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Using curriculum mapping and visualization to maximize effective change

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Abstract

This paper shares the process of developing a fully integrated assessment framework and model for a mapping curriculum. The foundational aspects of this model are the development of layered outcomes that occur at each level of the curriculum and the linking of courses together to ensure building blocks that are progressive within a program. The presented framework not only measures this integrated nature but also allows for assessment that is both summative and formative. A view of the different aspects of curriculum application—from knowledge building, application of knowledge, and transferability of knowledge to new contexts—is a focus of the course and program mapping. The model allows for qualitative and quantitative data to assess outcomes at multiple levels. In addition, the data collection process has been developed to allow for visualization of the data to effectively communicate results to various audiences. This communication allows for departmental feedback, program assessment, and reporting to interested constituencies. A case study is shared to further the understanding of the key concepts.

Keywords: Assessment, Curriculum, Mapping, Visualization

A recent trend in higher education is for programs to utilize curriculum mapping to address professional accreditation criteria (Greenstein, 2012; National Research Council, 2010). Curriculum mapping allows programs to quantify what they do, visually assess their strengths and weaknesses, and present to others highlights and results of their practices. The mapping process can be done prospectively or retrospectively (Line, Schutte, & McCullick, 2016). Prospective mapping is similar to using a map to plan out a summer trip. In prospective curriculum mapping, we start with what our students have and chart a way to teach them so that they get to where we want them to be at the end. In retrospective curriculum mapping, the process maps the locations of key points, enabling the evaluation of what was covered. This is similar to looking at tickets stubs from baseball games attended on a summer trip, plotting them on a map of the United States, and then trying to figure out if every team was seen or every ballpark was visited.

There are many ways to view curriculum mapping. Education World professes curriculum mapping as the process of collecting, recording, and assessing core aspects of a program (Education World, 2016). Their website goes on to highlight seven phases of curriculum mapping that allow the educators to review their curriculum (Education World, 2016). Complementing this definition, the Oklahoma State Department of Education (OSDE) highlights curriculum mapping as a tool that enables students to know what they are doing and why they are doing it. OSDE notes that curriculum mapping improves student success upon

graduation because of the coordination it affords educators (Oklahoma State Department of Education, 2016; Komenda et al., 2015; Rourke & Kanuka, 2009). The Association for Supervision and Curriculum Development notes that curriculum mapping opens vertical and horizontal lines of communication in academia because it “illustrates what is taking place in the classroom” (Johnson, Carlile, Checkley, & Baker, 2006; Komenda et al., 2015). The vertical lines allow program targets to be established and hit. Similarly, the horizontal lines allow peers to link assignments, content, and teaching methods (Komenda et al., 2015). The K-12 Teachers Alliance focuses on how curriculum mapping is a planning tool that allows scaffolding (Murray, 2016). Therefore, these different definitions indicate that curriculum mapping can be used to achieve a variety of goals including planning, evaluation, team building, and coordination of classroom activities. From an administrative view, mapping generates data that can be used to evaluate program outcomes, course efficiency, and learning outcome progression. Similarly, mapping can aid in the scaffolding of instructional material, development of instructor’s guides, and increasing diversity of learning levels within the program, course, or activity (Johnson, Carlile, Checkley, & Baker, 2006).

The diverse directions of mapping require that the purpose of the mapping with expected outcomes be defined at the outset of the process. The purpose of the mapping dictates what data will be gathered and how it will be processed. Gathering too much data is incrementally more time-consuming. Gathering too little data means the entire process will likely need to be repeated before benefits can be realized. Once the purpose and expected outcomes are defined, the next step is to clearly and carefully define the program outcomes to be mapped. The program outcomes can be labeled as outcomes, targets, or competencies, but they must be clearly defined. These outcomes should be aligned as follows:

University Learning Outcomes → Program Learning Outcomes → Departmental Learning Outcomes → Academic Program/Major Outcomes → Course Outcomes → Weekly/Module/Activity Outcomes

Once the program outcomes are defined, how and when they are met can be mapped (Murray, 2016). This article focuses on the organization, process, and visualization of mapping.

Organization

Aligning outcomes is essential (Oklahoma State Department of Education, 2016; Murray, 2016), and will reduce the need for future revisions. Some essential components of defining the outcomes are to review university documents, accreditation expectations, discussions with faculty and assessment of measurability. Focusing on these components early will eliminate anxiety, frustrations, and feelings of isolation later. The discussions with faculty will increase clarity of purpose and buy-in to the mapping process. This will reduce resistance to the process, especially when course reviews start.

When defining outcomes or competencies, one might consider the multiple audiences with whom mapping results might be shared. While exclusive competencies may be emphasized for accrediting agencies, an inclusive hierarchy can help facilitate auxiliary discussions amongst the department and faculty as a whole. Knowing who is ultimately receiving the information, as well as who is being asked to provide the information, is key to effective data collection and communication (Schutte & McCullick, 2016).

