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Review Article

Enhancing Institutional Assessment and Reporting Through Conversational Technologies: Exploring the Potential of AI-Powered Tools and Natural Language Processing

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Abstract - This study explores the potential of conversational technologies, AI-powered tools, and natural language processing (NLP) in enhancing institutional assessment and reporting processes in higher education. The traditional approach to assessment often involves labor-intensive manual analysis of extensive data and documents, which burdens institutions. To address these challenges, AI-powered tools, such as ChatGPT, LangChain, Poe, Claude, and others, along with NLP techniques, are investigated in relationship to their ability to improve institutional assessment practices and output. By leveraging these advanced technologies, assessment officers and institutional effectiveness, researchers can engage in dynamic conversations with data, transforming spreadsheets and documents from static artifacts into interactive resources. These tools streamline communication, collaboration, and decision-making processes, empowering committees and working groups to achieve their goals effectively. Additionally, the potential applications of NLP in analyzing vast amounts of institutional data, including student feedback, faculty evaluations, and institutional documents, shall be discussed. Language models enable the extraction of meaningful insights from unstructured data sources, facilitating real-time decision-making processes. Ethical considerations related to data privacy, mining, and compliance with regulations like FERPA are crucial aspects addressed in this study. The contribution of this research lies in uncovering the transformative impact of conversational technologies, AI-powered tools, and NLP techniques on institutional assessment and reporting. By embracing these advancements responsibly and ensuring alignment with ethical principles, institutions can unlock the full potential of these tools, facilitating more efficient, data-driven decision-making processes in higher education. The study showcases how conversational technologies, AI-powered tools, and NLP techniques offer new possibilities for improving institutional assessment and reporting practices. By integrating these technologies responsibly and addressing ethical considerations, institutions can enhance their assessment processes and make more informed decisions based on comprehensive, real-time insights.

Keywords - Human-machine interaction, Conversational AI, AI application, AI technique, AI-assisted mathematics, Natural language processing, Recognition and applications

1. Introduction

In the realm of higher education, the ability to effectively assess institutional performance and generate comprehensive reports is of paramount importance. However, the sheer volume of data and documents involved often poses significant challenges for institutions seeking to extract meaningful insights efficiently [1]. For instance, Cooper and Terrell conducted a 2013 study and found that institutions were allocating approximately $160,000 per year for assessment activities. The majority of this sum, approximately $108,000, was attributed to the salaries of assessment officers who may also have additional responsibilities beyond assessment. On average, the annual spending per student, based on the respondents' data, amounted to $51. Recent scholarship indicates a scarcity of published research focused on the escalating expenses associated with assessment practices in higher education [2]. However, given the prevailing financial crisis confronting many institutions, exacerbated by the approaching enrolment cliff of 2026, the imperative to identify cost-cutting measures, enhance operational efficiencies, and concurrently enhance the quality of actionable data cannot be underestimated [3]. This confluence of factors necessitates a timely examination of strategies and solutions to reduce personnel costs, improve time on task, and increase productivity [4].

Since the stable release of Open AI's ChatGPT-3 on February 13, 2023, the ability of the new tool to improve workflow in the industry has been of increasing interest, demonstrated by the fastest rate of adoption of new technology by a user base of 100 million in the same month [5]. These assumptions about improved speed were quantified in a study by Noy and Zhang from MIT, where the impact of ChatGPT on business professionals' productivity and work quality when writing business documents was investigated [6]. Their findings revealed that participants using the AI tool experienced a significant increase in productivity, with a 59% improvement in document production time compared to those without AI assistance, and the quality of that generated with ChatGPT was rated significantly higher by independent evaluators. With the reallocation of time in the writing process shifting from time spent on generating rough drafts to more time dedicated to refining the final deliverable, these studies provide insights into the future use of the tools to enhance productivity and work quality.

