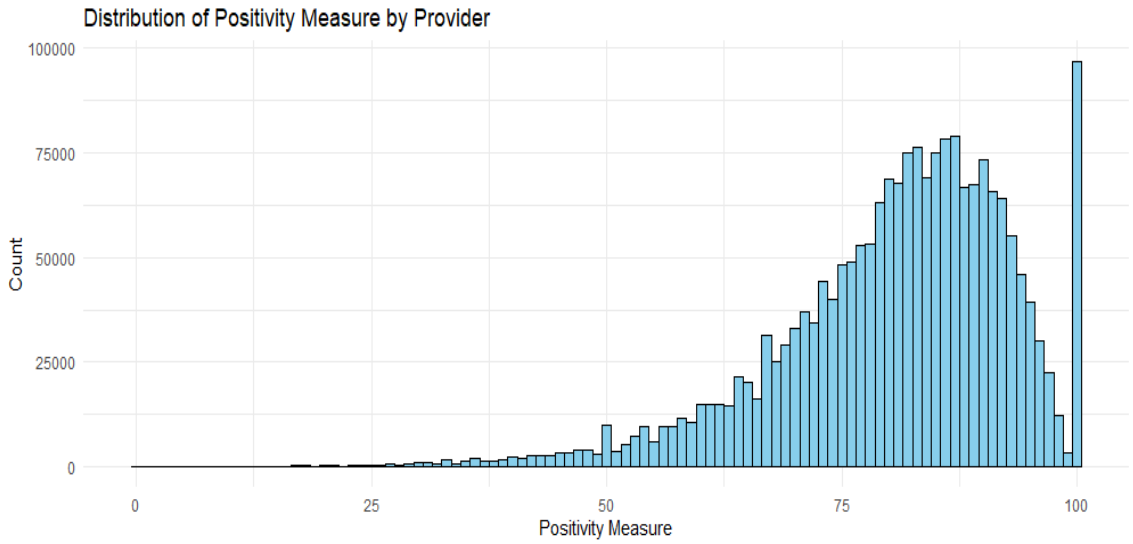

Figure 5: Distribution of the positivity measure by provider.

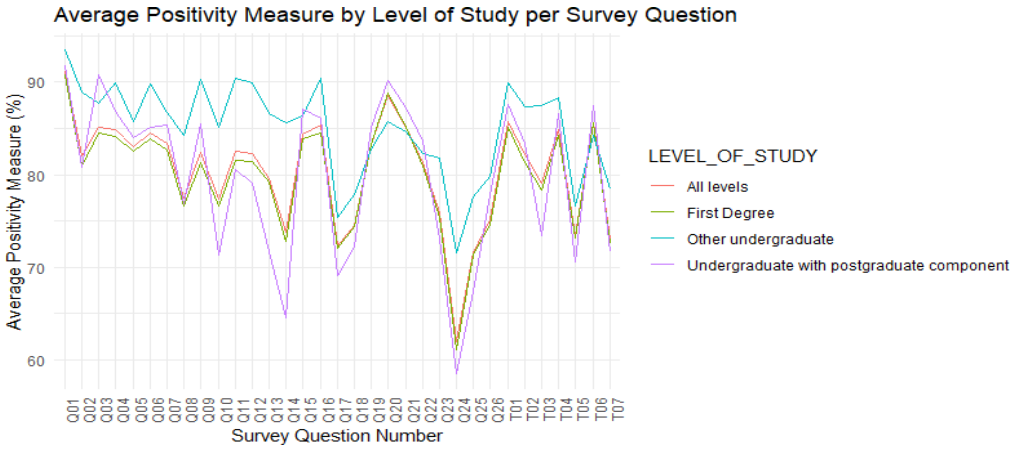

Figure 6: Average positivity measure by level of study for each question.

Figure 7 shows the top 20 institutions by response count. This shows which suppliers had the most survey respondents or students, such as the UK and England. Similarly, Figure 8 shows this information by question number.

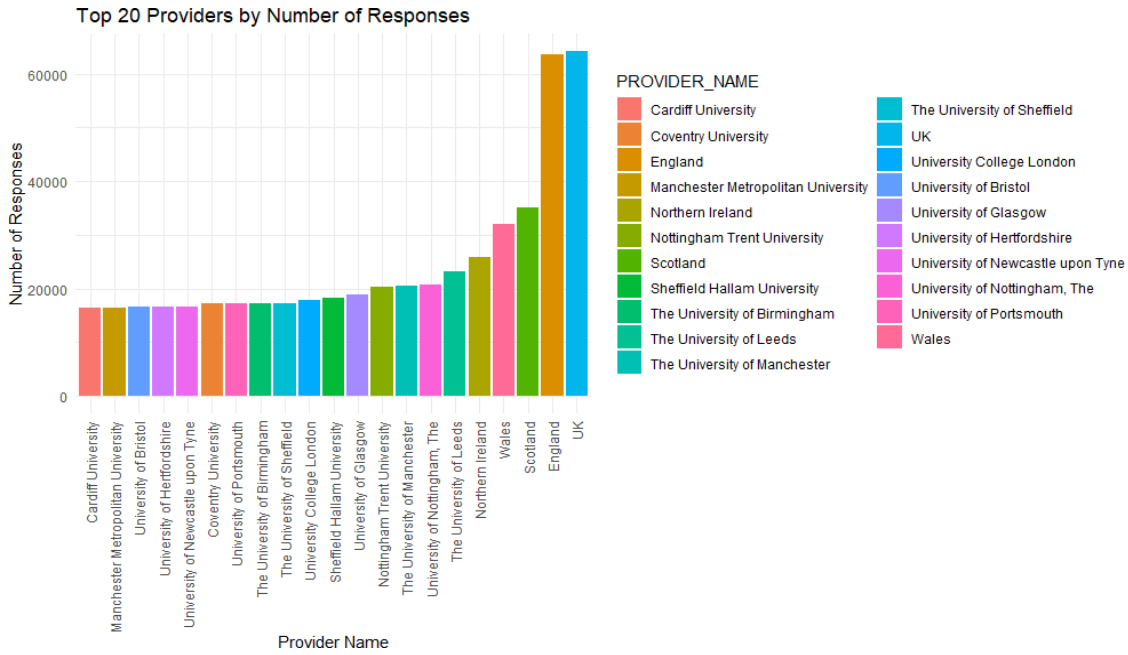

Figure 7: Top 20 providers by number of responses.

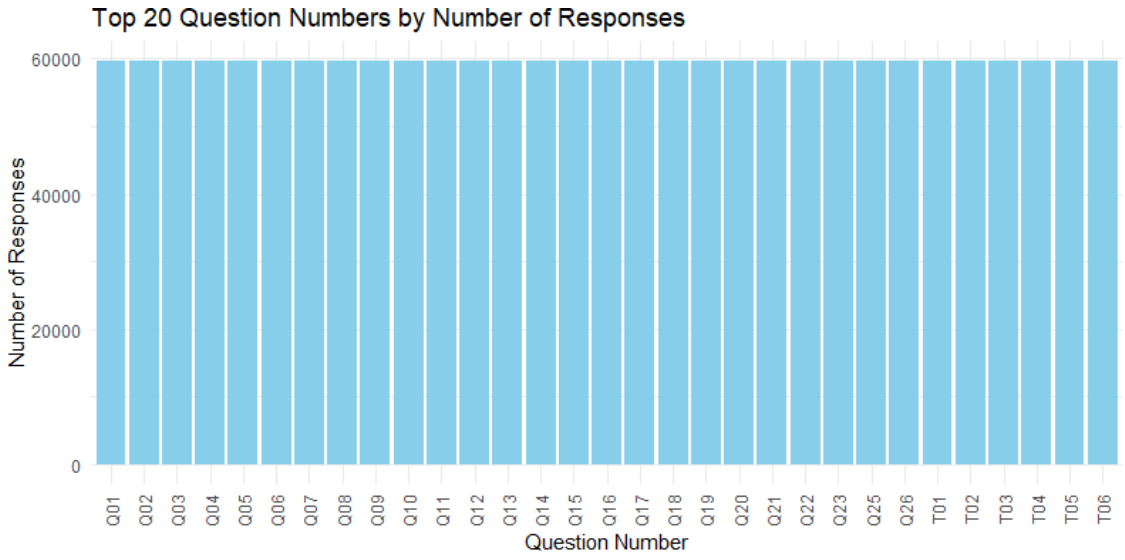

Figure 8: Top 20 question numbers by number of responses.