Once the learning outcomes are defined, either have faculty members or a committee map courses along the learning outcomes framework. Figure 1 is an example of how that might be collected. Again, in the process, it is important that there is a buy-in through multiple conversations about the agreed upon or adopted outcomes so that definitions are not ambiguous. The process helps to ensure that there is as

much consistency as possible amongst application of the definitions. This micro-mapping will include a lot of detail about course outcomes, assessment mechanisms used in the course (exams, papers, rubrics), and feedback mechanisms in place. Having a diversity of details will allow stakeholders to use the results in a variety of different ways in the future (Caillods, n.d.).

Figure 1 Learning Outcomes Mapping

COURSE NUMBER	COURSE NAME	INSTRUCTOR	LEARNING OUTCOME	SPECIFIC OUTCOME	DEPT OR CLASS OUTCOME	ASSESSMENT TOOL	GRADE SCALE	BENCHMARK	FY 2016	FY 2015
BUS 301	HR MGT	PROFESSORA	ANALYTICAL THINKING	STRATEGIC ANALYSIS	CLASS ONLY	PROJECT	PERCENTAGE BASED	75%	85%	82%
BUS 301	HR MGT	PROFESSORA	MULTIPLE FRAMING	TEAMWORK	CLASS ONLY	PROJECT	RUBRIC	20	23	21
BUS 301	HR MGT	PROFESSORA	REFLECTIVE EXPLORATION	CULTURE	CLASS ONLY	PROJECT	PERCENTAGE BASED	75%	83%	82%
BUS 301	HR MGT	PROFESSORA	PRACTICAL REASONING	CONTEXT	CLASS ONLY	PROJECT	PERCENTAGE BASED	75%	84%	81%
BUS 315	FINANCE	PROFESSORA	ANALYTICAL THINKING	DECISION MAKING	CLASS ONLY	EXAM	PERCENTAGE BASED	75%	78%	78%
BUS 315	FINANCE	PROFESSORA	MULTIPLE FRAMING	CONTEXTUAL ANALYSIS	DEPARTMENT	PROJECT	PERCENTAGE BASED	80%	82%	85%
BUS 315	FINANCE	PROFESSORA	PRACTICAL REASONING	DECISION MAKING	DEPARTMENT	PROJECT	PERCENTAGE BASED	80%	82%	83%
BUS 402	BUSINESS AS THEORY	PROFESSORA	MULTIPLE FRAMING	ROLE OF BUSINESS	DEPARTMENT	ASSIGNMENTS	PERCENTAGE BASED	75%	86%	88%
BUS 402	BUSINESS AS THEORY	PROFESSORA	PRACTICAL REASONING	LEADERSHIP	DEPARTMENT	ASSIGNMENTS	PERCENTAGE BASED	75%	86%	78%
BUS 402	BUSINESS AS THEORY	PROFESSORA	ANALYTICAL THINKING	THEORY ANALYSIS	CLASS ONLY	ASSIGNMENTS	PERCENTAGE BASED	75%	82%	86%
BUS 402	BUSINESS AS THEORY	PROFESSORA	REFLECTIVE EXPLORATION	LEADERSHIP	DEPARTMENT	ASSIGNMENTS	PERCENTAGE BASED	75%	85%	86%
BUS 403	BUSINESS AS PRACTICE	PROFESSORA	MULTIPLE FRAMING	EXPERIENTIAL	CLASS ONLY	PROJECT	PERCENTAGE BASED	75%	85%	84%
BUS 406	BUSINESS PROBLEMS AND POLICES	PROFESSORB	ANALYTICAL THINKING	FINO & SOLVE PROBLEMS	DEPARTMENT	PAPER	RUBRIC	35	36	40
BUS 406	BUSINESS PROBLEMS AND POLICES	PROFESSORB	ANALYTICAL THINKING	COMM. OF FINDINGS	DEPARTMENT	PAPER	RUBRIC	35	40	36
BUS 406	BUSINESS PROBLEMS AND POLICES	PROFESSORB	MULTIPLE FRAMING	CONTEXTUAL ANALYSIS	DEPARTMENT	PAPER	RUBRIC	35	40	37
BUS 406	BUSINESS PROBLEMS AND POLICES	PROFESSORB	REFLECTIVE EXPLORATION	TEAMWORK	DEPARTMENT	PROJECT	RUBRIC	18	22	21
BUS 406	BUSINESS PROBLEMS AND POLICES	PROFESSORB	PRACTICAL REASONING	STRAT. PROBLEM SOLVING	DEPARTMENT	PAPER	RUBRIC	35	38	41
BUS 406	BUSINESS PROBLEMS AND POLICES	PROFESSORB	MISSION ACTUALIZATION	PRESENTATION SKILLS	CLASS ONLY	PROJECT	RUBRIC	30	30	38
BUS 305	MARKETING	PROFESSORC	MULTIPLE FRAMING	APPLICATION OF KNOWLEDGE	DEPARTMENT	ASSIGNMENTS	PERCENTAGE BASED	75%	81%	85%
BUS 305	MARKETING	PROFESSORC	PRACTICAL REASONING	STRAT. PLANNING	DEPARTMENT	PROJECT	PERCENTAGE BASED	75%	84%	82%
BUS 101	BUSINESS FOUNDATIONS	PROFESSORC	PRACTICAL REASONING	BUSINESS IN SOCIETY	CLASS ONLY	ASSIGNMENTS	PERCENTAGE BASED	75%	82%	78%
BUS 231	BUSINESS LAW AND ETHICS	PROFESSORA	PRACTICAL REASONING	LEGAL FRAMEWORKS	CLASS ONLY	EXAM	PERCENTAGE BASED	75%	83%	80%
BUS 231	BUSINESS LAW AND ETHICS	PROFESSORA	MULTIPLE FRAMING	ETHICAL FRAMEWORKS	CLASS ONLY	PAPER	PERCENTAGE BASED	70%	79%	79%
BUS 202	PRINCIPLES OF MGT	PROFESSORD	ANALYTICAL THINKING	MANAGEMENT THEORY	CLASS ONLY	EXAM	PERCENTAGE BASED	70%	82%	85%
BUS 202	PRINCIPLES OF MGT	PROFESSORD	MULTIPLE FRAMING	ETHICAL FRAMEWORKS	CLASS ONLY	PAPER	PERCENTAGE BASED	75%	88%	78%
BUS 202	PRINCIPLES OF MGT	PROFESSORD	REFLECTIVE EXPLORATION	MANAGER ROLES	CLASS ONLY	PAPER	PERCENTAGE BASED	75%	79%	78%
BUS 202	PRINCIPLES OF MGT	PROFESSORD	PRACTICAL REASONING	PRESENTATION SKILLS	CLASS ONLY	PAPER	PERCENTAGE BASED	80%	85%	82%

