QUALITY MONITORING WITH BUSINESS INTELLIGENCE DASHBOARDS IN HIGHER EDUCATIONAL INSTITUTIONS USING NVIVO APPROACH TO SUPPORT QUALITATIVE ANALYSIS

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Abstract

Quality Monitoring in Higher Education (HE) is an important function which requires considerable resources in order to assure quality. Business Intelligence dashboards can help decision-makers in Higher Education Institutions (HEIs) by providing them with real-time monitoring of their service quality to meet quality assurance standards imposed by the government of the country concerned. A holistic framework for monitoring quality in Higher Education using business intelligence dashboards (HF-HEQ-BI) has been proposed based on a previous literature study. This paper outlines the validation of the proposed framework which used qualitative interviews with a panel of experts to gather their opinion about the factors that affect the design of business intelligence dashboards for monitoring quality in Higher Education. Qualitative data gathered through interviews has been analysed using Computer Assisted Qualitative Data Analysis Software (CAQDAS) using NVivo 12 to analyses the interview data. A modified holistic framework for monitoring quality in Higher Education using business intelligence dashboards (HF-HEQ-BI) has been presented based on the results of the qualitative analysis.

Keywords: Business Intelligence, Dashboard, Higher Education, Quality assurance, Qualitative analysis, NVivo12.

1 INTRODUCTION

Quality monitoring in the context of Higher Education (HE) encompasses many challenges such as the lack of knowledge of Quality Assurance (QA) systems [1] and maintaining the required documentation [2]. Business Intelligence (BI) can be utilised for monitoring strategic performance in HE [3]–[5]. BI dashboards deliver and display datasets from a combination of linked charts, and well-designed dashboards can aid users to gain insights into data and make decisions [6].

In the context of HE, institutions tend to deploy quality assurance standards such as the National Centre for Academic Accreditation and Assessment (NCAAA) standards in Saudi Arabia and the Quality Assurance Agency (QAA) in the UK. The adoption of these standards assures the minimum level of service quality in HEIs. Reflecting these standards, the authors have proposed a Holistic Framework for monitoring Quality in HE using BI dashboards (HF-HEQ-BI) [7]. For the purpose of monitoring quality in HE, public opinion aggregation from social media stakeholders (such as students) may be useful in determining the level of satisfaction reported in social media channels [7], [8].

The HF-HEQ-BI framework presented in [7] was reviewed with a panel of experts. Qualitative data analysis of the experts' responses was carried out using Computer Assisted Qualitative Data Analysis Software (CAQDAS) using NVivo 12. This paper shows the process of conducting qualitative data analysis as well as the modifications that were made to the HF-HEQ-BI framework as a result of the qualitative analysis.

2 LITERATURE REVIEW

2.1 Quality Monitoring in Higher Education

The nature of HE systems encompasses different internal and external stakeholders, as well as substantial funding allocated by governments in support of HEIs operations. This has led to stakeholder demands for assurance that resources are used in the most efficient way, thus, QA plays an essential role in assuring that the organisational mission and objectives are aligned to meet the expectations of stakeholders [9], [10].

Educational services are intangible and difficult to measure since the outcome is reflected in the improvement in knowledge, characteristics, and behaviours of individuals [11]. Key Performance Indicators (KPIs) are used by HEIs to benchmark performance in certain areas of the system. The actual performance is measured and compared to reference KPIs in order to determine the level of satisfaction or compliance with the target. As KPIs are directly related to the organisational mission, the achievement level can predict whether the HEI is aligned to its mission and strategic objectives. Furthermore, Colbran and Al-Ghreimil [2] suggested that, for the purpose of decision-making, good decisions require good information and datasets, therefore, metrics and KPIs can be relevant to learning and teaching as well as research. Additionally, basic datasets are required which can include time-series on achievement and attrition, student evaluations, and electronic assessment of submissions and reporting [2]. The results from these data sets may be aggregated on an individual, school, discipline, faculty, university, or system-wide basis.

Monitoring Quality in HE requires the analysis of considerable amounts of qualitative data. A major source of information about stakeholder satisfaction on the quality of services provided to Higher Education Institution (HEIs) is data coming from social media [8]. For the purpose of dealing with this type of data, sentiment analysis can be used to determine the level of satisfaction with service quality based on aggregating general opinion on social media [7], [8], [12].