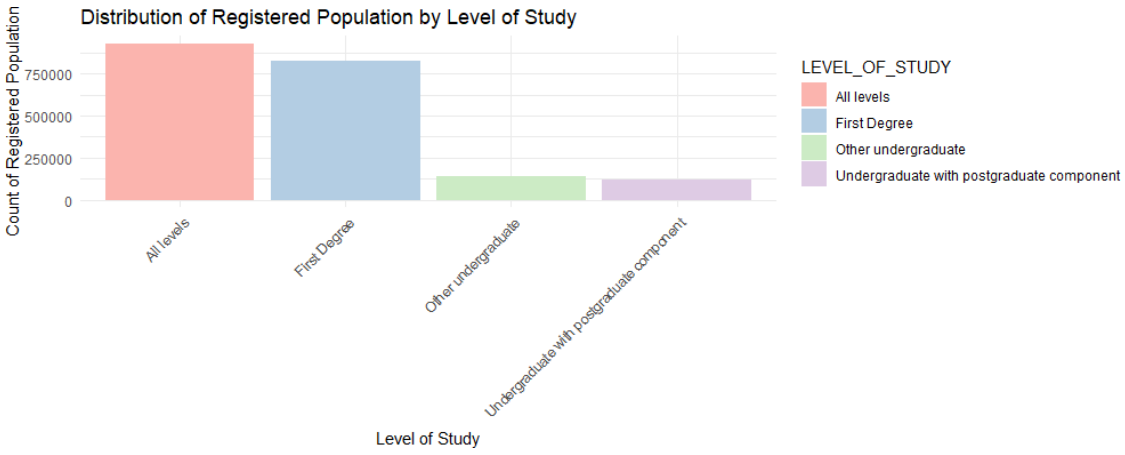

Figure 9: Distribution of the registered population by level of study.

Correlation analysis

A correlation matrix was developed to examine the interrelationships between the survey items in order to identify potential correlations among the numerous survey questions. Furthermore, the matrix was transformed into a heatmap, which is also referred to as a "corplot," in order to improve visual comprehension (Kassambara and Kassambara 2019). The straightforward identification of robust connections with Q11 is facilitated by the use of this graphical style, which highlights potential patterns and relationships that may be essential for further analysis. Q11 was selected in accordance with the research query. The determinants of satisfaction with the marks and assessments, as indicated in the POSITIVITY_MEASURE column, are the subject of Question Q11. The concentration was on individual institutions across "all modes" of research, with national and regional averages being excluded. In order to enhance clarity, specific inquiries were eliminated. Next, the data was categorized by the level of study, ranging from "all undergraduates" to "undergraduate with postgraduate component." The data after cleansing is depicted in Figure 10. Number of rows: 10.

```
> head(base_providers,10)
       UKPRN LEVEL_OF_STUDY SUBJECT_LEVEL CAH_CODE QUESTION_NUMBER POSITIVITY_MEASURE
 1: 10000163     All levels         CAH1    CAH02            Q01               86.8
 2: 10000163     All levels         CAH1    CAH02            Q02               78.1
 3: 10000163     All levels         CAH1    CAH02            Q03               82.0
 4: 10000163     All levels         CAH1    CAH02            Q04               64.3
 5: 10000163     All levels         CAH1    CAH02            Q05               68.0
 6: 10000163     All levels         CAH1    CAH02            Q06               76.0
 7: 10000163     All levels         CAH1    CAH02            Q07               78.1
 8: 10000163     All levels         CAH1    CAH02            Q08               59.4
 9: 10000163     All levels         CAH1    CAH02            Q09               72.9
10: 10000163     All levels         CAH1    CAH02            Q10               39.8
```

Figure 10: Cleaned data preview.

Data refinement for regression

In order to ensure the accuracy and relevance of regression analysis, questions that did not directly contribute to the primary research topic or exhibited low correlation were eliminated from the dataset. The data was categorized according to the level and style of the investigation. This segmentation generated datasets for intricate analyses, guaranteeing that each subset was significant.

Regression analysis

Linear regression

Numerous linear regression models were developed. The objective of these models was to identify the factors that influence student satisfaction with the marking and evaluation process. In order to ensure accuracy and robustness, robust standard error regression models and ordinary least squares (OLS) were implemented for each subgroup. While accounting for heteroscedasticity and other data discrepancies, this method guarantees comprehensive knowledge. In order to illustrate satisfaction levels and determinants, histograms and coefficient graphs were developed. The format of a linear equation is as follows:

Simple linear regression equations link the dependent variable Y to the independent variable X. In equation (1), $\beta 0$ represents the intercept, $\beta 1$ quantifies the change in Y for a one-unit change in X, and ε refers to the error factor that compensates for data variability (Montgomery et al. 2021, p. 12–13).

From equation (1), the derived equation (2) forms the cornerstone for conducting an exhaustive regression analysis to identify the determinants of satisfaction with marks and assessments. This study utilised grouped data sourced from the NSS to produce substantial findings. The regression model to be estimated is articulated as follows:

$$Q11,i = \alpha + \sum_{j=1, j\neq 11}^{26} \beta j Qj,i + ui, \qquad (2)$$

where:

$Q11,i$ is the positivity measure of Q11 (the question of interest) for the group i.

α is the intercept of the regression.

Qj,i is the positivity measure for each other question in the survey for the group i.

βj is the coefficient that measures the marginal effect of the positivity measure of question j on the positivity measure of Q11.

ui is the Gaussian error.

Logistic regression

The positivity metric was modified for binary outcome analysis. Responses over 70% were considered 'satisfied' while those below 70% were 'not satisfied'. Logistic regression was then used to predict binary satisfaction based on the study level and the subject level, which was created as q11_data. This model was essential for calculating student satisfaction probabilities based on certain factors. According to Hosmer et al. (2013, p. 35–36), consider a logistic equation in the format

$$g(x) = \ln\left(\frac{\pi(x)}{1-\pi\ x}\right) = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_p x_p. \quad (3)$$

Moreover, consider a multiple logistic regression model:

$$\pi(x) = \frac{e^{g(x)}}{1 + e^{g(x)}}. \quad (4)$$

The vector $x` = (x_1, x_2, ..., x_p)$ represents a set of p independent variables. Assume each variable is interval-scaled; the conditional probability of the result:

$$\Pr(Y = 1|x) = \pi(x). \quad (5)$$

Outliers analysis

The POSITIVITY_MEASURE of the 2023 NSS dataset was between 0 and 100. This range is indicative of the diverse spectrum of student satisfaction levels. In Figure 11, student dissatisfaction is indicated by zero numbers, which appear to be aberrations. This study's comparison revealed that the mean and minimum are somewhat improved by removing these outliers, as illustrated in Figures 12 and 13, but the median is not. This suggests that these low values are essential for the interpretation of student experiences, particularly in instances of substantial dissatisfaction. In order to provide a comprehensive and precise representation of student satisfaction, the research incorporated these outliers. This approach facilitated the assessment of educational quality by allowing for the comprehension of both high and low levels of student satisfaction.

```
>
> summary(base$POSITIVITY_MEASURE)
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
   0.00   74.00   82.70   80.58   89.60  100.00
>
```

Figure 11: Data cleansing summary for the positivity measure.

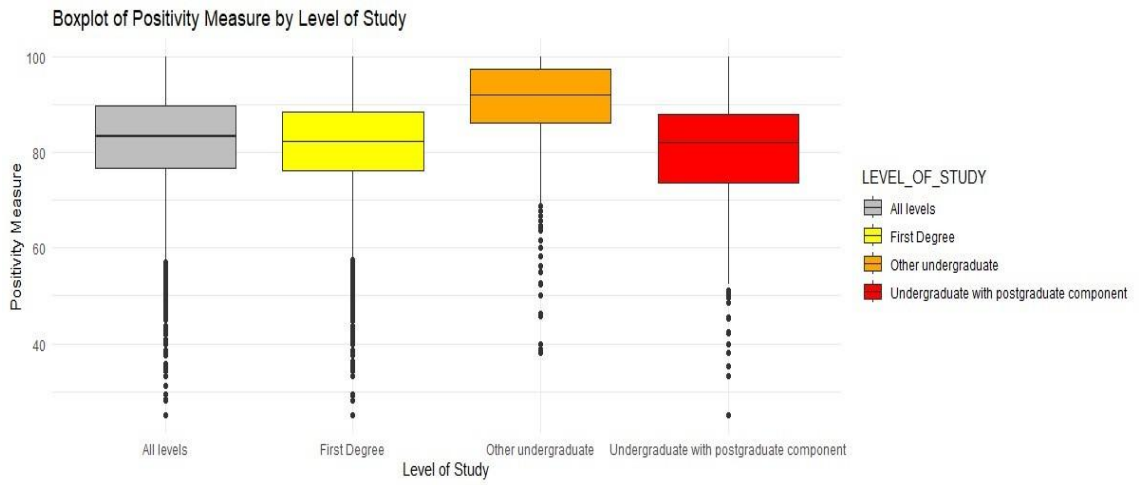

Figure 12: Boxplot of the positivity measure by level of study.

```
> list(With_Outliers = summary_with_outliers, Without_Outliers = summary_without_outliers)
$With_Outliers
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
  25.00   76.70   83.30   82.56   90.00  100.00

$Without_Outliers
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
  56.80   77.10   83.40   83.16   90.00  100.00
```

Figure 13: Comparative summary of q11_data with and without outliers.