Once each course has been mapped, the mapping of the academic program or major comes next. This is referred to as macro-mapping (Caillods, n.d.). Depending on the level of analysis, one could also aggregate this up to a departmental or school basis. The data collected in the program is analyzed and then mapped out by the defined outcomes. The levels of the outcome can be categorized as introduced, reinforced, and applied following Bloom’s Taxonomy (Komenda et al., 2015). See Figure 2 for an example. Other mapping options for outcomes could be to follow Communities of Inquiry and categorize outcomes as the development of social, teaching, and cognitive presence (Rourke & Kanuka, 2009). This helps to see where the “events” are occurring and what is needed to obtain the feedback needed for the analysis.

Figure 2 Categorization of Learning Outcomes

Learning Outcomes	Departmental Outcome												Collected pieces of evidence
	B	A	E	B	B	B	B	B	E	A	B	B	
	U	C	C	U	U	U	U	C	C	U	U		
	S	O	O	S	S	S	S	O	O	S	S		
	1	1	1	2	2	2	3	3	3	4	4		
	0	1	0	0	3	0	0	1	0	0	4		
	1	1	1	2	1	2	1	5	8	1	2		
											0		
											6		
											3		
											3		
Analytical Thinking – Students will develop a comprehensive understanding of how to access information and critically analyze complex material in order to evaluate evidence, construct reasoned arguments and communicate both inferences and conclusions.		I	I	I					R	R	R	D	D

Indicates if Department Outcome is Introduced, Reinforced or Demonstrated

One note to consider is that ensuring that data exist and can be effectively linked to support course outcomes (and ultimately program objectives) is an integral step to be performed in tandem with defining course outcomes. In addition, as a practical consideration, before requesting data, one should have a firm understanding of how that data might be used. Sketching a framework to identify the overall assessment process goals can aid in the data collection process. One might consider whether or not the assessment process will take place in various stages, the level of brevity desired in participant responses to data requests, and how the results will ultimately be communicated to others. Although certainly not meant to be an exhaustive list, answering these questions can lead to data collection efficiencies, and consequently, a more impactful illustration of results (Komenda et al., 2015; Rourke & Kanuka, 2009).

