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Developing a Streamlined Approach to Manage Program Documents and Assessment Data (Work in Progress)

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Developing a Streamlined Approach to Manage Program Documents and Assessment Data

Abstract

Management of course outline data and assessment metrics is a central tenet of the continuous quality improvement (CQI) plan for engineering and engineering technology programs accredited by the Accreditation Board for Engineering and Technology (ABET). This paper presents a work-in-progress description and assessment of a recent method (implemented in Fall 2020) for storing, accessing, and managing data used for course outline and assessment metrics within the engineering technology programs at the University of Dayton. Systemic shortcomings in the prior method where course outline and instructor assessment data were managed using uncontrolled Microsoft Word documents and templates on a departmental network drive was a motivating factor to implement a new data management method. These shortcomings included: 1) lack of access to the network drive by adjunct faculty members, 2) documents which were uncontrolled and were without a formal revision record, and 3) data storage methods which lacked future capability for efficient/timely data analysis and report automation. Once it was determined that an improved method was needed, a variety of options were investigated before the department settled upon a solution utilizing modern software tools in the Google Suite. Full-time faculty began using the newly developed data management tool in Fall 2020; a revised version of the tool was adopted in Fall 2022 and used by the department faculty at large. Beyond simply offering a more robust course outline data and assessment metric storage method, the presented paper demonstrates how the current method can allow for a more efficient and responsive CQI process. One of the stated goals in the development of the new tool was to provide instructor generated feedback directly to the programs CQI reports (without the need for transcription or copy/paste). This tool will allow reports to be generated directly from the source material in a timely manner, enabling more efficient and timelier CQI program meetings. Furthermore, because of the dynamic nature of the data management tool, new and refined reports for use in the CQI process and accreditation review are possible and part of an ongoing development.

Nomenclature

ABET	Accreditation Board for Engineering and Technology
CLO	Course Learning Outcomes
CQI	Continuous Quality Improvement
ET	Engineering Technology
ETAC	Engineering Technology Accreditation Commission
IAI	Instructor Assessment of Instruction
PEV	Program Evaluator
SOA	Student Outcome Assessment

Motivation and Background

The ABET/ETAC accreditation criteria include Criterion 4 which requires a program to maintain a documented process to assess and evaluate student outcome attainment as a factor in its continuous improvement actions [1]. The continuous quality improvement (CQI) plan for the Engineering Technology (ET) Programs at the University of Dayton is structured as two concurrent assessment loops: the strategic loop is short-term focused (1-3 years) on defining and modifying specific program objectives and student outcomes while the tactical loop is longer-term focused and informed by appropriate program constituencies such as alumni, professional societies, and industry partners; see Figure 1. Successful implementation of the CQI process requires thorough and accurate documentation of course learning outcomes (CLO), proper assessment of student learning, and justification for changes to the programs of study. Particularly important in the strategic loop is the development and assessment of CLOs & student outcome performance indicators, and the evaluation/reporting of assessment results tracked over appropriate time periods.