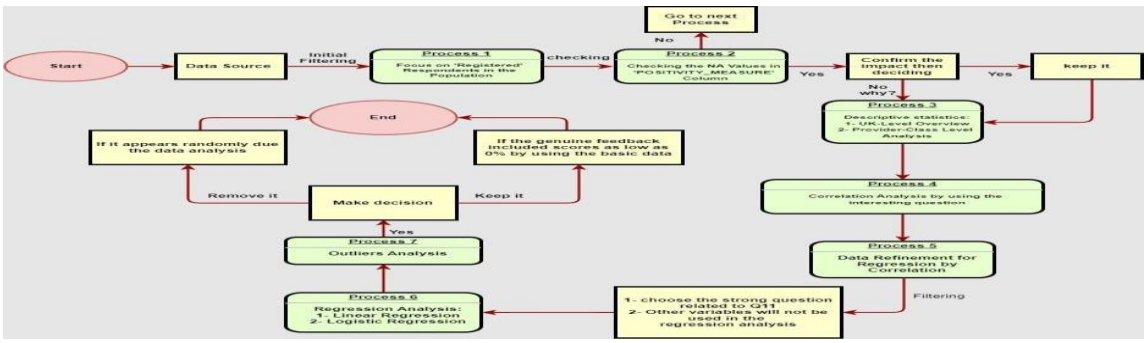

Figure 14: Workflow of the project to determine student opinions.

Results analysis

The UK's National Student Survey (NSS) is a critical tool for evaluating the current status of university education in an era characterized by a heightened emphasis on higher education and its transformative potential (Hazelkorn 2015, cited in Pollet and Shepherd 2022; Chung Sea Law 2010). It is essential to investigate and comprehend the factors that influence student satisfaction with the marking and assessment processes in UK universities as this study navigates an academic landscape that is constantly changing. The research query, "What are the determinants of satisfaction with the marks and assessments of UK university students?" is of great importance to policymakers, prospective learners, institutions, and students. The NSS, an exhaustive repository of students' candid opinions about the quality of their courses, is instrumental in this endeavor. This research endeavored to illuminate the factors that contribute to student contentment by addressing this inquiry. This can subsequently enhance the student experience and support the overarching ethos of public accountability in higher education by enabling prospective students to make informed decisions. Consequently, this research endeavor explored the extensive dataset provided by the National Student Survey (NSS), which is open source on behalf of the UK's funding and regulatory agencies (Office for Students 2023). The NSS is an invaluable source of inspiration and insight in the pursuit of disentangling the determinants of student satisfaction in the UK's vibrant HE landscape, as it has consistently high response rates and the participation of every UK university and many institutions.

Data approach

In addressing the research question of identifying the determinants of satisfaction with marks and assessments among UK university students, this research centres on leveraging the rich dataset provided by the NSS. This comprehensive survey, consisting of 26 questions across seven distinct categories, offers a comprehensive snapshot of students' experiences within the HE system. To investigate satisfaction with marking and assessment criteria, this study focused on Q11, which directly elicits students' opinions. Its dependent variable is the positivity measure derived from the responses to Q11, capturing the proportion of good and very good answers. To unearth the determinants of this satisfaction, the study employed the positivity measures of the other survey questions as independent variables. By adopting this approach, this study aimed to provide insights into the factors that significantly influence students’ positive perceptions of marking and assessment processes. Thus, this study aimed to contribute a more nuanced understanding of students’ educational experience from their perspective.

Summary statistics

Table 4: UK descriptive statistics by level of study (Office for Students 2023).

How fair has the marking and assessment been on your course? Positivity measure by Study Level	All levels	First Degree	Other undergraduate	Undergrad. with postgrad.
Medicine and dentistry	73.8	78.0	71.4	73.4
Subjects allied to medicine	75.7	75.0	87.1	72.3
Biological and sport sciences	82.7	82.2	89.7	83.3
Psychology	78.0	77.9	87.9	76.7
Veterinary sciences	86.6	80.2	91.0	86.9
Agriculture, food and related studies	84.0	83.3	85.6	90.3
Physical sciences	81.9	81.7	76.2	82.5
Mathematical sciences	84.9	84.1	100.0	88.5
Engineering and technology	80.8	80.2	91.4	80.8
Computing	83.5	83.1	92.6	82.5
Architecture, building and planning	80.4	80.0	94.1	84.0
Social sciences	80.4	79.8	92.0	80.1
Law	76.2	76.1	93.7	76.0
Business and management	82.5	81.6	92.4	80.9
Language and area studies	83.4	83.4	NA	78.2
Historical, philosophical and religious studies	85.0	84.9	90.0	86.2
Education and teaching	82.8	81.1	93.1	86.0
Combined and general studies	88.3	88.0	92.8	63.2
Media, journalism and communications	82.6	82.4	94.3	NA
Design, and creative and performing arts	81.7	81.4	89.3	75.5
Geography, earth and environmental studies	82.7	82.5	93.1	85.4
Average	81.80	81.28	89.89	80.64
S.D.	3.54	2.97	6.34	6.48

Source: Own calculation based on National Study Survey (NSS), 2023 which was open source (Office for Students 2023).

Table 4 provides a comprehensive overview of the responses to the inquiry "How fair has the marking and assessment been on your course?" in the United Kingdom, categorized by subject and study level. Initially, the sample is composed of a greater number of first-degree students, as evidenced by the similarity between the average and the average of all levels. Secondly, the positivity measure between subjects does not exhibit a significant degree of heterogeneity. The subjects associated with medicine exhibit the lowest positivity measure, at 75.7%, and the highest positivity measure is associated with combined and general studies, at 88.3%, when all educational levels are taken into account. In general, it can be inferred that students are exceedingly satisfied with the assessment procedure. Nevertheless, the results are distinct when examining granular data, despite the fact that this relatively low dispersion is maintained when examining aggregate data. The results of Table 4 are replicated in Table 5, which displays the average, minimum, maximum, and standard deviation of individual provider data. In this instance, the positivity measure for Q11 at certain universities is less than 50%. This discovery underscores the necessity of undertaking regression analyses on both aggregate and granular data in order to capitalize on the potential heterogeneity of responses among providers.

Table 5: Individual provider descriptive statistics for all levels of study (Office for Students 2023).

How fair has the marking and assessment been on your course?				
Positivity measure statistics by Study Level and Subject				
	Mean	**S.D.**	**Min.**	**Max.**
Agriculture, food and related studies	84.7	11.0	53.8	100.0
Architecture, building and planning	81.2	8.0	57.9	100.0
Biological and sport sciences	83.8	9.3	48.0	100.0
Business and management	84.3	9.2	51.8	100.0
Combined and general studies	84.2	10.5	58.3	100.0
Computing	84.0	8.6	60.0	100.0
Design, and creative and performing arts	83.8	9.6	47.5	100.0
Education and teaching	84.1	10.0	58.7	100.0
Engineering and technology	83.2	7.9	64.7	100.0
Geography, earth and environmental studies	83.8	8.4	67.4	100.0
Historical, philosophical and religious studies	87.9	7.3	70.0	100.0
Language and area studies	84.6	7.4	61.1	100.0
Law	78.2	9.4	58.7	100.0
Mathematical sciences	87.0	10.0	54.0	100.0
Media, journalism and communications	83.4	8.7	53.8	100.0
Medicine and dentistry	76.1	10.3	48.9	91.7
Physical sciences	81.9	9.6	53.2	100.0
Psychology	78.6	8.8	54.6	100.0
Social sciences	83.1	8.2	58.3	100.0
Subjects allied to medicine	78.8	10.5	49.2	100.0
Veterinary sciences	85.4	8.0	68.2	97.3

Source: Own calculation based on National Study Survey (NSS), 2023 which was open source (Office for Students 2023).

Regression analysis

Let us concentrate on equation 2, which was derived from equation 1. Selecting a subset of the numerous regressors to apply and concentrate on during regression analysis is a practical approach. In order to achieve this without sacrificing generality or biases, a correlation analysis is conducted between the dependent variable and all prospective regressors, as illustrated in Figure 15.

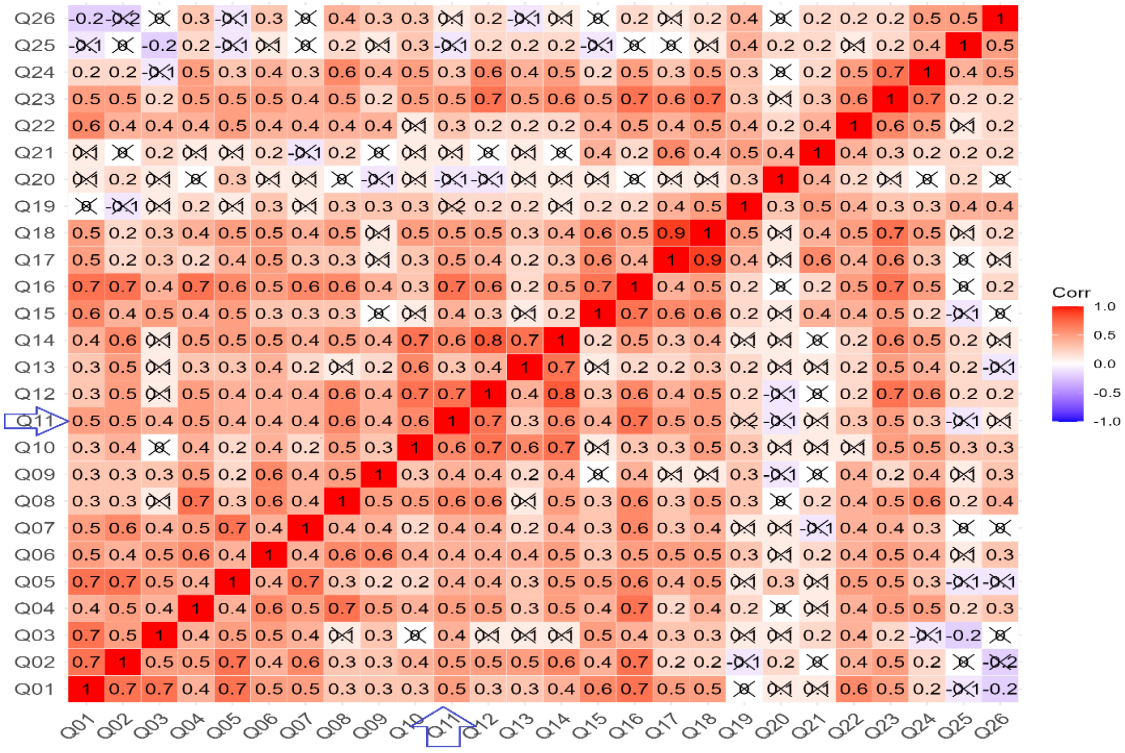

Figure 15: Correlation analysis.