At the same time, despite the popularity of ChatGPT in particular, there are limitations to its input and output. Luckily, there has been a slew of recently released AI-powered tools, such as Claude, that are equipped with an extended context window of 100,000 tokens [7]. By comparison, the default limit for Open AI's ChatGPT is 2048 tokens, with a maximum that can be set at 4096 tokens [8]. These recent advances open up new possibilities for institutions, allowing them to leverage these new frameworks' immense processing powers to streamline and enhance their assessment and reporting processes. By rapidly digesting and analysing extensive amounts of textual information, these tools hold the potential to revolutionize institutional assessment and empower institutions to make informed decisions based on comprehensive insights at an accelerated rate [1].

By leveraging the conversational abilities of these new AI-powered tools in institutional assessment and reporting, educational institutions can unlock significant benefits. First, the ability to query data in investigatory and dialogical manners is revolutionary. It addresses the main limitation of writing identified by Socrates, who noted that written texts are fixed and unable to respond to questions or engage in a conversation, thus limiting their capacity to convey true knowledge [9]. However, the advent of generative and conversational AI has challenged this constraint by providing unprecedented opportunities for interactive engagement with data. In contrast to written texts, conversational AI tools enable users to have dynamic and interactive conversations with data, which allows individuals to pose questions, seek insights, and conversationally explore complex datasets. This paradigm shift in how information may be interacted with holds significant potential for various domains, including education, research, and institutional assessment.

These tools can automate routine tasks involved in the development of reports, strategic plans, and other institutional documents. By analysing large amounts of data and providing insights based on data analysis, these tools enable institutions to make informed decisions and improve their overall performance. Past tools used include learning analytics dashboards [10]. However, integrating these newly available tools can further streamline communication and collaboration among committees and working groups, facilitating more efficient and effective decision-making processes. For example, AI-powered tools can assist in the analysis of student feedback and faculty evaluations, extracting meaningful insights to identify trends, strengths, and areas for improvement [11]. Outcomes reporting and portfolios alike can also quickly be queried for insights, which institutions can then use to enhance teaching and learning practices, tailor support services, identify opportunities for professional development, and ensure institutional compliance with accrediting bodies [12]. One of the main advantages of AI-powered tools is their ability to automate routine administrative tasks, such as data collection, data analysis, and report generation, already demonstrated in the industry [13].

Furthermore, as Dwivedi et al. argue [14], faculty, staff, and administrators can focus their expertise on more complex and value-added activities that require human judgment and critical thinking by reducing the time and effort required for these tasks. The realignment of annual tasks allows for greater productivity and efficiency, empowering institutions to allocate their resources effectively and optimize their operations. The benefits are already being realized through similar integration of blockchain-powered technologies in the service sector [15].

Though, unlike counterparts in industry, higher education institutions face the procedural challenge of collecting, generating, and submitting various types of assessment reports to accrediting bodies on an annual basis [16]. These reports include the Institutional Self-Study Report, Program Assessment Reports, General Education Assessment Reports, Student Learning Outcomes Assessment Reports, and Institutional Effectiveness Reports. Each report serves a specific purpose in evaluating compliance with accreditation standards, assessing student learning outcomes, measuring curriculum alignment, and demonstrating an institutional commitment to continuous improvement [17].

To address these challenges and enhance the assessment and reporting processes, this study focuses on the potential of conversational technologies, AI-powered tools, and NLP in higher education. By exploring the application of these innovative tools, the study aims to provide considerations and use cases for their effective implementation in each of the five main reporting types for higher education. Conversational technologies and AI-powered tools have the capacity to revolutionize decision-making, facilitate collaboration among stakeholders, and unlock valuable insights from institutional data. By embracing these technological advancements while ensuring ethical and data privacy considerations are addressed, higher education institutions can embark on a transformative journey to improve their assessment and reporting practices. The study will offer specific examples and recommendations for implementing conversational technologies and AI-powered tools, empowering institutions to enhance their quality, accountability, and continuous improvement efforts in higher education.