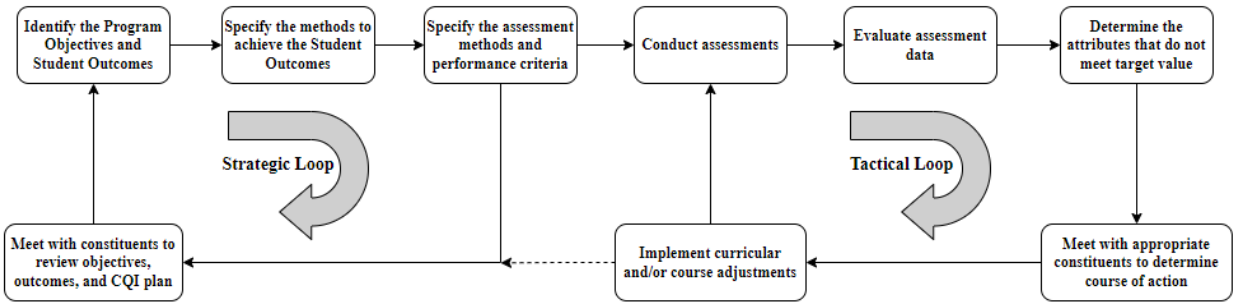

Figure 1: CQI Process Map

Incumbent to successful implementation of the strategic loop is the ability to store and access course outlines and their associated CLOs and student outcome assessments (SOAs). Additionally, timely reporting of and access to course assessment data is critical in making any necessary course improvements as part of the routine CQI process. Prior to the 2016 ABET visit to the School of Engineering at the University of Dayton, faculty members within the Engineering Management, Systems, and Technology Department maintained three distinct files to store the course outlines, instructor assessment of instruction (IAI) data, and the SOA data. The course outline was written to match the ABET course syllabi requirements. The IAI was a standardized form that all instructors completed after teaching an engineering technology course section to document the attainment of the CLOs, as well as an assessment of their pedagogical strategies, the students' preparations for the class, and their teaching resources. Finally, the SOA was a form that was used to collect any specific faculty assessments for a particular course that were needed for the ABET student outcome performance indicators rubrics for the given program. Similar information was contained within the course outline, IAI, and SOA with the course outline and IAI both including the CLOs and the course outline and SOA both listing the specific student outcome assessments. Data coherence among these files is critical; however, due to the presence of three individual, unlinked documents, data coherence was not always

achieved. Therefore, in 2016 the department faculty members decided to merge the three files for each course into a single course outline template.

These course templates were created using Microsoft Word and they were distributed to all full-time departmental faculty members on a shared network drive. Faculty members were requested to download the course outline templates at the beginning of the semester as they prepared their course offerings, ensuring all current required course outcomes and topics were met. The faculty members would again access the course outline templates at the end of the semester to complete the IAI and SOA. The course assessments would be saved back to the shared network drive into a separate location using a file naming convention that would capture the specific year, semester, and section of the course data being reported.

Using the single course outline templates did improve data coherence between the course outline, IAI, and SOA data, however, a few issues with how course information and associated assessment data was overall being managed within the CQI process were discovered. First, since the data collection process used shared, uncontrolled Microsoft Word documents, they allowed for modifications outside the formal review and revision process. This became problematic not just because it allows a faculty member to violate the CQI process, but also because it causes discrepancies between the departmental course outline templates and the official University course details which are stored in a separate software database system. Allowing course outline template modifications outside the CQI process, whether inadvertent or unilateral, created course updates without documentation of the revisions being made, without proper feedback and oversight, and made the department dataset inconsistent with the official University course inventory management system.

Another issue in how course information and assessment data was being managed using the single course outline templates was related to the use of an internal network drive to store both the template documents and the resulting assessment data. The internal network drive, while accessible to all full-time faculty members, was not accessible by adjunct faculty members. Adjunct faculty members therefore needed to work with a full-time faculty member to access the course outline template at the beginning of the semester as they prepared their courses. Likewise, at the end of the semester the adjunct faculty members needed to submit their IAI and SOA forms to a full-time faculty member to have them stored in the appropriate location on the internal network drive. This lack of direct access to the internal network drive hindered the timely collection of the assessment data necessary for the routine CQI process.

Finally, the CQI process using the course outline templates resulted in many discrete documents holding the assessment data collected from all the course sections each semester. The IAI and SOA data was recorded using a portion of the course outline template. Sometimes the data entered was incorrect or incomplete, and for the data to be useful within the CQI process, it had to be manually reviewed and summarized each semester which consumed a large amount of time. Furthermore, the summarization of data required much of the information to be moved

from the submitted Word documents into Excel workbooks so it could be graphically shown for both analysis and reporting purposes. The unvalidated data entry method coupled with the manual summarization and reporting processes provided multiple opportunities for human errors to enter the assessment phase of the CQI process.

Curriculum Database

As the prior section laid out, there was a clear need for an improved data management system for course content and assessment data at our institution. This finding is not unique to the ET programs in the Engineering Management, Systems, and Technology Department but is a repeatedly discussed issue at other institutions, see the works by Cliver et. al [2] and Ray et. al. [3]. To address these issues, a small task force composed of ET faculty members spearheaded the framing, development, and implementation of a new data management tool in three phases.

Framework Phase

The initial framework phase consisted of defining the objectives of the data management tool, see Table 1.