2.2 Business Intelligence Dashboards

Business Intelligence Dashboards are becoming key components in performance management that visually summarise large amounts of data in terms of a series of graphs [13]. Dashboards can assist decision makers to gain insights into data and identify trends and patterns in data to assist in the decision making process [6]. In the context of Higher Education, dashboards are considered a key element for monitoring and presenting information for management as they represent the status of KPIs and make it easier for decision makers to identify trends and patterns in their data [3]. Only a few studies have addressed the factors that contribute to the design of BI systems in the context of HE [14].

3 RESEARCH METHODS

The purpose of this investigation is to initiate an understanding of the factors that affect the design of Business Intelligence (BI) systems for monitoring Quality in Higher Education. The findings of this investigation are used to enhance the Holistic Framework for monitoring Higher Education Quality using Business Intelligence Dashboards (HF-HEQ-BI) which was outlined by the authors in a previous study [7]. The HF-HEQ-BI developed in [7] was based on underpinning theoretical frameworks, which resulted in a 5 pillars framework. The factors affecting the design that are related to each pillar had been identified through extensive investigation of over 60 publications from the literature. The themed factors that are related to each pillar based on their relevance, were developed from the researchers' analysis of the literature. Therefore, a validation of these factors using a qualitative approach based on interviewing a panel of experts was required.

The process of interviewing a panel of experts was used by Muller et.al. [15] in identifying the opportunities and limitations of using Service Oriented Business Intelligence (SoBI) architecture. In addition, Jahatigh et.al. [16] interviewed practical experts and academics to identify the main dimensions of BI. Angell et.al. [17] interviewed a panel of experts in identifying factors of service quality in post graduate higher education.

As the initial proposed HF-HEQ-BI Framework has been developed based on a previous extensive literature review, the factors identified throughout the process and associated pillars have been documented [7]. In this paper, the process of qualitative analysis of the data acquired from interviewing the panel of experts will be discussed in terms of using NVivo 12 as a Computer Assisted Qualitative Data Analysis Software.

For the purpose of this study, a panel of ten experts from Saudi Arabia, USA, UK, India, Egypt, and Australia with considerable experience in Quality Assurance in HE ranges from 6 to 30 years were interviewed in compliance with the Staffordshire University Ethical procedure. The literature on qualitative focus groups suggests eight to ten participants is sufficient for the purpose of conducting these interviews [18], [19]. The participants were each given the same individual short presentation using MS PowerPoint slides to describe what is meant by Business Intelligence Dashboards and the HF-HEQ-BI framework and were sent copies of the questions to be discussed prior to the scheduled

interviews. The responses to each question were collated and the transcript completed by the researcher was sent to each expert for approval before conducting the analysis of the data collected.

4 DATA ANALYSIS

For the purpose of the qualitative data analysis, the NVivo12 software package was used to analyse the information gathered from the participants. All responses were typed in Word format (NVivo allows data entry from formats such as Word, PDF, Excel, or Picture) and collected into a file (called node) to theme the answers related to each question from each individual participant. Each question was coded, and all answers related to each question can be viewed separately. Therefore, the software allows the data related to each question to be accessed as shown in a sample question from the interviews in Fig. 1.