Figure 15 illustrates the matrix of correlations between each variable (the positivity measure of each query). It was developed for the purpose of visual interpretation. The relationship between the row variable and its correlate with all other columns is represented by each cell. The Pearson correlation coefficient is represented by the numerical value in each cell. The cell is not statistically significant if it is marked with an X, meaning that there is no correlation. The cell becomes redder as the positive correlation between the two queries' positivity measures increases. Bluer the cell, the stronger the negative correlation between the positivity measures of the two queries. For example, Q01 and Q02 exhibit a seventy percent positive correlation, or 0.7. Conversely, the correlation between Q01 and Q25 is not statistically significant. Regarding Q11, there is a highly significant correlation with other questions, with the exception of Q19–21, 25, and 26. Consequently, the regression analysis did not incorporate these variables. It is imperative to emphasize that correlation does not imply causality, and that during regression analysis, certain variables that are correlated with the dependent variable may lose their significance if another variable is more significant. The NSS data was employed in the regression analysis conducted here, with the following factors in mind:

- All regressions included all modalities of study, including full-time, part-time, and apprenticeship, to avoid the potential issue of dividing the data for these groups, as part-time and apprenticeship had significantly fewer observations.
- Two distinct exercises were conducted: one that utilized the data aggregated by all subjects in the survey (Table 7) and the other that utilized the individual subjects at a more granular level (Common Aggregation Hierarchy 3, or CAH 3) (Table 8).
- The regressions were conducted for all levels of study and by level category: first degree, other undergraduate, and undergraduate with postgraduate component in both exercises.
- The OLS method and the robust approach (White heteroskedastic corrected standard errors) were implemented. Although the coefficients are identical for both methods, the significance alters when prospective heteroskedasticity is taken into account.

Table 2 shows the corresponding questions with each notation to explain the regression results in Tables 6 and 7. The target question is marked in red.

Table 6: Regression analysis at the aggregated subject level (Office for Students 2023).

Determinants of Satisfaction on Marking and Assessment

Regressions on All modes and All subjects by level of study

	All levels		First Degree		Other undergraduate		Undergrad. with postgrad.	
	OLS	Robust	OLS	Robust	OLS	Robust	OLS	Robust
(Intercept)	7.271	7.271	2.827	2.827	22.043**	22.043**	32.579**	32.579*
Q01	0.089	0.089	0.255+	0.255	0.119	0.119	-0.238	-0.238
Q02	-0.059	-0.059	-0.015	-0.015	-0.009	-0.009	0.035	0.035
Q03	0.073	0.073	0.137+	0.137	0.038	0.038	0.377***	0.377**
Q04	0.066	0.066	-0.119	-0.119	0.187*	0.187+	0.034	0.034
Q05	-0.047	-0.047	0.009	0.009	-0.055	-0.055	0.624***	0.624***
Q06	-0.123	-0.123	-0.149	-0.149	-0.171	-0.171	-0.01	-0.01
Q07	0.026	0.026	0.06	0.06	-0.038	-0.038	-0.131	-0.131
Q08	0.036	0.036	0.137*	0.137	0.01	0.01	0.022	0.022
Q09	-0.166*	-0.166	-0.19*	-0.19	-0.202*	-0.202+	-0.475***	-0.475**
Q10	0.365***	0.365***	0.388***	0.388***	0.301***	0.301***	0.412***	0.412***
Q12	0.362***	0.362***	0.227**	0.227*	0.292**	0.292**	0.299**	0.299**
Q13	-0.105***	-0.105**	-0.052	-0.052	-0.116**	-0.116*	-0.003	-0.003
Q14	0.121*	0.121	0.087	0.087	0.018	0.018	-0.129	-0.129
Q15	0.082	0.082	-0.12+	-0.12	0.061	0.061	0.079	0.079
Q16	0.294***	0.294**	0.318**	0.318*	0.309***	0.309**	-0.392*	-0.392*
Q17	0.05	0.05	0.005	0.005	0.052	0.052	-0.078	-0.078
Q18	-0.097*	-0.097	-0.033	-0.033	-0.108+	-0.108	0.122	0.122
Q22	-0.211***	-0.211***	-0.23***	-0.23**	-0.1+	-0.1	-0.145	-0.145
Q23	0.226***	0.226**	0.363***	0.363***	0.226***	0.226**	0.176	0.176
Q24	-0.064	-0.064	-0.116+	-0.116	-0.047	-0.047	0.132+	0.132
Num.Obs.	352	352	259	259	210	210	99	99
R2	0.729		0.674		0.601		0.838	
Log.Lik.	-1046.478		-768.842		-629.063		-278.596	
AIC	2137.0	2755.0	1581.7	2013.7	1302.1	1636.1	601.2	713.2
BIC	2222.0	4033.8	1659.9	2860.2	1375.8	2268.7	658.3	915.6

+ p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001

Source: Own calculation based on National Study Survey (NSS), 2023 which was open source (Office for Students 2023).

Table 6 illustrates the findings when the aggregated subject level of the data is taken into account. Initially, the R-squared values are consistently greater than 60%, indicating that all regressions are well-fitted. Secondly, the number of observations for the first degree is nearly identical to that of all levels, which will result in comparable outcomes. Third, the regression results are subject to greater variability and lower confidence due to the limited sample size of undergraduates with postgraduate components. Only Q10, Q12, Q13, Q14, Q16, Q18, Q22, and Q23 are statistically significant when examining column 3 (all levels, robust regression). This implies that the clarity of the marking criteria (Q10) and the opportunity to demonstrate what has been learned (Q12) are positively correlated with contentment with marking and assessment. Additionally, the more favorable the feedback (Q14), the more favorable the assessment and marking are perceived. The perception of support from the teaching staff for the learning process (Q16) and the perception that the students' opinions are valued by the staff (Q23) are also associated with satisfaction. In contrast, the perception of impartiality in the evaluation (Q13) and the opportunity to provide feedback on the course (Q22) appear to be negatively correlated when feedback is received on time. The final two results are counterintuitive; however, they may be the result of biases that arise from data aggregation. In practical terms, the results indicate that a 1% increase in the positive perception of the clearness of assessment results in a 0.365% increase in the positive perception of the impartiality of marking and assessment, which is approximately one-third of a percentage point. The same effect is observed when the positivity of the opportunity to demonstrate what has been learned is increased. Lastly, a 1% increase in the perception that the staff values the students' opinions results in a

0.226% increase in the perception of impartiality in the evaluation process.
The previous results were upheld when accounting for first-degree and other undergraduate students. The opportunity to delve into ideas and concepts in depth (Q05) and intellectual stimulation in class (Q03) are highly valued by undergraduate students with a postgraduate component. The perception of impartiality in marking and assessment is nearly 0.63% enhanced by a 1% increase in the positivity measure for this question. It is a significant and impressive outcome. Nevertheless, it is not significant for other degrees, as the teaching objective is to establish elementary knowledge rather than delve into the subjects in the absence of a postgraduate component. The effects of the clearness of the assessment criteria and the opportunity to demonstrate knowledge are also more pronounced than in the other levels of study. This is the standard method of regression analysis: "an increase in one unit of X increases Beta units of Y." The units of X and Y are measured in percentage points in this instance. Consequently, a one-unit increase in X corresponds to a one-percent increase in $\beta 1$ % of Y when equation 1 is employed (Montgomery et al. 2012).

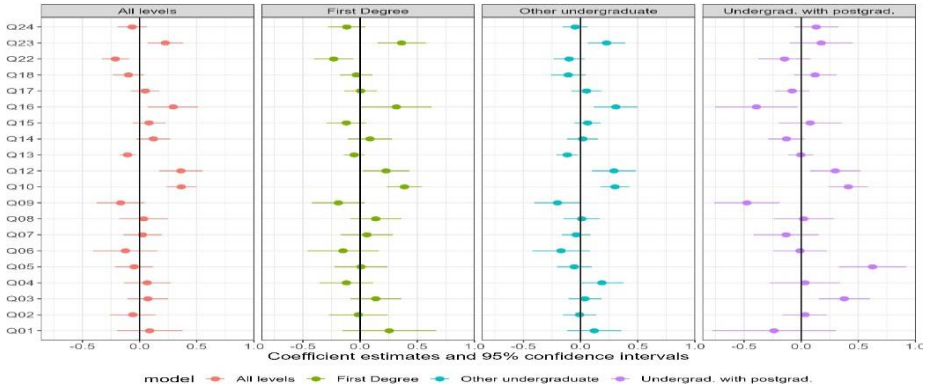

Figure 16: Aggregate subject-level coefficient estimates.