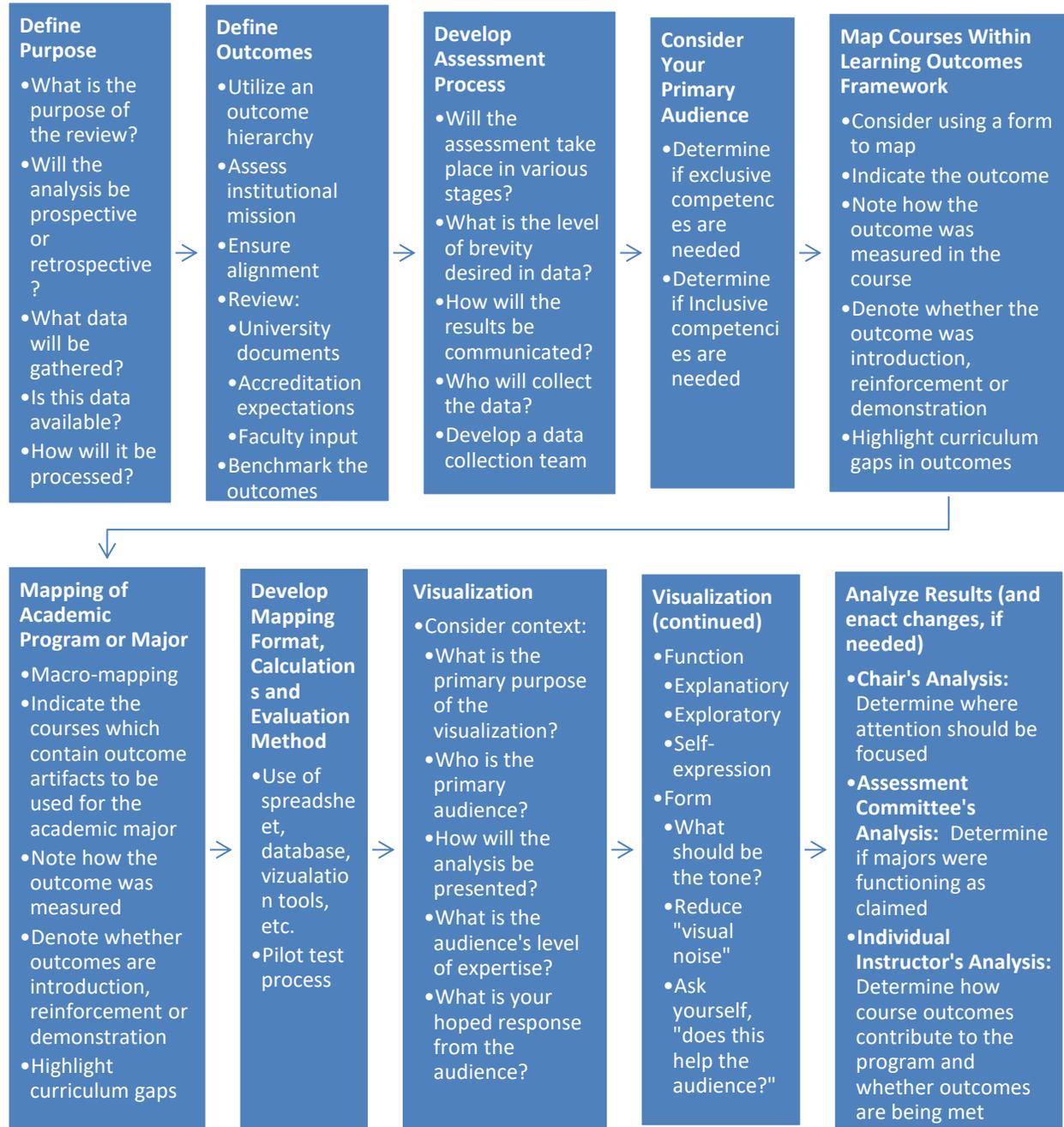
Process

Mapping, like most other forms of research, starts with a problem statement or research question. In both prospective and retrospective mapping, the problem statement or research question is likely to revolve around some permutation of, “What do we do and when do we do it?” or “We need to find out if we teach what we say we teach.” Answering these questions and associated sub-questions is a central purpose of the mapping. With the mapping purpose and the program outcomes defined, the next step becomes developing the mapping format, calculations, and evaluation method. As noted above, the purpose of the mapping can include social or administrative benefits, in addition to the mapped outcomes. These social and administrative benefits are addressed in the next section. Who will collect the data depends on the additional goals of the mapping process.

The mapping itself can be done in a spreadsheet or database. The complexity of the spreadsheet or database is defined by the objectives and methods. Once the spreadsheet or database is created, pilot testing the process with two or three courses will increase the potential of the desired outcome. A typical process of evaluating a course usually involves a review of the syllabus or lesson plans (Line, Schutte, & McCullick, 2016). The review can be done by the primary course instructor or by a neutral party who is familiar with the subject and the instructional process. The reviewer enters a “hit” whenever a module outcome meets a program outcome. If done in a spreadsheet, these entries would be done in the associated column and row. As noted previously, when entering the “hit” when a module outcome meets a program outcome, the notation can indicate a variety of things such as the learning level, Carnegie Units, or the activity type (individual assignment, group assignment, experience, video, etc.). The value of the activity towards the overall course grade can also be factored into the entry. The end result will be a map of program outcomes met at the course level. When done in a spreadsheet, each course can be a worksheet. Aggregate scores can be tallied and introduced into a “program” worksheet. This allows for specific activities, courses, and programs to be evaluated using the same map. The criteria used and the complexity of the map will be based on the goals of the mapping process.