2. Literature Review

Institutional assessment is an essential component of higher education, providing institutions with the data and insights needed to evaluate their programs, services, and student outcomes. In recent years, there has been an increased focus on the importance of institutional assessment, driven by accreditation requirements, government regulations, and the need to improve student success and retention. Institutional assessment includes five main reports: Institutional Self-Study Reports, Program Assessment Reports, General Education Assessment Reports, Student Learning Outcomes Assessment Reports, and Institutional Effectiveness Reports. Perhaps the most well-known for most academics involves their own programmatic reporting each year. A cyclic academic program

review systematically gathers evidence of programmatic practices and policies, including inputs, outputs, processes, and their alignment within a continuous improvement framework. Program review processes have gained importance in institutions and academic field organizations as they seek to promote accountability, legitimacy, and effective change [18-19]. Scholars have emphasized the need for strong connections between program review and strategic planning to enhance institutional efficiency [20]. Moreover, there is a growing demand for alignment between accreditation standards and academic program reviews to facilitate resource efficiency and directed action [21].

The significance of academic program review is supported by empirical studies demonstrating its impact on curricular improvements, staffing realignment, outcomes-based assessment models, unit restructuring, and institutional outcomes such as transparency, accountability, and productivity [22-25]. Despite its importance, benchmarking efforts within the program review process have historically been limited [26-27]. Stakeholders face challenges in identifying benchmark categories and scope, and the development of comprehensive metrics for program review is still ongoing for many institutions [28-29].

While outcomes assessment within program review has received significant attention, empirical studies directly examining the effectiveness of academic program review remain limited, with most literature consisting of theoretical guidelines and standards. Notable prior research includes Ewell, Paulson, and Kinzie's [30] comprehensive study on program-level assessment practices, which emphasized using assessment results for program review activities. The purpose of program review encompasses maintaining or improving program quality, feasibility, and viability, evaluating effectiveness or performance, and ensuring accountability, reporting, transparency, and data collection [30-38]. However, critics have raised concerns about the failure to review purposes and policies and the perception of authoritarian and non-collegial processes by faculty participants [21, 39].

Since online education became more popular around 2000, institutions have struggled to bridge the gap between distance assessment standards and the use of technology for gathering data. For instance, Mattingly et al. [40] examined learning analytics as a tool for assessment citing the use at the University of Wollongong, the University of Michigan, Purdue University, and the University of Maryland, Baltimore County. However, these early attempts to leverage technology were still cumbersome and time-consuming. Since then, implementing big data technologies using cloud-based infrastructures has found applications in various domains, including healthcare, geospatial analytics, business intelligence, and education [41]. Educational data, which can be considered a form of big data, can benefit from the use of big data technologies to generate valuable analytics for educational organizations [42]. Cloud computing has been recognized as a recent technology that gained greater use during the global pandemic with applications in education [43].

When applied to education, there are certain variables to consider that vary slightly from industry. For instance, IBM's big data model identifies five characteristics of big data: volume, velocity, variety, veracity, and value [44]. Student data collected at the individual level is characterized by large volume, generated at high velocity, and consists of diverse types of data [45]. With such volume, the manual entry of student data introduces a greater likelihood of errors and uncertainty, highlighting the importance of veracity in educational reporting systems [46]. Automating aspects of the reporting process with educational intelligence solutions can leverage the same data and analytics to enhance operational efficiency, support decision-making processes, and add value to educational institutions [47]. In fact, more and more cloud-based big data technologies developed prior to 2023 have been particularly suitable for developing analytical solutions in the education and research domain [48]. These solutions demonstrate the ability to integrate analytics derived from big data with insights to provide value-based solutions [49].

However, as Alam [50] has noted, these solutions are often cost-prohibitive for institutions already under financial duress. While examples from various institutions demonstrate the effectiveness of analytics in driving positive outcomes, the financial constraints of educational institutions must be considered. Recent advancements in generative AI solutions offer great potential for expanding the reach of analytics to a broader range of institutions. To overcome these cost barriers and to refocus personnel time, the use of affordable and scalable generative AI solutions tailored specifically for educational institutions should be considered. By making these technologies more accessible, institutions under financial duress can also leverage the transformative potential of learning and academic analytics to enhance student success, improve teaching practices, and drive institutional effectiveness. While solutions are launched with various APIs at an ever-increasing rate, such as ChatGPT, LangChain, Poe, and Claude, the same strategies can be used how to leverage them for purposes of institutional assessment. The following section will outline strategies for the five main reporting types for adoption at any size of the institution.