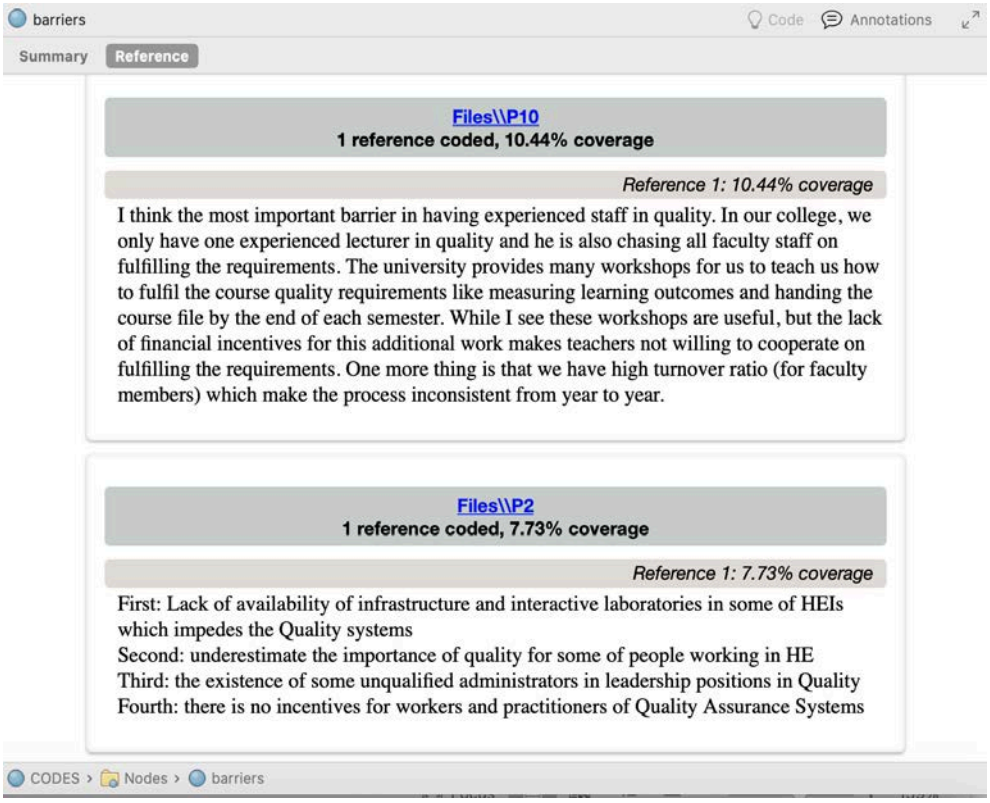

Figure 1. NVivo Sample Questions from the Interviews

The NVivo software provides a 'text search' capability which helps in determining whether the factors analysed had been confirmed by the participant. It allows searching of all respondents or specific respondents from the participants. The researchers used 'text search' capability to look at each factor in order to determine whether participants had mentioned that factor in their transcript to be able to determine if they agreed with the factor or not. Fig. 2 shows a sample of text search for the factor 'Top Management'.

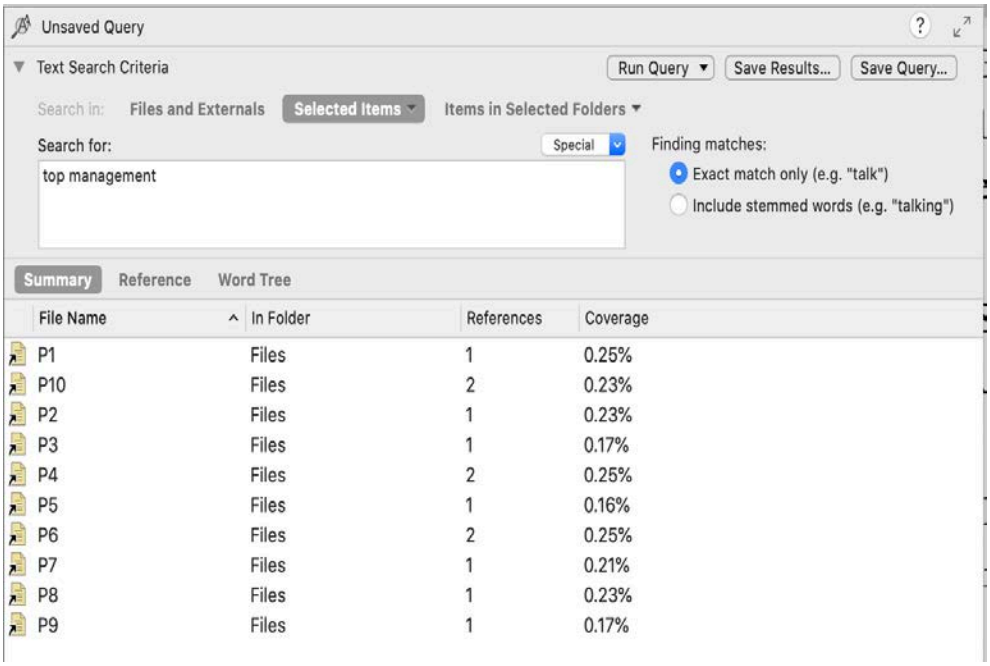

Figure 2. Sample Text Search for 'top management' factor

Open ended questions vary in responses, therefore, word frequency and word trees helped in identifying patterns in participants' responses, which helped the researchers to formulate and extract pertinent information from their responses. Fig. 3 and Fig. 4 shows an example of the word frequency of the key words that had been mentioned in the transcripts and the corresponding word tree from the selected key word 'quality'.