Table 1: Curriculum Database Objectives

Objective	Comment
Data	● Store all information contained in the prior course outlines templates and allow for future expansion.
Access	● Easily accessible by all full-time and adjunct faculty.
Controlled	● Restrict the ability of unauthorized users to alter course and assessment data. ● Log all data accesses.
Revision History	● Maintain a dated revision log with rationale/justification (e.g., dept. vote).
Cost	● Minimal purchase cost. ● Minimal person hours to develop, implement, and maintain.

After sketching out the rough objectives of the curriculum database, several software tools were considered (SQL database, Microsoft Access, MATLAB) before the final selection of the Google Suite was made. Google Suite offered a well-comprised solution wherein:

1. All faculty with an @udayton email address could gain read access to the database,
2. Edit and write access for data entry could be limited to particular users,
3. Purchase cost was zero because of existing software partnerships between the university and Google,

4. Through use of the Sheets and Form tools, the data types and revision history could be recorded, and,
5. The g-script programming language is essentially java-script and readily learned by novice users.

Development Phase

Two distinct development phases of the curriculum database occurred; the first release came in Fall 2020 followed by a revised version in Fall 2022. While the details of the database structure and data entry/revision logging changed considerably between the first and second versions, the dataset (maintained in a Google Sheet file) and general faculty user experience was largely unchanged. The remainder of this paper focuses on the second release of the curriculum database.

A faculty user will typically interact with the curriculum database twice a semester: firstly, during the lead up to the semester to pull the current course content outline, and secondly, at the conclusion of the semester to complete their IAI. A Google Form is the user interface that the faculty member will complete their request for a course outline or IAI data entry form, see Figure 2. If the request is for a course outline, the faculty member will receive an email with a dated PDF course outline attachment. If the request is for an IAI, the faculty member will receive an email with a link to a dynamically generated Google Form specific to the requested course. A dynamic IAI form is necessary because each course has specific CLOs which must be assessed individually, and each course may also include SOA(s) which must also be entered. Herein lies the inherent strength of the curriculum database combined with the Google Suite tools; course content is maintained in a single, controlled database from which course outlines, IAIs, and SOAs are drawn. The prior issues of data coherence are rendered moot.

The significant revision work between the initial version of the database and the Fall 2022 release centered around the ability to input, edit, and delete course content data in the curriculum database. Because editing course data should be done only at the direction of the course coordinator with appropriate approvals from the department faculty, school curriculum committee, registrar's office, etc., careful consideration was given to how write and edit access to the database was structured. Controlling access to write and edit the curriculum database is readily accomplished using Google Forms. Access to blank forms for new courses, pre-filled forms for enacting course edits, or archiving a discontinued course, can be limited to particular individuals, groups of users, all users within an email domain, or given unlimited access. Edit and write access to the curriculum database is restricted to a limited number of users (e.g. department chair, admin, undergraduate curriculum coordinator, and program curriculum coordinators). Read access requests are open to all users in the email domain. All read, write, or edit accesses to the database are logged and when data is edited, a version history is recorded. Controlling access in this manner ensures that the curriculum database is secure while remaining accessible, and that a version history for course changes is maintained.