3. Recommendations

Assessment reporting involves many stakeholders across an institution of higher education, from the president to the students, to gather data and feedback, though most report generation often falls on a select few [51]. Of those individuals, department heads, deans, assessment officers, and program coordinators may spend a Lionshare of their late spring and early summer deployment on assessment activities [52]. From assessment summits, department meetings, and outcomes debriefs from offices of institutional effectiveness, faculty and staff can easily dedicate a great deal of time and effort to gathering, reviewing, formatting, and submitting assessment reports [53]. While the activity of assessment is a crucial practice to provide evidence of an institution's compliance with accreditation standards and demonstrate ongoing efforts to assess and improve educational quality, the percentage of time actually considering how and what to improve is outweighed by the time spent collating the data itself [54].

As such, providing a model that can be adopted to reduce time spent on reviewing and generating reports and more time spent on understanding and replying to key insights provided by the data would benefit all constituents involved in the assessment process [55]. To address this, the following recommendations shall be provided. While specific requirements may vary depending on the accrediting agency and the institution's mission and programs, some common types of required assessment reports include (Table 1):

Table 1. Types of assessment reports

1. **Institutional Self-Study Report:** This comprehensive report provides a detailed overview of the institution's mission, goals, programs, and resources. It typically includes a thorough analysis of the institution's compliance with accreditation standards, assessment of student learning outcomes, faculty qualifications and development, governance and administration, financial stability, and institutional effectiveness (Eaton, 2015).
2. **Program Assessment Reports:** Institutions are often required to submit individual assessment reports for each academic program offered. These reports focus on evaluating the quality and effectiveness of the program in terms of student learning outcomes, curriculum alignment, faculty qualifications, resources, and continuous improvement efforts. They typically include assessment data, analysis of results, and action plans for improvement (Heinrich, 2012).
3. **General Education Assessment Report:** Many accrediting bodies emphasize the assessment of general education or core curriculum requirements. Institutions are required to submit reports that demonstrate how the general education program aligns with institutional learning outcomes, assesses student achievement of those outcomes, and uses the results to inform curriculum and instructional improvements (Walvoord, 2010).
4. **Student Learning Outcomes Assessment Report:** This report focuses on the assessment of student learning outcomes at the institutional level. It provides evidence of how the institution assesses and measures student achievement of desired learning outcomes across various programs and disciplines. The report typically includes assessment methods, data collection and analysis, results, and strategies for using the findings to enhance teaching and learning (Anderson et al., 2005).
5. **Institutional Effectiveness Report:** Accrediting bodies often require institutions to demonstrate their commitment to continuous improvement and institutional effectiveness. The institutional effectiveness report outlines the institution's processes for assessing and improving its overall effectiveness, including areas such as strategic planning, resource allocation, faculty and staff development, student support services, and community engagement (Ewell, 2011).

While these represent some of the main types of assessment reports, accrediting bodies may require variations on an annual basis from institutions. The specific reporting requirements vary depending on the accrediting agency and the specific circumstances of an institution [56]. Regardless, these reports collectively represent an institution's commitment to maintaining educational quality, continuous improvement, and accountability for the education they provide students. The reports themselves may vary in length, formatting, and required material, but the process for creating them is fairly uniform [57].

Creating an assessment report as an assessment specialist in higher education involves several key steps. The process begins by identifying the purpose and scope of the report, followed by defining clear assessment objectives. Designing appropriate assessment methods and tools, data collection, and analysis are essential in gathering meaningful information. The assessment findings are then interpreted and organized into a well-structured report, including an executive summary, introduction, methods, results, discussion, and recommendations. Communicating the results to relevant stakeholders and implementing action plans based on the findings are crucial. Continuous monitoring and evaluation of the implemented plans ensure ongoing improvement. By following these steps, assessment specialists contribute to enhancing student learning outcomes and institutional effectiveness in higher education (Table 2) [58-60].