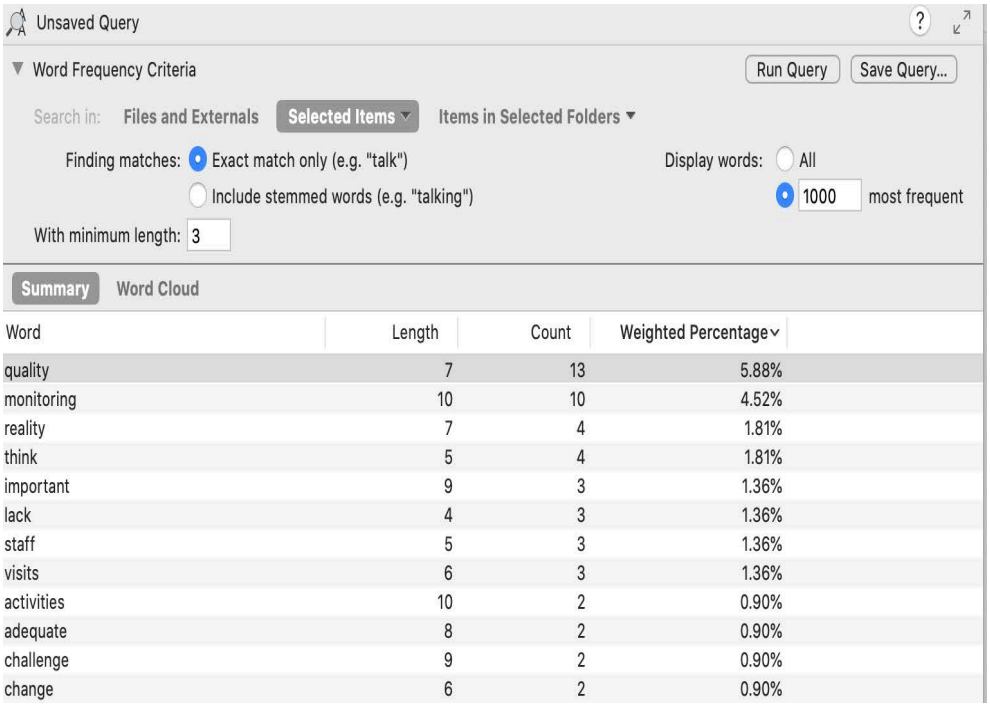

Figure 3. Word Frequency Example

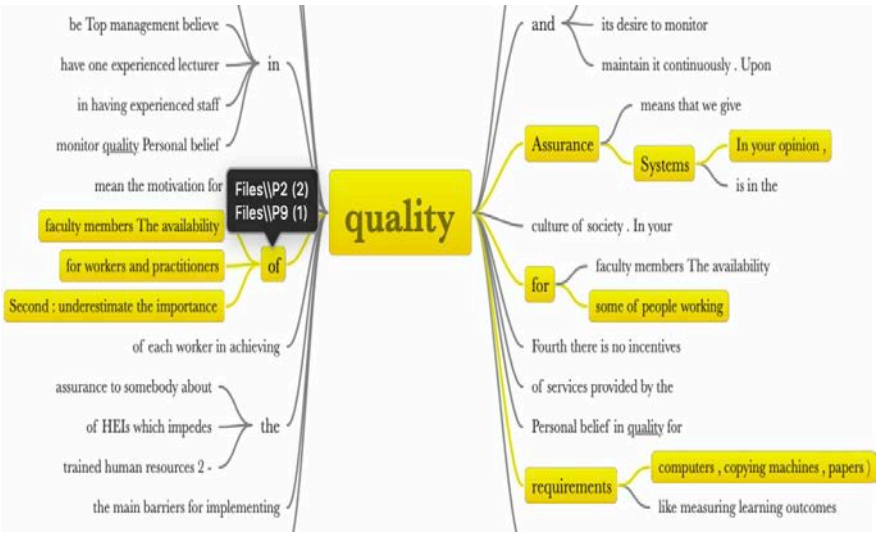

Figure 4. Word Tree Example

The word frequency function can help the researcher to identify particular words such as Quality and determine the pattern of statements connected to this word. The word tree also enabled the researchers to determine whether this word was proposed by one or several participants. If the researcher selects any of these words to look for, they can also see the pattern of statements tied to this word in the word tree. The word tree can indicate what had been said by each participant.