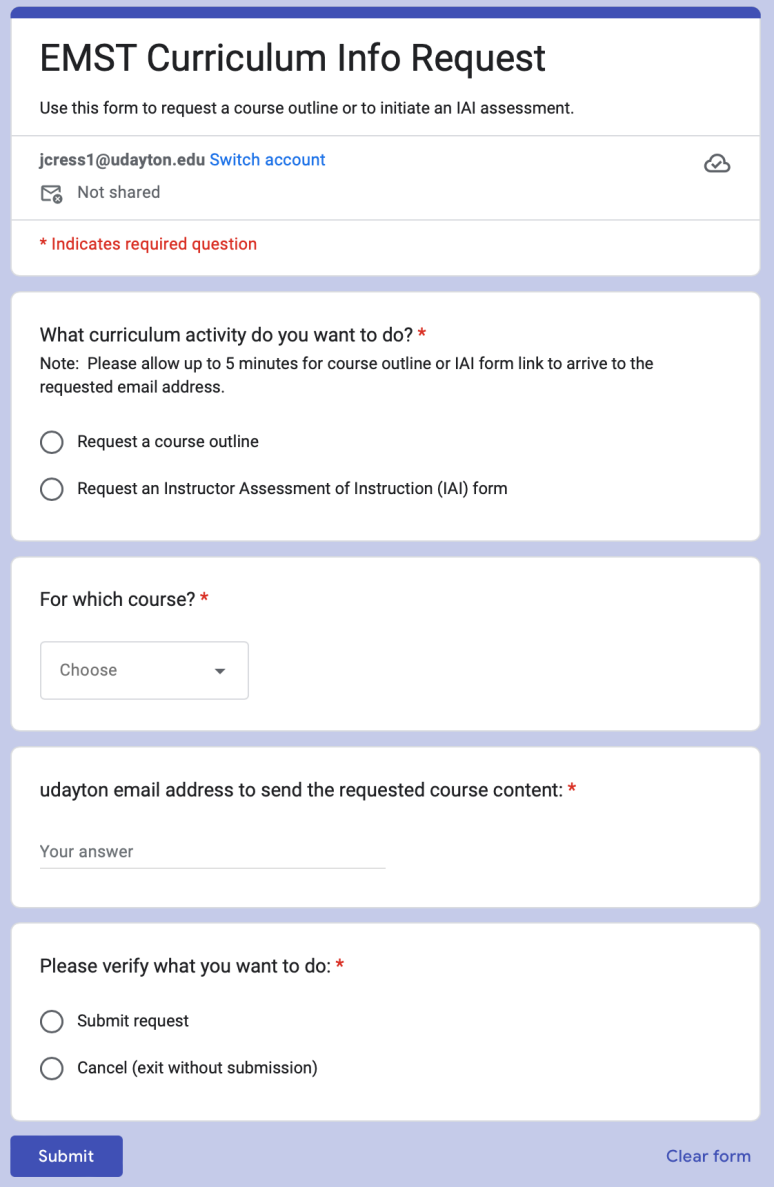

Figure 2: Curriculum Info Request Form

Implementation Phase

The second version of the curriculum database and user interface forms were released to faculty in Fall 2022. Course outline requests were made by faculty members beginning in Fall 2022 and IAI submissions were made beginning with the Summer 2022 courses. To date, the tool has been used to request 94 course outlines and 57 course IAIs by 29 unique users for 53 unique course codes. This has resulted in an IAI submission compliance rate of 100% for Summer 2022 and 72% for Fall 2022.

Conclusions and Next Steps

The next necessary steps in the development and implementation of the curriculum database are to build out a suite of reporting tools. In consultation with the program coordinators, the

undergraduate studies coordinator, admin, and department chair, the following is a working list of the types of reports envisioned:

1. Faculty Compliance
    a. Check that course outlines are requested at the beginning of the semester.
        i. Alternatively, automate the process to send course outlines to each instructor a certain time-period prior to the start of the term.
    b. Check that IAIs are completed by a given data after the end of the semester.
2. Collate/Summarize appropriate IAI data fields by program for the CQI process.
3. Generate current resource list such as:
    a. Course coordinators
    b. Utilized equipment and software
    c. Required and supplemental textbooks

Beyond these types of reports, a wealth of useful information is gathered as part of the IAI process that can and should be shared with faculty. This information could be easily included as an additional document or attachment to the course outline when requested. Such information includes:

- Pedagogical approaches and techniques that did and did not work well the last time the course was taught.
- CLOs that were not covered in a prerequisite course in the prior one to two semesters.

Each of these reports or shared information, provides additional context and understanding to the faculty member instructing a given course.

An additional aim of the curriculum database reporting focuses on ABET. One goal is to help change the mentality surrounding the ABET Self Study Report from a document revisited and revised every six years to instead a living document that is continually updated and helps inform the direction of the ET curriculum in both the CQI Strategic and Tactical loops, see Figure 1. A second goal is to assist in the sharing of course material with ABET PEVs during site visits. The ET Programs within the Engineering Management, Systems, and Technology Department have electronically shared course material with the ABET PEVs using a custom developed user interface during the last three ABET site visits [4]. A future goal is to expand the curriculum database to also store and/or link to these course materials to automate the creation of the user interface and ensure its coherence with the most recent curriculum data.

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