Mapping of courses can be done in a variety of programs. See Figure 3 for an example. After the Competencies or Program Outcomes are loaded (in this case on the left column), the items to be mapped should be entered (in this case in the top row). A totals column should be created on the right. Additional attributes can then be entered across the top. This example includes point value for each item mapped. Formulas should then be created for the calculation of the total value of competencies and a count of competencies hit by the course. The process of mapping starts with a review of the course items to be mapped. The reviewer then enters a match or hit in the appropriate cell linking the competency with the item. Additionally, the associated learning level can be recorded with various hit designations. In this example, the map illustrates there were 41 matches across 5 of the 9 competencies.

Figure 3
Course Mapping Process



Visualization

One of the primary benefits of recording assessment data in a spreadsheet, like Microsoft Excel, is the flexibility offered in displaying that data. Historically considered to be a niche discipline of a select few, data visualization has now become a widespread practice used by many (Berinato, 2016; Kirk, 2012). In

the context of curriculum mapping, data visualization offers the opportunity to effectively communicate assessment results to both internal and external users (Schutte & McCullick, 2016). Key to that effective communication is the consideration of the context surrounding the visualization as well as the function and form of the display itself (Kanflie, 2015; Kirk, 2012).

Understanding the context of a visual display requires one to know the purpose of the data analysis, how the analysis will be presented (i.e., live presentation or remote delivery), who is the audience, what is the audience's expertise in reviewing visual displays, and what is the hoped response from the audience regarding the display (Knaflic, 2015).

Although understanding the context of the visual display is a prerequisite to the creation of the display, the individual components of context are often considered concurrently (Kirk, 2012). A visualization of an exclusive curriculum mapping approach, whose primary audience may be accrediting bodies, should show very clearly which courses hold assessment artifacts, what constitutes a positive assessment, and whether or not those positive assessments are being met (i.e. purpose). A response or action one might seek from the accrediting body is an understanding of one's assessment process, as well as an agreement that learning outcomes are appropriately connected and thoughtfully considered throughout the institution. Alternatively, a visualization of an inclusive mapping approach may expand its visual display to help individual faculty members (i.e. audience) determine the focus of course outcomes, the frequency of assessment methods (i.e. exams, projects, etc.), the effectiveness of assignments, and whether achievement of individual benchmarks are obtained (i.e. purpose). A response or action one might seek from faculty members is to identify and remediate those courses for which learning outcomes are not being met or are not present. From the above, one can see that audience and purpose, two components of context, work together in helping to define one another.

In addition to examining one's purpose from an audience-specific viewpoint, one should also consider examining purpose from a general perspective. In the book, *Data visualization: A successful design process*, Kirk offers three functional areas of visualization: explanatory, exploration and self-expression (Kirk, 2012). Berinato (2016) further defines exploration by distinguishing that which is confirmatory in nature, visual confirmation, and that which is truly exploratory, visual exploration. One should note that it is not unreasonable for the purpose of one's visualization to oscillate among these areas (Berinato, 2016). For instance, one may initially define one's purpose as visual confirmation of what one believes is present in the curriculum (i.e. retrospective curriculum mapping); if confirmed, one's purpose may pivot to become more explanatory in nature. If unconfirmed, one may be forced to change one's purpose of visual exploration. Both retrospective and prospective curriculum mapping may, at times, pivot their purposes to become more explanatory in nature; however, one could surmise that the initial purpose of prospective curriculum mapping may focus more on exploration and development. In contrast, retrospective curriculum mapping may initially focus more on confirmation or explanation. Knowing one's general purpose allows one to properly set the tenor during the construction of a visual tool.

The creation of a basic visualization tool does not require a significant amount of in-depth training. An effective and economical platform on which to build a display for one's assessment results is Microsoft Excel. Pivot tables and charts provide convenient user-friendly ways to visually explore and represent data. Power Pivot allows for further data modeling, integration of varied data sources and easier continuity of data, as assessment information is updated each semester. In addition, slicers provide a useful means of transforming static data into an interactive dashboard. Data validation tools allow for consistency in terms used and responses received during data collection. Further information on these