A picture of Table 6 can be seen in Figure 16. Based on the amount of study, each panel matches a column in Table 6 (only strong columns are taken into account). In the regression, the dots show the coefficient values for the y-axis variable, and the line around them shows the 95% confidence interval. If a line crosses the zero line, it means that the variable is not important. Seeing the optimism measure's impact on the dependent variable as a graph helps us understand it. All the dots whose confidence intervals are completely to the right of the zero line are factors that make people think that marking and grading is fair. We've already talked about most of the effects, but Figure 16 shows that because the sample size was so small, the confidence intervals for the parameters estimated in the fourth column are bigger. In addition, the results, both good and bad, seem stronger than in the other columns.

Table 7: Regression analysis at the aggregated individual subject level (Office for Students 2023).

Determinants of Satisfaction on Marking and Assessment

Regressions on All modes and individual subjects by level of study

	All levels		First Degree		Other undergraduate		Undergrad. with postgrad.	
	OLS	Robust	OLS	Robust	OLS	Robust	OLS	Robust
(Intercept)	12.728***	12.728***	13.036***	13.036***	22.068***	22.068***	18.826**	18.826**
Q01	0.055**	0.055*	0.061**	0.061*	0.111+	0.111	0.01	0.01
Q02	-0.067***	-0.067***	-0.061***	-0.061***	-0.056	-0.056	0.004	0.004
Q03	0.072***	0.072***	0.071***	0.071***	0.034	0.034	0.019	0.019
Q04	0.059***	0.059**	0.052***	0.052**	0.137**	0.137*	-0.023	-0.023
Q05	-0.02	-0.02	-0.022	-0.022	-0.062	-0.062	0.072	0.072
Q06	-0.061***	-0.061***	-0.074***	-0.074***	0.09	0.09	0.045	0.045
Q07	-0.048***	-0.048**	-0.04**	-0.04*	-0.028	-0.028	-0.075	-0.075
Q08	0.004	0.004	-0.013	-0.013	0.006	0.006	0.06	0.06
Q09	-0.03*	-0.03*	-0.038**	-0.038*	-0.161**	-0.161**	-0.03	-0.03
Q10	0.306***	0.306***	0.306***	0.306***	0.239***	0.239***	0.298***	0.298***
Q12	0.237***	0.237***	0.239***	0.239***	0.172***	0.172**	0.214***	0.214***
Q13	-0.005	-0.005	0.004	0.004	-0.065*	-0.065*	-0.075**	-0.075**
Q14	0.081***	0.081***	0.077***	0.077***	0.097*	0.097*	0.048	0.048
Q15	0.053***	0.053***	0.054***	0.054***	0.036	0.036	0.113*	0.113+
Q16	0.156***	0.156***	0.133***	0.133***	0.18***	0.18**	0.041	0.041
Q17	0.011	0.011	0.008	0.008	-0.009	-0.009	0.112***	0.112**
Q18	0.001	0.001	0.013	0.013	0.017	0.017	-0.022	-0.022
Q22	-0.013	-0.013	0.001	0.001	-0.048	-0.048	-0.03	-0.03
Q23	0.108***	0.108***	0.123***	0.123***	0.14***	0.14**	0.067	0.067
Q24	-0.045***	-0.045***	-0.045***	-0.045***	-0.068*	-0.068*	-0.044	-0.044
Num.Obs.	6047	6047	5465	5465	471	471	536	536
R2	0.561		0.546		0.579		0.551	
Log.Lik.	-20597.141		-18719.291		-1530.878		-1875.793	
AIC	41238.3	53246.3	37482.6	48326.6	3105.8	3961.8	3795.6	4781.6
BIC	41385.8	93664.6	37627.9	84290.3	3197.2	5831.4	3889.8	6987.9

+ p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001

Source: Own calculation based on National Study Survey (NSS), 2023 which was open source (Office for Students 2023).

Table 7 has the same layout and ideas as Table 6, but it looks at the results for each subject to make the most of the data's precision. First, the sample grows from 352 observations across all levels to almost 6,000. Second, the fit is still good, but not as good as it was in Table 6 (look at the R-squared measure). Third, there are a lot more important factors this time than there were before.

If you look at all of the levels and focus on the robust results, you'll see that all but Q05, Q08, Q13, Q17, Q18, and Q19 are important. Questions about the teaching process (Q01–04) are now important, which is different from the earlier results. For example, a 1% rise in the positive view of staff explanations raises the perception of fairness of the marks by 0.06%. Interestingly, making the topics interesting seems to have a bad effect on how fair people think the grades and tests are. However, making the material intellectually stimulating (Q03) and pushing the students to do better (Q04) has a positive effect on how fair people think it is. Once more, students are happier with their grades and assessments when the criteria for grades are clear (Q10), they can show what they've learned (Q12), they get better feedback (Q14), they think the teachers support their learning (Q16), and their opinions are taken into account (Q23). Also, people think that the marking and evaluation are more fair when they can easily get in touch with the teaching staff (Q15).

If you look at the first-degree sections, this group is what drives most of the results at all levels. All the facts that were talked about before are still true. On the other hand, other undergraduate columns show that most of the teaching process is not thought about in terms of how fair the grading and marks are. Once more, the most important factors are how clear the marking standards are (Q10) and the chance to show what one has learned (Q12).

Last but not least, the number of undergraduates with postgraduate components has changed since Table 6's findings. The variables in the training process don't matter at all; only how clear the criteria for marking are and the chance to show what you've learned do. These students also care more than other students about how the course is organized (Q17). A 1% rise in how well people think the course is organized leads to a 0.1% rise in how well people think the marking and grading are fair. This rise is similar to the one seen before when equation 1 was used (Montgomery et al. 2012).

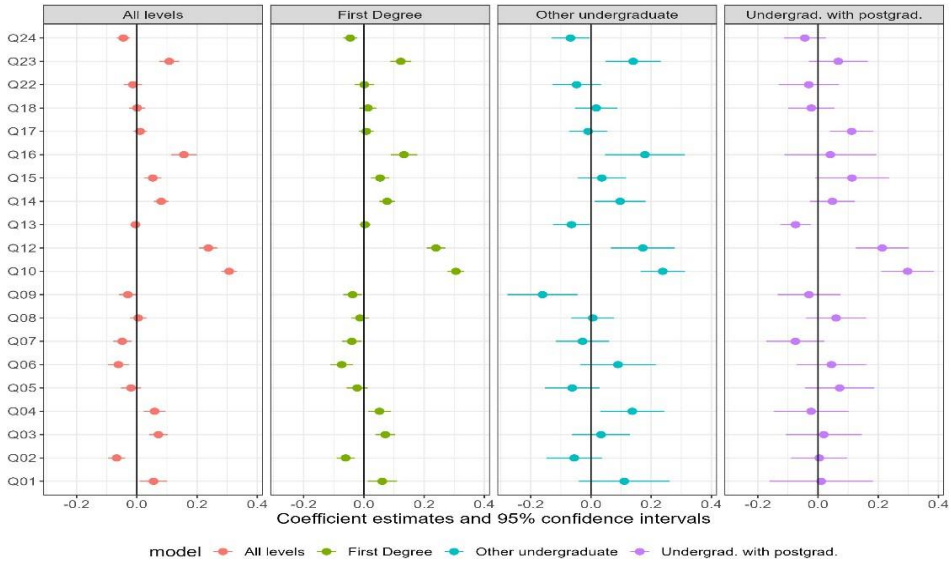

Figure 17: Aggregate for individual subject-level coefficient estimates.

A picture of Table 7 can be seen in Figure 17. Based on the amount of study, each panel matches a column in Table 7 (only strong columns are taken into account). Just like with Figure 16, this picture has a story behind it. The most interesting change is that the confidence intervals got wider instead of tighter, even though the sample size of the college students with a postgraduate component grew from 99 observations to 536. This can happen when providers are in very different positions. The effects of Q10 and Q12 are bigger for all study levels than they are in Figure 16.