Table 2. 10 Steps in creating assessment reports

1. **Identify the Purpose:** Determine the purpose and scope of the assessment report. Clarify what aspects of student learning or institutional effectiveness will be assessed and reported on (AAUP, 2015).
2. **Define Assessment Objectives:** Clearly define the objectives and specific outcomes you want to achieve through the assessment process. This will guide the data collection and analysis methods (Rebitzer et al., 2004).
3. **Design Assessment Methods:** Select appropriate assessment methods and tools that align with the objectives and outcomes. This may include surveys, interviews, observations, tests, or portfolio reviews. Develop rubrics or scoring criteria for consistent evaluation (Martin et al., 2019).
4. **Collect Data:** Implement the assessment methods to collect relevant data. Ensure data collection is systematic, reliable, and representative of the target population. Use appropriate sampling techniques if necessary (Shiffman, 2007).
5. **Analyze Data:** Analyze the collected data using appropriate statistical or qualitative analysis techniques. Identify trends, patterns, strengths, weaknesses, and areas for improvement based on the assessment objectives (Bose, 2008).
6. **Interpret Findings:** Interpret the data findings in the context of the assessment objectives and institutional goals. Provide meaningful insights and explanations of the results, highlighting areas of success and areas that need attention (Gama et al., 2022).
7. **Prepare the Report:** Organize the assessment findings into a coherent, well-structured report. Include an executive summary, introduction, methods used, results, discussion, and recommendations. Use clear and concise language and present data visually when appropriate (Janssen, 2023).
8. **Communicate Results:** Share the assessment report with relevant stakeholders, such as faculty, administrators, and decision-makers. Present the findings in a format that is accessible and understandable to the intended audience. Encourage discussion and feedback on the results (Eisman et al., 2021).
9. **Implement Action Plans:** Collaborate with stakeholders to develop action plans based on the assessment findings. Identify strategies, interventions, or changes that can be implemented to address areas for improvement and enhance student learning or institutional effectiveness (McMillan et al., 2020).
10. **Monitor and Evaluate:** Continuously monitor and evaluate the effectiveness of the action plans implemented. Track progress, collect additional data if needed, and assess the impact of the interventions. Adjust and refine assessment strategies as necessary (Knight & Skrtic, 2021).

What should be noted with these steps is that arguably all can be assisted by the use of generative AI tools, though the one selected may be determined by the type and size of data, process, analysis and output required. Firstly, AI tools can help identify the purpose and scope of the report by analyzing institutional data and highlighting areas that require assessment focus [61]. Secondly, these tools can aid in defining clear assessment objectives by aligning learning outcomes with program goals [62]. Thirdly, AI can assist in designing assessment methods and tools by recommending appropriate formats and rubrics based on desired outcomes [63]. Additionally, AI can play a significant role in data collection and analysis, efficiently processing large volumes of data and identifying patterns and trends. When interpreting and organizing assessment findings, AI-generated data visualizations and summaries can facilitate a better understanding of the results [64].

Moreover, AI can support the communication of assessment results by generating personalized reports tailored to stakeholders' needs. AI-powered tools can also contribute to implementing action plans by providing recommendations for instructional interventions or curriculum modifications [65]. Continuous monitoring and evaluation of implemented plans can be supported by AI analytics, providing real-time feedback on intervention effectiveness. AI can aid in revising and updating assessment reports by offering automated updates on key performance indicators and identifying areas for improvement [66]. Lastly, generative AI can provide insights

and recommendations to enhance student learning outcomes and institutional effectiveness [66]. By leveraging generative AI technologies throughout the assessment process, assessment specialists can streamline data collection, analysis, and reporting, ultimately leading to more efficient and effective assessment practices in higher education.

For example, consider the annual programmatic assessment carried out by each academic unit for each degree offered at an institution. The reporting officer(s) gather or extract outcomes reporting or artifacts from the learning management system (LMS) or another repository, review based on rubrics or benchmarking analysis, and write a report, often comparing and noting trends from previous assessment cycles. In order to accelerate the process, one may use tools such as ChatGPT, LangChain, Poe, Claude, and others with the following steps to expediate the assessment process [67] (Table 3).