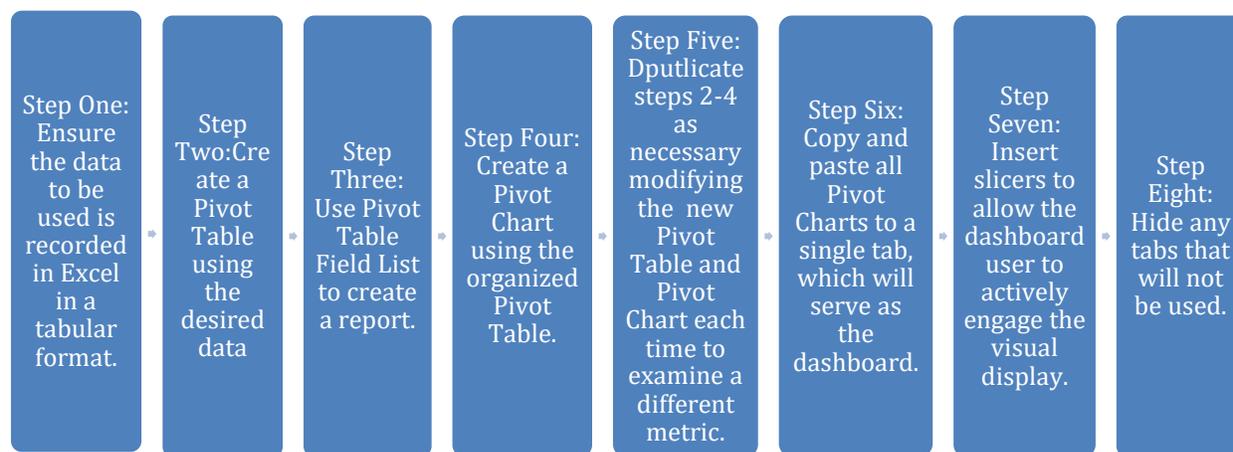
and other features of Excel can be easily accessed online at the Microsoft Office Support webpage (Microsoft, 2017).

Symbiotic in nature, the tone or form of the visualization tool should represent clearly the overall function of the tool (Kirk, 2012). If one’s general purpose is explanatory, one might consider using a practical tone in the creation of a visualization tool such as a dashboard. When creating a dashboard, one should keep in mind that following a practical or pragmatic visualization approach implies that one should avoid adding unnecessary graphics or features known as “visual noise” (Kirk, 2012; Knafllic, 2015; Yu, 2016). Instead, pragmatic visualization concerns itself with the efficiency in allowing one to read, interpret, and gain insight from the data display (Kirk, 2012; Kosara, 2007). One should continue to focus on the question, “Does this help the audience understand or gain insight from the information?” One should strive to ensure that every aspect of a visual display has a reason and reinforces one’s overall objective (Kirk, 2012; Knafllic, 2015; Yu, 2016). With that said, it should be noted that when one’s purpose is more exploratory in nature, one’s time may be focused more on the creation of ideas and insights rather than the perfection of how a visualization should look. The latter being considered more heavily once one’s purpose shifts to explanation (Berinato, 2016).

Overall, visually displaying data offers the benefit of efficiently communicating results and the opportunity to gain insights (from a pictorial representation) that one might not have gleaned otherwise (Tukey, 1977).

Creating a visualization tool, like a dashboard, is easier than you might think. Figure 4 is a brief listing of general steps (Acampora, 2016) and (Excel Campus, 2016); see also (Walkenbach, 2015), (Collie & Singh, 2016) and (Microsoft, 2017) outlining one way in which a user could create a basic dashboard in Microsoft Excel using a PC. Further information on this and other steps may be found by accessing the resources cited above.

Figure 4
Steps to Create A Dashboard



Chair Perspective

The role of the department chair or dean of the program in assessment has to include both summative and formative aspects. The leader must be able to establish variables, understand the interplay of these variables, sort through vast amounts of data to assess performance, and communicate results, as well as

analyze and define needed changes (Line, Schutte, & McCullick, 2016). The mapping procedure coupled with the visualization of results creates a mechanism to accomplish these goals without a lot of duplication of efforts.

One of the roles of the program leader is to align institutional goals with program goals. This includes outcomes as we have mentioned above, but it also includes finding a way to mediate the application of institutional policy while being sensitive to disciplinary nuances (Mutch & Brown, 2001). By aligning program goals with institutional goals, that process becomes much easier. In effect, this is the alignment of the strategic and operational aspects of the institution.

The visualization aspect allows for ease of communication of results. It helps those within and outside the discipline to receive a dashboard of key indicators with the additional data available to peruse as desired. It allows internal users to keep the macro approach to the data, but also find specific areas in their own courses to work on. It also allows them to compare across the program to see where they are succeeding individually, as well as collectively, while also identifying gaps in the same manner.

For external users, the alignment and visualization break down communication barriers of what is being measured. The alignment aspect provides a common understanding of outcome language. The visualization makes it easy to understand where the strengths and weaknesses lie. This helps external users get a snapshot of key aspects of the analysis with the ability to dig deeper as needed (Caillods, n.d.).