The results from the focus group of experts can be summarised and the related information can be themed into nodes. Each node represents transcripts from one or more participants that are related to a similar factor (such as 'Top Management' factor). Each factor has been mapped to the respective theoretical pillar of the framework according to the theme responses from the participants. Fig. 5 shows a sample node of the 'Social' pillar where all related factors mentioned by participants have been documented.

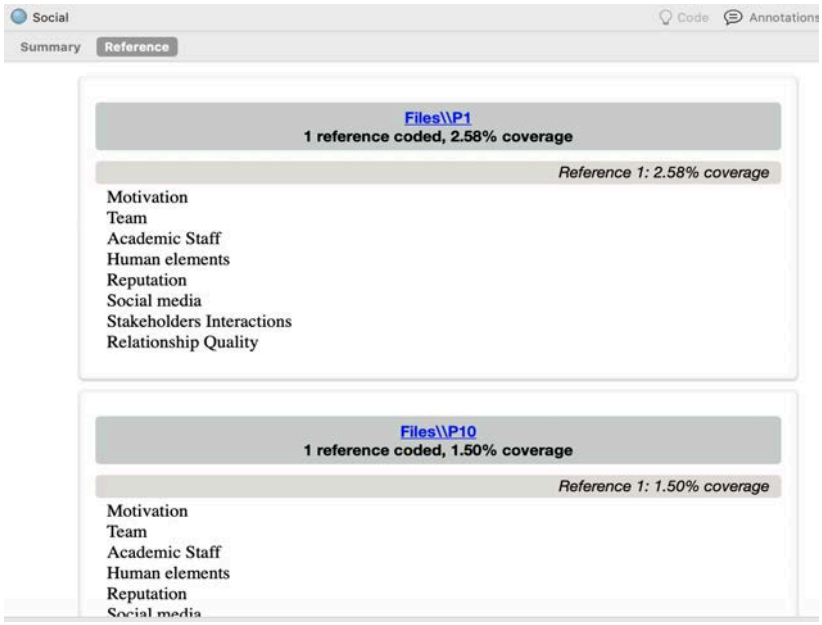

Figure 5. Sample of Node

5 DISCUSSION

The qualitative analysis presented in this paper uses NVivo 12 software and shows the benefits of using it in analysing qualitive data from experts interviews in relation to questions and answers from the participants. The responses generated from participants in the study were inserted into NVivo12

software by the researchers. This allows data to be themed by creating nodes. These nodes in NVivo12 make it easier for researchers to organise and classify data that are related to each other. Word frequencies and word trees in the software allows the researchers to determine the patterns of responses so they can interpret the general pattern of the participants' responses based on interview questions and discussion in the interviews.

Conventional manual qualitative data analysis of these results may lead to omission of opinion that might be important. The use of Computer Assisted Qualitative Data Analysis Software such as NVivo12 for qualitative data analysis can reduce this risk as the researcher can categorise all statements that are related to certain question which can be aggregated in one location (node). This node can then be analysed using NVivo capabilities and the word frequencies and word trees can show all data related to the node under study with minimised risk of omitting important aspects.

The results of the qualitative analysis were used to modify the proposed HF-HEQ-BI framework as shown in Fig. 6. The modification based on the findings from the qualitative evaluation included the following: 'Methods' has been changed to 'Special Requirements'; 'Purpose' changed to 'Continuous Improvement' and 'Requisite Resources' changed to 'Resources'; and 'Management' changed to 'Top Management Support'; and 'Quality Assurance Standards' and 'National Qualifications Framework' have been merged into 'QA regulations'; and 'Costs' and 'Relationship Quality' has been deleted.

The framework in Fig. 6 shows the 42 factors affecting the dashboard design which are linked to the 5 theoretical pillars for monitoring quality, which are: Technology, Organisation, Environment, Business, and Social.