Table 3. Steps to use AI for assessment

1. **Identify the role of the AI:** Specify that the AI will act as a specific role (e.g. an English Literature faculty member) conducting an assessment on a degree program (e.g. BA in English program).
2. **Provide context and task:** Explain that the AI will be trained on the previous year's assessment report and will compare it to the current year's data. Paste in the previous year's assessment report, including all columns such as means of assessment, instruments used, results obtained, and proposed actions for improvement.
3. **Copy the rubric:** Include a complete rubric for the first desired learning outcome. The rubric should contain all criteria for assessment and grading instructions, including any decaying average, if applicable.
4. **Describe the task:** Explain that the AI's task is to apply the rubric to the artifact that will be posted. Provide assessment, feedback, and key takeaways for improvement based on the application of the rubric. Compare the results to the previous year's data to identify areas of progress or areas that need further attention.
5. **Paste in the artifact:** Include the text from the artifact that will be assessed using the rubric.
6. **Incorporate the output:** Take the output generated by the AI, which includes the assessment, feedback, and key takeaways, and paste it into the assessment report.
7. **Repeat steps 3-5:** Repeat the process for the remaining learning outcomes, copying the respective rubrics, describing the task, pasting the artifacts, and incorporating the output into the assessment report.

The steps are best for assessing short-form papers as the AI can be instructed to utilize the provided rubric and grade the artifacts accordingly. There are several free options, such as training ChatGPT-3.5 or 4 using the rubric as a reference and then pasting in the papers to be assessed. The AI will analyze the content and provide feedback based on the rubric's criteria. For long-form papers or when dealing with multiple documents, an API such as LangChain, Poe, or Claude can be employed to upload larger files or multiple documents for assessment. These larger upload models allow efficient evaluation and analysis of extensive textual materials.

Additionally, services like Bearly. AI and other APIs that support assessing large files, such as theses and dissertations, can be utilized. Alternatively, a combination of tools like Poe and Claude can be employed to evaluate large textual documents and convert them from PDF to text format for assessment purposes.

However, one important consideration is privacy and data security. To address this, measures should be taken to ensure that data leaks are prevented [68]. It is advisable to turn off the option for data to be used for training purposes and develop a proprietary API hosted on the university server to maintain control over the assessment process and data security [69]. Nevertheless, institutions, including assessment officers, staff, and faculty assessors, can save on personnel costs by incorporating AI into the assessment process. This can lead to increased efficiency and reduced workload. However, being mindful of the ethical implications and potential privacy concerns associated with AI usage is crucial. As a recommendation, using the previous year's report as a template can streamline the process, allowing for the incorporation of the most recent data and enabling reflective

observations to be written. If incorporating AI into the report becomes challenging, it may indicate that the report itself has become convoluted and in need of streamlining. Taking this opportunity to make necessary changes and adapt the systems to be more interpretable by AI can lead to significant efficiency savings.

4. Conclusion

Reflecting on the current state of assessment in education, the pressing need for innovative solutions to streamline and enhance assessment processes becomes evident. The traditional assessment methods often require significant time and resources, from collecting and analysing data to generating meaningful insights and recommendations. The cumbersome process has created a demand for advanced technologies, such as generative AI tools, to assist educators and institutions in overcoming the challenges associated with assessment. The imminent integration of generative tools into standard word processors and suites, like Microsoft Office, offers promising prospects for the future of assessment [70]. By leveraging the capabilities of these tools, educators can experience improved productivity and efficiency in generating insights from assessment data. The automation and assistance provided by AI-powered solutions can greatly expedite the assessment process, allowing educators to focus more on analysing the results and implementing targeted interventions for student success.

However, it is important to note that the integration of AI into assessment practices should be approached with careful consideration of ethical implications, data privacy, and the need for interpretability. Future research should aim to address these concerns and explore best practices for the ethical use of generative AI in assessment. Additionally, further investigation is warranted to examine the effectiveness and reliability of AI-powered assessment tools, ensuring their alignment with established assessment standards and the unique needs of diverse educational contexts. As we anticipate future releases and advancements in generative AI, it is crucial for researchers, educators, and institutions to collaborate in exploring the full potential of these tools. By embracing AI solutions and conducting further research, we can revolutionize the assessment landscape, making it more efficient, accurate, and beneficial for all stakeholders involved in the educational process.

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