This can be extremely helpful when reporting results to users. The time it takes to explain the data has been minimized allowing for some excellent conversations to take place regarding what to do about the gaps and successes. The conversations about the next steps can be richer and deeper, instead of getting lost in the data. This provides a stronger opportunity in the provision of a solid feedback loop for the department and the organization.

Faculty Perspective

The role of faculty in curriculum mapping, and assessment in general, is a topic of much discussion (Maki, 2010). Described by Maki as “the means of answering those questions of curiosity about our work as educators,” (2010, p. 3) the assessment process would appear to be critically dependent upon faculty involvement. One might conclude that effective involvement would be active, collaborative, and reflective in its nature (Caillods, n.d.; Rourke & Kanuka, 2009). In effect, this creates a community of inquiry from the program and faculty perspective.

To enhance the likelihood that faculty assumes an active role in the design and implementation of the curriculum mapping and assessment process, it is important for faculty to experience the exercise as an internal initiative inclusive of ownership rather than an external mandate (Lederman, 2010; Bok, 2013; Maki 2010). In addition, discussion, and therefore collaboration, may be bolstered when assessment design takes place at the department level, allowing for personal input and more flexibility to respond to remedies where needed (Bok, 2013).

Interestingly, dynamic visualization with interactive features, particularly when developed in-house, appears uniquely suited to assist in fostering organic participation. In its incipient design, curriculum mapping will invaluablely benefit from faculty input on a range of topics. Beyond the routine discourse occurring in mapping and assessment (e.g., agreement on outcomes, terms, measurements), considering the visual display of data allows for a reflective component in which faculty may contemplate (and comment on) what display of information would assist one in reaching one’s goals. This allows for rich

discussions on topics such as what information is most helpful, where do suspected gaps currently exist, and what is truly needed to improve.

From an operational perspective, it is important to explore how courses can be adjusted to improve standing within the mapping process (Greenstein, 2012). Explaining how to use layering within and between courses to score higher allows faculty members to see a positive opportunity to contribute more to programs and institutional outcomes without compromising academic freedom or pedagogy/andragogy. This is where the application of collected data comes into play. If the mapping process is appropriately designed, categorized levels of outcome can be used to scaffold learning and increase a course's potential to contribute to program outcomes. This is also an opportunity for a course to become more dynamic in its assessment process. An example of this would be a business course that focuses on a Strengths, Weaknesses, Opportunities, and Threat (SWOT) analysis. If the program has an outcome to increase communication skills as well as business acumen, then adjusting the SWOT analysis assignment from a written paper to a written speech could increase the score in the mapping process for this particular assignment. If the same program had an international focus, then applying the SWOT analysis speech to a foreign population on an international topic would add even more points in the mapping process. Utilizing the motive to increase a course's score will increase the ability of a program to reach its objectives. Thus, exploring how points are attained in the mapping process will increase how the mapping process can strengthen a program.

Change does not happen in a vacuum. It will take collaboration among all institutional constituencies (Maki, 2010). Working as a team throughout the entire mapping process will increase the potential for meaningful course and program changes.

Case Study

In an effort to share the process to illuminate the benefits and potential pitfalls of assessment, a case study of the Liberal Arts College business program in the Midwest will be utilized. This is provided not as a "how to," rather it is an effort to provide some additional context to the discussion.

The program had a strong history of assessment that collected numerous outcomes, in excess of 35, to determine the performance of this program. This was deemed too many to measure in a manner that would provide the feedback needed. In addition, some of the outcomes being measured were so narrowly focused that the additional information they yielded did not provide effective program feedback nor institutional feedback regarding the progress of the overall college learning outcomes.

The department went through an audit of their learning outcomes. This included a number of intentional components. First, the group took their existing outcomes and determined which were critical for disciplinary preparation. They then categorized the remaining outcomes into themes to see what areas emerged into categories to measure multiple outcomes. Once these categories were determined, the department benchmarked their program against top-ranked business schools and aspirant colleges to ensure they were consistent with industry standards. This was further compared to accrediting body standards. Once alignment was ensured and measures of control were established, the department assessed their program outcomes to secure alignment with the institutional goals, mission and focus. While it may seem counterintuitive to end with institutional goals instead of starting there, the last step was set up as more of a check. The original assessment learning outcomes were aligned with the mission of the college so congruency should have been maintained throughout the process. However, if an

exercise of mission alignment had never taken place, a department would want to start with first assessing the institutional mission and then moving into outcome development.

The next step in the process was to map the curriculum. Each faculty member was given a form to map the learning outcomes throughout the courses they taught. They identified which learning outcome they addressed, how they measured that outcome (test, paper, exercise), the measurement tool (grade, score on a rubric) and if it was an introduction, a reinforcement or a demonstration of the concept. This allowed faculty members to assess where the outcomes were occurring, if a layered approach to learning was happening and how they were being measured. In addition, it highlighted where there were gaps in the curriculum.

