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## Assessing High Impact Practices Using NVivo: An Automated Approach to Analyzing Student Reflections for Program Improvement

**C**ritical reflection allows students to synthesize their learning and deepen their understanding of an experience (Ash & Clayton, 2009). A recommended reflection method is for students to write essays about their experiences. However, on a large scale, such reflection essays become difficult to analyze in a meaningful way. At Roanoke College, we have developed a system to automate the qualitative coding process using a software analysis tool (i.e., NVivo). This inductive approach allows us to identify patterns in student learning that indicate effective and ineffective aspects of applied learning experiences. It provides a more nuanced and rich approach to the analysis of student learning outcomes in order to ensure the quality of our programs through continuous improvement.

Ash and Clayton's (2009) article on high impact educational practices (HIPs) describes the benefits of using student reflection essays as assessment tools and gives detailed prompts for eliciting reflective writing. Their DEAL model includes three key parts: Describe, Examine, and Articulate Learning. The prompt that is given to students provides scaffolding for a deep reflection by asking students to describe a key experience using only factual information; examine the experience from three perspectives (academic, civil engagement, and personal); and, articulate their experiential learning and how it might influence future goals.

At Roanoke, using the DEAL model provided a framework for students to create deep reflections rather than write only surface descriptions. The reflections have revealed what students learn from high impact practices. However, using critical reflection essays to assess an institution-wide program is difficult, given the length and personal nature of student essays. Initially, the program faculty attempted to score sample essays using the DEAL Model Critical Thinking Rubric (Ash, Clayton, & Moses, 2007) but found the rubric did not capture student voice about learning; therefore, they turned to an inductive analytical approach, which allowed them to identify themes that emerged organically from student essays and captured the nuance of student experiences.

Identifying themes in student essays is time-consuming and became infeasible when Roanoke College's experiential learning programs grew to include hundreds of students. Although we considered returning to survey assessment or analyzing only a sample of essays, we decided instead to utilize NVivo software and develop an automated approach to qualitative analysis.

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NVivo is qualitative analysis software that allows researchers to follow a variety of qualitative coding strategies and increase their speed with tools for organizing qualitative sources and themes. Additionally, NVivo provides many functions for quickly searching essays for specific phrases, analyzing data, and creating figures and graphics. While traditional applications of NVivo can be employed to save time while analyzing reflection essays, we developed a system using the software’s text search query function that completely automates the process. We developed our system using 171 research reflection essays written by students. Then, given the early success of our automated coding process, additional NVivo search queries were developed to analyze the other high-impact practices in the experiential learning program at Roanoke College (i.e., internships, service-learning, and study-away).

### Method

Our automated system uses a framework of syntax developed to work with NVivo’s text search query function. Before developing syntax, the different research themes were organized, and fourteen themes (identified in Table 1) emerged organically from the student essays. When identifying and organizing themes, care was taken to be specific, knowing that themes could later be combined, so that no data would be missed when automatically searching.

**While traditional applications of NVivo can be employed to save time while analyzing reflection essays, we developed a system using the software’s text search query function that completely automates the process.**

Table 1

*Research Essay Themes*

Category	Theme
Collaboration with others	Relationship with advisor Collaboration with peers Collaboration with staff and other experts
Gained skills/knowledge of field	Applied coursework Graduate school/career preparation Improved presentation skills
Personal growth	Increased confidence Overcame obstacles Increased self-efficacy Improved time-management
Other	Presenting served as a learning experience Encountered obstacles and frustrations Wants to continue research Struggled with time-management

**We have found that when our automated system is coupled with a person who checks the search query results, we are able to identify all themes with complete accuracy.**

While identifying the themes that emerged in the essays, an inventory of the word combinations used to describe each theme was organized. This inventory was later developed into a framework of syntax. We began developing the framework using a sample of 49 of the 171 student essays, which we first coded manually using a grounded theory approach (Strauss & Corbin, 1998). Once the essays were manually themed, each theme was analyzed for the syntax students used to describe it. The text search query function within NVivo was then used to search for the syntax corresponding with each theme until the query function yielded the same results as found in manual analysis. A text search query was developed for each corresponding theme. An example of a theme and its corresponding syntax is shown in Table 2.

The results of the text search queries were compared to the manually identified themes. Once we ensured the results of the text search query were accurate for the first sample of 49 essays, we ran a new sample of student essays through the queries. At first, the queries were inaccurate, frequently missing themes and falsely identifying other themes that were not present. The accuracy of each query was improved by following a process of manually coding essays, running the essays through the queries, assessing the accuracy of the queries compared with the manual coding, and making small changes to the queries to increase accuracy. This process was repeated until all 171 research essays were analyzed both manually and automatically using the queries. The text search queries became increasingly