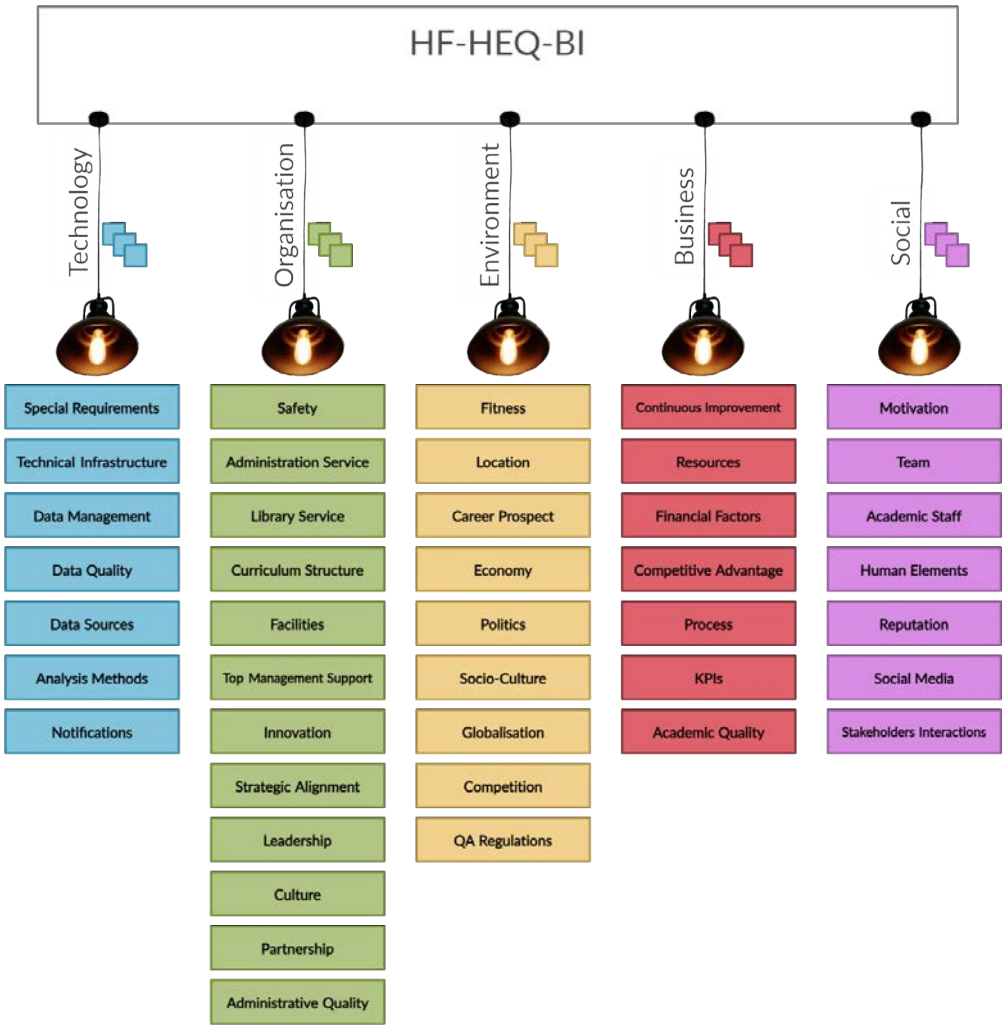

Figure 6. Holistic Framework for Monitoring Quality in Higher Education using Business Intelligence Dashboards (HF-HEQ-BI)

6 CONCLUSIONS

This paper discussed the qualitative evaluation of the Holistic Framework for Monitoring Higher Education Quality using Business Intelligence Dashboards (HF-HEQ-BI) presented in previous work [7] and the way in which the framework was modified following the analysis of comments by domain experts. Qualitative data gathered from interviewing experts in quality in Higher Education has been analysed for the purpose of validating the factors that affect the design of Business Intelligence dashboards for monitoring quality in Higher Education. The resulting framework in Fig. 6 shows a total of 42 factors grouped under 5 theoretical pillars. The dashboard for monitoring quality should be designed according to this framework to reflect the factors shown in these five pillars. The use of CAQDAS for qualitative analysis provides visualisation of responses from participants which enriches the analysis. This approach to qualitative data analysis may be used for handling large sets of data coming from social media as well as for quantifying feedback on service quality, for example, questionnaires from open days and module feedback. Open ended questions vary in responses; therefore, word frequency and word trees will help in identifying patterns in participants responses. Further work will include validating the framework through a quantitative survey of quality practitioners in Higher Education Institutions.

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