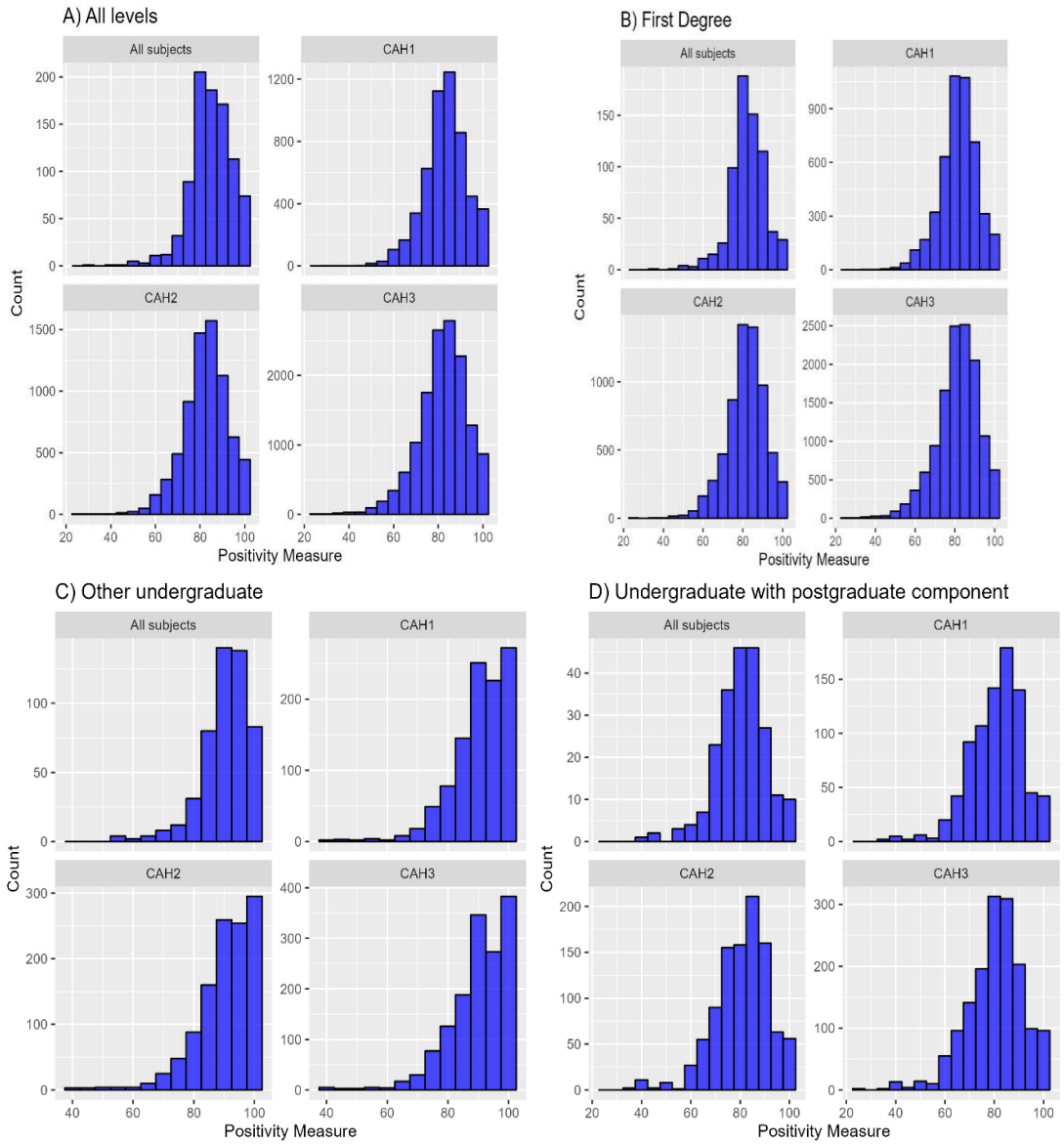

Figure 18: Distribution of satisfaction for different levels by subject level: A) All levels; B) First degree; C) Other undergraduate; D) Undergraduate with postgraduate.

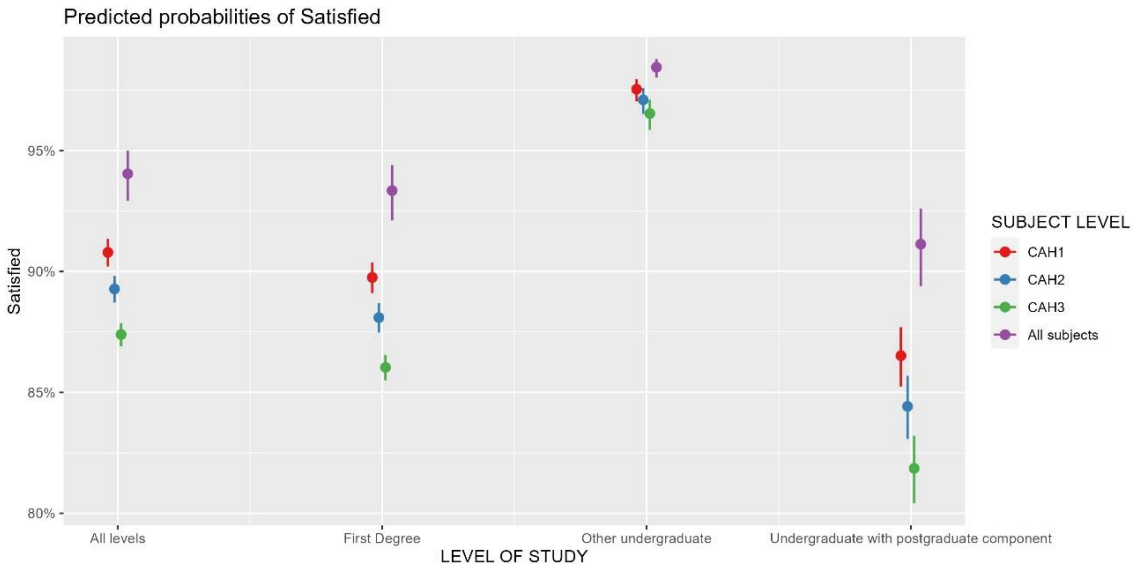

Figure 19: Predicted probabilities of satisfaction: A) All subjects: NSS 2023 results at the provider level split by level of study; B) CAH1: NSS results for providers split by level of study and broad subject groups; C) CAH2: NSS results for providers split by level of study and more detailed subject groups; D) CAH3: NSS results for providers split by level of study and most detailed subject groups.

The data is mostly at high positive values, which can be seen clearly in Figure 18, which shows a mean of about 80%. This trend points to a general level of happiness among students. However, it is important to note that the left tail is longer than the right. This shows that there is a specific group of schools or programs where student satisfaction is much lower, hitting about 20%.

Based on Figure 19, a close study of the numbers shows that university students in the UK are very happy with their grades and ratings. Some scholarly fields feel the same way about the feeling of satisfaction. It's important to note that students who are classified as "other undergraduate" have regularly shown satisfaction levels above 95% in a wide range of fields. Eighty-two percent of people are very satisfied with their jobs, even in groups with lower satisfaction rates, like undergraduate with postgraduate component in CAH3 topics. It's clear from this study that most university students in the UK are okay with and happy with the way they are evaluated.

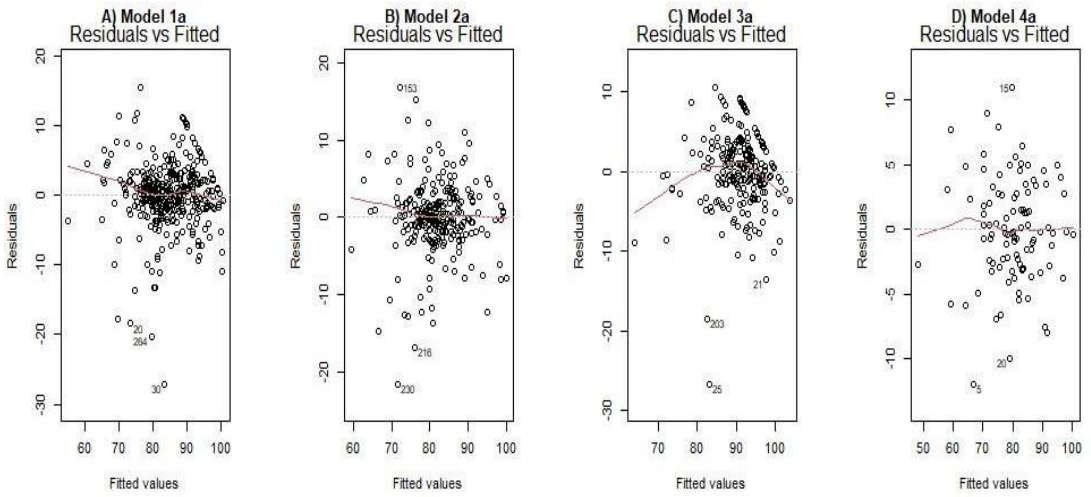

Figure 20: Regression analysis for 'all subjects' at different levels: A) All levels; B) First degree; C) Other undergraduate; D) Undergraduate with postgraduate.

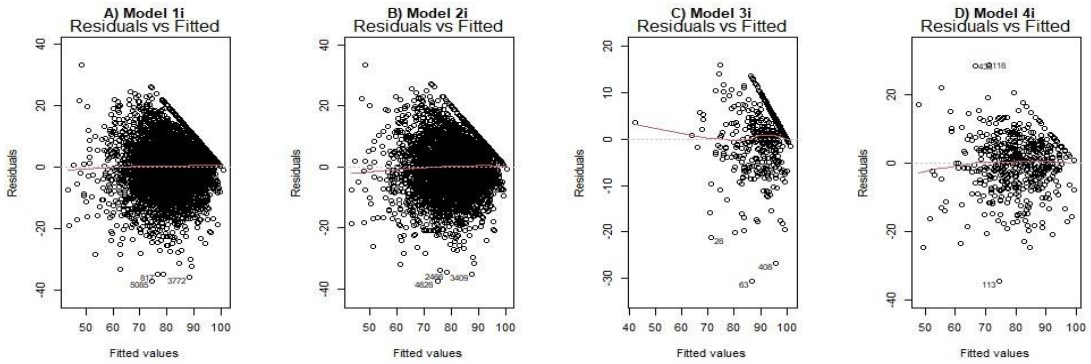

Figure 21: Regression analysis for 'CAH3' at different levels: A) All levels; B) First degree; C) Other undergraduate; D) Undergraduate with postgraduate.