Table 2  
*Example Theme and Syntax*

Theme	Query
Relationship with advisor	"Dr. & question"~15 OR "Dr. & thanks"~9 OR "Dr. & excellent"~15 OR "Dr. & amazing"~9 OR "working & closely"~3 OR "one-on-one" OR "worked & closely"~9 OR "discussing & Dr."~8 "advisor & explained"~9 OR "Dr. & mentor"~9 OR "professor & closely"~5 OR "Dr. & collaboration"~9 OR "Dr. & collaborate"~9 OR "Dr. & collaborated"~9 OR "Dr. & collaboratively"~6 OR "Dr. & support"~9 OR "Dr. & understanding"~9 OR "Dr. & helpful"~9 OR "advisor & collaboration"~9 OR "collaboratively & Dr."~5 OR "met & weekly"~5 OR "learned & mentor"~5 "help & mentor"~5 OR "Dr. & meetings"~5 OR "Dr. & always"~5 OR "one & professor"~4 OR "faculty & guide"~8 NOT "rather & Dr."~5 OR "support & advisor"~9 OR "Dr. & together"~9 OR "Dr. & guidance"~9

accurate each time an additional set of essays was analyzed, until no themes were missed with the automated coding. In order to further improve the accuracy of our system, text search queries were skewed so that the searches identify all themes present in the essays, along with extra essays where themes may not be present; this allows for the possibility to review query results and filter out any wrongly identified themes. We have found that when our automated system is coupled with a person who checks the search query results, we are able to identify all themes with complete accuracy. A summary of the process for developing each query is visually outlined in Figure 1.

### Implications

The NVivo query approach led to increased efficiency in the assessment of most HIPs included in the experiential learning program at Roanoke College. Developing the system required an undergraduate student assistant to work full-time on this project for three weeks. The automated system is currently being used to effectively analyze undergraduate research, internship, and service-learning essays. A student assistant can automatically analyze reflection essays, run analyses on the data, and write a report on the findings in approximately one to two days.

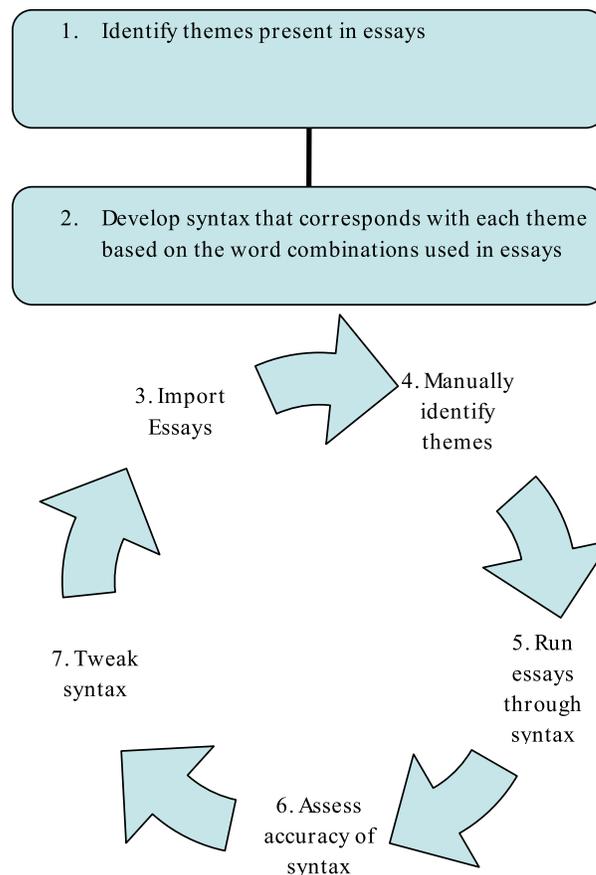
Although effective for several HIPs, the methodology did not produce reliable results for study-away reflection essays. When analyzing study-away reflections, we followed the same approach outlined in Figure 1 but found the results of the queries to be consistently inaccurate. We believe this is because students participating in study-away programs at Roanoke College were required to reflect, but they were not given a structured prompt (e.g., Ash & Clayton's [2009] DEAL model). This lack of structure led to inconsistent and often vague reflections that were difficult to analyze with text queries. Therefore, we recommend that those trying to emulate our automated analysis provide their students with structured prompts.

Initially, we had concerns that in automating the process, the integrity and authenticity of the reflection essays would be lost. We recognize that the automated approach does not replace a manual and in-depth analysis of student essays for a deep understanding of individual student growth; however, from an assessment standpoint, increasing the speed of qualitative analysis allows for more responsive program improvements based on student learning data. Prior to automated coding, student assistants analyzed qualitative data at the end of each semester, and there was not enough time to review the data and implement changes before the beginning of the next semester. Additionally, because qualitative data is coded using consistent text search queries, more comparisons can be made across programs. Furthermore, an efficient approach to qualitative analysis eliminates the need to analyze only a sample of essays, a practice that will likely result in missed opportunities for improvement.

Based on our findings, we believe our automated system is applicable to institutions and programs interested in analyzing reflection essays for assessment purposes. However,

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**Automated qualitative analysis holds promise for institutions of all sizes, even large universities where qualitative assessment practices may seem impractical.**



*Figure 1.* Developing a framework of text search queries. Repeat steps 3 through 7 until text search queries are completely accurate.

student reflection essays must be structured by prompts, and researchers must develop a unique system of themes and corresponding syntax specific to the experience. Automated qualitative analysis holds promise for institutions of all sizes, even large universities where qualitative assessment practices may seem impractical. The automated system is highly adaptable, with the query method working well for most high impact practices at Roanoke College.

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