Another step faculty members took in this process was to share what skills and knowledge were needed for students to have when they entered each course. That provided an opportunity for faculty to see earlier in the sequencing what was needed out of their course. It opened up communication about course outcomes. It also allowed the department to develop a more coordinated approach to the curriculum, which was readily shared with students, both formally and informally.

Once outcomes were aligned and mapping was done, it provided an opportunity to make sure the assignments were building in a manner that allowed for the layered approach to learning that was being sought. In addition, it eliminated some of the concepts in upper-level classes that were already being taught and achieved in lower level classes. Opening up the communication amongst the faculty members was, thus, extremely helpful in making the program more integrated.

With a coordinated approach to outcomes, the department was able to narrow down the number of artifacts collected to five versus the 35 collected previously. This was due to the layering of outcomes. Now, upper-level courses could utilize assignments that built on the knowledge and skills obtained previously in the program.

This provided a feedback loop at multiple levels – assessment committee, department administrator, and individual instructors. For the assessment committee, they had a much more manageable number of results to review that was a result of a number of inputs. This allowed them to see if the major(s) were functioning as they claimed. It provided a much more integrated report instead of a collection of several classes. Focusing on a smaller number of outcomes that were built from the 100 to the 400 level courses allowed for a macro look at the overall effectiveness of the program. From an institutional perspective, this built cohesion within the program.

For the department administrator, the results provided a guide on where to focus attention. When certain areas were falling short in a given year or trends were identified over several years, the administrator could narrow in on the source of the concern. This outcome of curriculum mapping provided the opportunity for a more focused analysis of problem identification and problem-solving in a program.

With the ability to narrow in on specific courses and compare courses across the curriculum, individual instructors could see how the outcomes in their courses were contributing to overall program outcomes, and compare their results with their colleagues. This allows for a better understanding of how to develop learning activities in their own individual courses.

Part of the assessment process was to utilize Microsoft Excel and develop a visualization of the outcomes. This manifested itself in a dashboard for the assessment process. This dashboard provided a way to get

some quick feedback on the results of the assessment. By looking at the graphs, one is able to quickly see how things are going and ascertain trends in the data.

Another aspect of the visualization tool was to provide the ability to dig into various categories of the data to get at some of the comparability of the various courses and outcomes. It had the capability to allow the visuals to be adjusted to include course comparisons, outcome comparisons and heat maps. These allowed a look into where the outcomes were occurring and at what frequency they were occurring. This allowed the administrator to fully utilize the richness of the data and further enhance the feedback loop.

Finally, the visualization tool allowed for ease of communication to outside users. It provided a method to enhance the understanding of the data being shared and the results being discussed. Therefore, the users could quantifiably see where the strengths and weaknesses lie so that they too knew where to focus their analysis.

Based on the outcomes of curriculum mapping, changes have been implemented in the curriculum for this particular program. They have been able to streamline and enhance the curriculum in the individual courses based on the layering analysis of the curriculum. Faculty members have been able to see how their course fits into the overall program outcomes, and it has subsequently opened up conversations regarding how to do this better jointly. In addition, and not inconsequentially, curriculum mapping provides students with a message and a realization that the curriculum is intentionally built. Indeed, a curriculum with a strong foundation leads to effective outcomes. The students assess the program as a coordinated set of classes when they hear professors talking about what is done in other classes, and the congruency of their learning provides context and meaning to their current tasks. In short, they know they are building to specific learning outcomes so the journey is a bit easier to accept.

On a more micro level, the program is working on developing rubrics that expand throughout the program. This means that the same skills are being measured throughout. For example, in the 100 level courses, the scale may be 1-3; in the 200 level courses, the scale is 1-5; in 300 level courses, the scale is 1-7; and in the 400 level courses, the scale is 1-10. This allows students to see the progression of their knowledge, skills, and abilities. In addition, various courses are working on joint projects to allow for multiple skill development to take place in tandem. These focus on the learning outcomes of the program. Many other discussions are taking place as well, but, in short, the feedback loop is dynamic. It is both summative and formative, with the real value in the latter component.

This particular program plans to continue to iterate the process. They hope to expand to other majors and overall departmental outcomes that include multiple majors. They are working on an input process that will increase ease of data input, increase access and further enhance reliability. All of these factors are built off the system of mapping and visualization.

Summary

This article outlines the process and the many benefits of utilizing a mapping approach for assessment. When this is coupled with a visualization tool, it can provide an effective and efficient way of determining learning outcome achievement and making improvements in programs. The effectiveness of this approach will vary with each program given the unique characteristics of each program and the application of the process.

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