Lastly, in regression analysis, the residuals-fitted values plot is crucial. It is an essential instrument for assessing the model's performance. In relation to the predictor variables, this study examined if the residuals showed any observable correlation or pattern. The residuals in an optimal theoretical framework have a random distribution with zero at its center. As seen in Figures 20 and 21, this shows that the model's assumptions have been met and that there is no systematic association, thus suggesting a satisfactory match overall. These numbers imply that, in relation to the predictors, our model well captured the variation in student satisfaction levels. This supports the validity of our research findings, especially when it comes to identifying the elements that influence people's satisfaction with academic assessments given in university settings (Penn State University 2023).

Conclusion and summary of the determinants

With the help of priceless NSS data and the compelling question, "What are the determinants of satisfaction with the marks and assessments of UK university students?" this study has uncovered a complex web of variables that have a big impact on how students view the marking and assessment procedures. Notable insights can be gained from the analysis results, which are summarized in Table 6. Notably, two important factors that determine how satisfied students are with their grades and tests are the clarity of the marking criteria and the chance to exhibit newly learned material. The perceived fairness of the review process significantly improves with just a 1% rise in favorable opinions of these elements. Additionally, a key factor in determining student satisfaction is the caliber of the comments and the feeling of support received from the faculty. This study did, however, also uncover some fascinating unexpected results, such as the apparent inverse association between timely feedback and the feeling of evaluation fairness. It is admitted that data aggregation might have affected these findings, necessitating additional research.

The results of this study are further supported by Table 7, which provides a detailed subject-level analysis. It emphasizes how important staff explanations, intellectual stimulation, and pushing students to grow as individuals are in influencing students' opinions on assessment fairness. It also emphasizes how crucial it is to have easy access to the instructional staff. Interestingly, this study found differences between student groups. Postgraduate undergraduate students place more value on intellectual stimulation and in-depth investigation. On the other hand, opportunities for knowledge demonstration and the clarity of the marking standards have a greater impact on other undergraduate students, especially those obtaining their first degrees. Additionally, Figure 19 demonstrates broad student happiness, with certain categories continuously above 95% satisfaction, while Figure 18 displays an average satisfaction level of 80%. This demonstrates how generally accepted evaluation practices are among college students in the UK. The complexity of student satisfaction with marking and assessment in UK universities was highlighted by this study. It gave educators and organizations looking to improve the student experience important insights by illuminating these factors. Consequently, the research findings support the ongoing enhancement of higher education in the United Kingdom.

Table 8: Summary of the determinants.

NO	Determinant	Explanation
1	Marking Clarity	A comprehensive comprehension of the marking standards significantly boosts satisfaction, whereas even a marginal enhancement has a discernible impact on perceived fairness.
2	Demonstration Opportunities	The capacity of pupils to proficiently demonstrate their acquired information is crucial for their overall satisfaction.
3	Feedback Quality	The level of satisfaction experienced by individuals is significantly impacted by the degree of clarity and constructiveness shown in the feedback they get.
4	Staff Support	The provision of both intellectual and emotional support from faculty members is crucial in fostering the satisfaction of students.
5	Feedback Timeliness	Interestingly, the perception of fairness may not necessarily align with the provision of prompt response.
6	Clear Staff Explanations	The provision of clear explanations by the teaching personnel is crucial in ensuring student satisfaction.
7	Intellectual Challenge	Courses that provide intellectual stimulation and provide challenging material are well esteemed
8	Staff Accessibility	Being able to easily approach and communicate with staff impacts students' views on assessment fairness.
9	Student Category Differences	Satisfaction determinants can vary among different student groups.

Discussion

The NSS statistics were thoroughly examined in the current study. The purpose of the study was to determine the main determinants of student satisfaction with the marking and assessment practices employed by UK institutions in 2023. The study emphasized the significance of having explicit marking standards and giving students the chance to demonstrate the knowledge they have acquired. It was demonstrated that the perceived fairness of evaluations significantly improved with even a slight increase of 1% in positive perceptions of these characteristics. Additionally, the influence of the quality of the feedback and the faculty members' perceived support were found to be important variables. The subject-level investigation helped to highlight how important staff explanations and intellectual stimulation are in shaping students' perspectives. It is important to note that this element is highly valued by undergraduate students who have a postgraduate component. They place a strong emphasis on carrying out exhaustive investigations. However, first-degree students stress the importance of precise and unambiguous grading guidelines. Academically, it is evident that UK university students' mean satisfaction levels with their experiences with marking and assessment have continuously stayed around 80%. This result suggests that these students are generally happy. The following points could come after this discussion:

Clarity of the marking criteria and demonstrating acquired knowledge

The main focus of this study was the undeniable significance of assessment rubrics' clarity and the degree to which students are given opportunities to demonstrate their acquired knowledge. This is in line with Bell's (2022) viewpoint, which emphasized the significance of well specified assessment criteria in shaping students' opinions. The results of this study emphasize the development of congruence in expectations between teachers and students. This is essential for fostering a sense of fairness and satisfaction.

The role of feedback

This study's emphasis on feedback quality is evidence of its critical role in influencing the academic experience. Lenton (2015) endorsed this viewpoint, stressing the value of constructive and helpful criticism in significantly improving the learning process. However, the study discovered an interesting anomaly: the speed at which respondents received responses was negatively connected with their opinions of how fair the review process was. Although this conclusion may appear paradoxical, it indicates that when it comes to feedback, students place a higher priority on thoroughness and relevance than on immediateness. This viewpoint aligns with the stance that Humphries-Smith and Hunt (2015) investigate.

Diverse perceptions across student categories

The data's level of detail highlights the minute differences in perceptions between different student groups. According to the study's findings, undergraduate students who also pursued a postgraduate component had a great propensity for in-depth research and intellectual stimulation. These results are consistent with Marie's (2016) research. This specific group naturally gravitates toward a more demanding academic experience because it often engages in advanced research and study. On the other hand, the results of this study show that explicit marking standards have the greatest impact on first-degree students. The observation is consistent with Sofroniou et al. (2020)'s findings, which emphasized the essential importance of clearly specified assessment standards for undergraduate students.

The spectrum of satisfaction

Even while the majority of the research shows high levels of student satisfaction, it's crucial to acknowledge that there are some atypical examples. The existence of some programs and institutions that showed noticeably lower levels of satisfaction than others confounded the conclusions. In their discussion of variability, Bell and Brooks (2018) suggested that these discrepancies might be caused by exogenous factors that are not within the purview of the National Statistical Service (NSS).

The multifaceted nature of satisfaction

This study demonstrated the multifaceted nature of the academic experience by identifying a complex network of elements that affect students' pleasure. Despite the fact that the NSS provides useful quantitative data, it is crucial to recognize that these metrics might only offer a restricted viewpoint. According to Lenton's (2015) research, understanding the whole scope of the student experience requires acknowledging qualitative subtleties, unique experiences, and narratives.

Data limitations

- Absence of qualitative data. This research only utilised quantitative data. Therefore, it is incomplete in qualitative perspectives that may be obtained via the use of interviews or open questions.
- Narrow academic focus. The questions primarily focus on academic encounters, ignoring important elements such as personal, economic, and social conditions that might influence student satisfaction. Therefore, dependence on numerical data may not fully capture students' subjective experiences and feelings.
- Volume and complexity of the data. Large datasets are difficult to manage and analyse. Therefore, accuracy and the handling of discrepancies and missing data are crucial.

Conclusion

The caliber of student experiences is still crucial in the ever changing world of higher education. Since its inception in the early 2000s, the NSS has been a source of wisdom. There was a push to use data-driven insights in place of in-depth subject reviews. It has developed over time into a priceless instrument for documenting the opinions of senior undergraduates and influencing the direction of instructional tactics. An exploratory exploration of the viewpoints of UK university students was the focus of this study. It looked at how satisfied they were with their academic standing and evaluation processes. The current study carried out a comprehensive examination of the NSS data in order to identify the wide range of intricate components that go into a positive assessment of the experience of higher education. The literature review served as a foundation for investigating how the NSS evolved as a measure of student viewpoints and educational quality. By providing a historical context and highlighting the importance of student participation in shaping educational policy and institutional goals, this research laid the groundwork for a more thorough investigation.
A robust quantitative research methodology was applied in this study. To search through the NSS data, the RStudio software's analytical features were employed. RStudio was used to apply techniques like data filtering, data cleansing, decision-making with missing values, descriptive statistics, correlation analysis, and regression analysis. A systematic investigation was made possible by this methodological technique. It resulted in the identification of the significant impact that clear assessment criteria and constructive criticism have on student satisfaction. This was accomplished by concentrating on Q11 and employing regression and correlation models together with a summary of descriptive statistics.

All levels of student satisfaction were high. This demonstrates the high level of satisfaction that students at UK universities have with assessment practices, as evidenced by the categories that often receive approval rates above 95%. Thus, striving for academic greatness is a process rather than a final goal. Institutions that prioritize the student experience, stay flexible, and learn from data-driven insights like the NSS are well-positioned for long-term success. The results of this study act as a compass, pointing stakeholders in the direction of well-informed decision-making and enhanced student experiences as the educational landscape in the UK and worldwide continues to change.
This study has significantly advanced our understanding of the factors that influence students' satisfaction with assessment procedures at UK higher education institutions. Nonetheless, we recommend that the data in this study be combined with qualitative information, such as that obtained from focus groups or interviews. This could improve the study's quantitative findings and offer a more thorough grasp of the experiences of students and the underlying causes affecting their levels of satisfaction. To improve on the present understanding of student satisfaction, we specifically recommend including interview questions about subjective emotions.

References

Arel-Bundock, V. 2022. modelsummary: Data and Model Summaries in R. *Journal of Statistical Software* 103(1). doi: 10.18637/jss.v103.i01.

Auguie, B., Antonov, A. and Auguie, M.B. 2017. *Package "gridExtra": Miscellaneous Functions for "Grid" Graphics*. Available at: https://cran.r- project.org/web/packages/gridExtra/index.html [Accessed: 26 September 2023].

Bell, A.R. and Brooks, C. 2018. What makes students satisfied? A discussion and analysis of the UK's national student survey. *Journal of Further and Higher Education* 42(8), pp. 1118–1142. doi: 10.1080/0309877X.2017.1349886.

Bell, K. 2022. Increasing undergraduate student satisfaction in Higher Education: the importance of relational pedagogy. *Journal of Further and Higher Education* 46(4), pp. 490–503. doi: 10.1080/0309877X.2021.1985980.

Callender, C., Ramsden, P. and Griggs, J. 2014. *Review of the National Student Survey: Summary Report*. Available at: https://discovery.ucl.ac.uk/id/eprint/1530788 [Accessed: 4 October 2023].

Canning, J. 2017. Conceptualising student voice in UK higher education: four theoretical lenses. *Teaching in Higher Education* 22(5), pp. 519–531. doi: 10.1080/13562517.2016.1273207.

Douglas, J.A., Douglas, A., McClelland, R.J. and Davies, J. 2015. Understanding student satisfaction and dissatisfaction: an interpretive study in the UK higher education context. *Studies in Higher Education* 40(2), pp. 329–349. doi: 10.1080/03075079.2013.842217.

Dowle, M., Srinivasan, A., Gorecki, J., Chirico, M., Stetsenko, P., Short, T., Lianoglou, S., Antonyan, E., Bonsch, M., Parsonage, H. and Ritchie, S. 2019. Package 'data.table'. *Extension of 'data.frame'*. Available at: https://r-datatable.com, https://Rdatatable.gitlab.io/data.table, https://github.com/Rdatatable/data.table [Accessed: 26 September 2023].

Gunn, A. 2018. Metrics and methodologies for measuring teaching quality in higher education: developing the Teaching Excellence Framework (TEF). *Educational Review* 70(2), pp. 129–148. doi: 10.1080/00131911.2017.1410106.

Higher Education Funding Council for England. 2001. *Information on Quality and Standards of Teaching and Learning: Proposals for Consultation*. Bristol: Higher Education Funding Council for England.

Higher Education Funding Council for England. 2002. *Information on Quality and Standards in Higher Education: Final Report of the Task Group*. Bristol: Higher Education Funding Council for England.

Hosmer Jr, D.W., Lemeshow, S. and Sturdivant, R.X. 2013. *Applied logistic regression (Vol. 398). John Wiley & Sons.*

Hothorn, T., Zeileis, A., Farebrother, R.W., Cummins, C., Millo, G., Mitchell, D. and Zeileis, M.A. 2015. Package 'lmtest'. *Testing linear regression models*. Available at: https://cran.r-project.org/web/packages/lmtest/lmtest.pdf [Accessed: 6 October 2023].

Humphries-Smith, T. and Hunt, C. 2015. An investigation of what feedback students recognise as feedback. In: *International Conference on Engineering and Product Design Education*, Loughborough University.

Kassambara, A. and Kassambara, M.A. 2019. Package 'ggcorrplot'. *R package version 0.1*. Available at: http://www.sthda.com/english/wiki/ggcorrplot-visualization-of-a- correlation-matrix-using-ggplot2 [Accessed: 22 September 2023].

Komsta, L. and Novomestky, F. 2015. Moments, cumulants, skewness, kurtosis and related tests. *R package version 14(1)*. Available at: http://www.komsta.net/ [Accessed: 26 September 2023].

Kuhn, M. and Wickham, H. 2020. *Tidymodels: a collection of packages for modeling and machine learning using tidyverse principles*. Available at: https://www.tidymodels.org/ [Accessed: 3 October 2023].

Lenton, P. 2015. Determining student satisfaction: An economic analysis of the National Student Survey. *Economics of Education Review* 47, pp. 118–127. doi: 10.1016/j.econedurev.2015.05.001.

Marie, J.A. 2016. Student Views on the Value of Feedback. *Journal of Education and Training Studies* 4(6). doi: 10.11114/jets.v4i6.1523.

Mock, T. 2023. gtExtras: Extending 'gt' for Beautiful HTML Tables. *R package version 0.5.0.9004*. Available at: https://jthomasmock.github.io/gtExtras/, https://github.com/jthomasmock/gtExtras [Accessed: 1 October 2023].

Montgomery, D.C., Peck, E.A. and Vining, G.G. 2021. *Introduction to linear regression analysis*. John Wiley & Sons.

Office for Students. 2023. *Home*. Available at: https://www.officeforstudents.org.uk/ [Accessed: 15 September 2023].

Penn State University. 2023. *4.2 - Residuals vs. Fits Plot*. STAT 501. Available at: https://online.stat.psu.edu/stat501/lesson/4/4.2 [Accessed: 11 November 2023].

Pollet, T.V. and Shepherd, L. 2022. Subscales in the National Student Survey (NSS): Some considerations on their structure. *Journal of Further and Higher Education* 46(9),
pp. 1195–1211. doi: 10.1080/0309877X.2022.2060069.

RStudio Team. 2020. *RStudio: Integrated Development for R*. Boston, MA: RStudio, PBC. Available at: https://posit.co/download/rstudio-desktop/

Seale, J. 2010. Doing student voice work in higher education: An exploration of the value of participatory methods. *British Educational Research Journal* 36(6), pp. 995– 1015. doi: 10.1080/01411920903342038.

Sofroniou, A., Premnath, B. and Poutos, K. 2020. Capturing student satisfaction: A case study on the national student survey results to identify the needs of students in stem related courses for a better learning experience. *Education Sciences* 10(12), pp. 1–22. doi: 10.3390/educsci10120378.

Weerasinghe I.M.S., Lalitha, R. and Fernando, S. 2017. Students' Satisfaction in Higher Education Literature Review. *American Journal of Educational Research* 5(5), pp. 533–
539. Available at: https://ssrn.com/abstract=2976013http://pubs.sciepub.com/education/5/5/9.

Wickham, H. 2011. ggplot2. *Wiley Interdisciplinary Reviews: Computational Statistics*
3(2), pp. 180–185. doi: 10.1002/wics.147.

Wickham, H. and Wickham, M.H. 2017. Package 'tidyr'. *Easily Tidy Data with 'spread' and 'gather()' Functions*. Available at: https://tidyr.tidyverse.org, https://github.com/tidyverse/tidyr [Accessed: 26 September 2023].

Wickham, H. and Wickham, M.H. 2020. *Package 'plyr'*. Available at: http://had.co.nz/plyr, https://github.com/hadley/plyr [Accessed: 26 September 2023].

Wickham, H., Bryan, J., Kalicinski, M., Valery, K., Leitienne, C., Colbert, B., Hoerl, D., Miller, E. and Bryan, M.J. 2019. Package 'readxl'. *Version 1.3.1*. Available at: https://readxl.tidyverse.org/ [Accessed: 20 September 2023].

Wickham, H., François, R., Henry, L., Müller, K. and Wickham, M.H. 2019. Package 'dplyr'. *A Grammar of Data Manipulation. R package version 0.8*. Available at: http://dplyr.tidyverse.org, https://github.com/tidyverse/dplyr [Accessed: 26 September 2023].

Williams, R. and Brennan, J. 2003. *Collecting and using student feedback on quality and standards of learning and teaching in higher education*.

Xie, Y., Cheng, J. and Tan, X. 2018. DT: a wrapper of the JavaScript library 'DataTables'. *R package version 0.4*. Available at: https://github.com/rstudio/DT [Accessed: 15 October 2023].

Zeileis, A., Lumley, T., Berger, S., Graham, N. and Zeileis, M.A. 2019. Package 'sandwich'. *R package version*, pp. 17. Available at: https://sandwich.R-Forge.R- project.org/ [Accessed: 15 October 2022

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