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Mapping Knowledge Units Using a Learning Management System (LMS) Course Framework

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Abstract**ABSTRACT**

The purpose of this paper is to examine the outcomes of using a Learning Management System (LMS) course as a framework for mapping the Centers of Academic Excellence in Cyber Defense (CAE-CD) 2019 Knowledge Units (KU) to college courses. The experience shared herein will be useful to faculty who are interested in performing the mapping and applying for CAE-CDE designation.

Location

KC 400

Disciplines

Higher Education Administration | Information Security | Management Information Systems | Technology and Innovation

Comments

Switched to Practice track as a better fit for this paper.

INTRODUCTION

Knowledge Units are “tightly targeted technology areas composed of a set of topics to be covered and expected student outcomes and masteries” (Klappenberger, 2017, p. 4). By way of a process known as mapping, institutions seek to “provide evidence that they address each topic and objective of the required KUs” (Klappenberger, 2017, p. 3). The task of mapping curriculum to these, along with Committee on National Security Standards (CNSS) and National Security Telecommunications, Information Systems Security Instruction (NSTISSI) standards, recurs every five years. The process can be handled a number of ways; emailing a CAE KU Mapping Matrix (spreadsheet), referring to course syllabi and academic catalog descripts, and/or interviewing professors are traditionally the data collection methods used. One or two people enter the resulting data into the designated federal mapping database. The process, while effective, is singular in its outcome: The curriculum is mapped to its appropriate KU depending on the desired CAE designation, and the task is complete. For the upcoming 2019 submission cycle, a Learning Management System (LMS) course has been utilized as a framework for mapping the Centers of Academic Excellence in Cyber Defense 2019 Knowledge Units. This process should lead to the development of a more dynamic process, one that “will allow further analysis and review needed to gain a greater understanding of the relationship between the Frameworks” (Mapping ~, n.d.). Thus, by design, many seemingly superfluous details are included in this examination so that others who want to employ this framework also can be successful and glean additional outcomes from this process.

BACKGROUND

The mapping requirement has been fulfilled by the College three times since 2005. Research of this process includes reflecting on how this was done in the past. In 2005 the College mapped to the CNSS and NSTISSI standards. A spreadsheet similar to the current Mapping Matrix was created and emailed to all instructors for identification. Two administrative staff compiled this data and worked one on one with instructional staff to collect syllabi. One of the administrators keyed that resulting data into the federal database. In 2009 the first mapping was printed for reference, then a different instructor mapped CNSS and NSTISSI standards to the federal database. Similarly, in 2013 another instructor attending training on the new Knowledge Units reviewed the curriculum to determine where changes occurred from the prior mapping, and then keyed the resulting data into the federal database.

Review determined this process to be tedious, labor-intensive and boring. The instructional staff has largely inherited this CAE-CD designation benefit without understanding the prerequisite process. Through delegation of more of this process, the negative aspects largely can be overcome. The suggestion of collaboration in Klappenberger's Resource Guide can become more emphasized, which could encourage a new enthusiasm and creativity.

A UNIQUE APPROACH

Building the Course in the LMS

Since there is no current documentation or other evidence that this framework has been employed, building a course in an LMS seems to be a unique approach. "Through the process of mapping, it is the task of each institution to specify how ... KU topics will be met and how the outcome will be determined" (Klappenberger, 2017, p. 9). Klappenberger (2017) describes the use of Mapping Matrix spreadsheets for new applicants, and acknowledges the tediousness of this practice upon entering a renewal cycle. Meanwhile he mentions that working with the course topics and objectives can either be done individually or collaboratively. However, he fails to suggest connecting all of these components. Toward that end, using a Learning Management System is a unique approach to mapping KU to courses both collaboratively and individually. Employing Modular Object-Oriented Dynamic Learning Environment (MOODLE) as the LMS, the mapping process can be set up similarly to a curriculum.

It can be constructed a number of ways: Single Activity Format, Social Format, Topics Format, and Weekly Format. The Single Activity Format and the Social Format have a single container, which is limiting for separating KU. Because all mapping participants are familiar with the Topics Format, training on how to use the format can be eliminated, and the framework can be focused specifically on course mapping. The maximum number of topics per this type of course is fifty-two. While more than one KU could be placed in a topic, two courses better facilitate grouping the required core, technical, and non-technical together and separating the optional KU in its own course.

The image shows a screenshot of the MOODLE course settings interface, organized into several sections:

- Course format:**
 - Format: Topics format
 - Number of sections: 12
 - Hidden sections: Hidden sections are shown in collapsed form
 - Course layout: Show all sections on one page
- Appearance:**
 - Force language: English - United States (en_us)
 - News items to show: 5
 - Show gradebook to students: Yes
 - Show activity reports: No
- Files and uploads:**
 - Maximum upload size: Site upload limit (4.9GB)
- Completion tracking:**
 - Enable completion tracking: Yes
- Guest access:**
 - Allow guest access: No
 - Password: [Empty field] Unmask
- Groups:**
 - Group mode: No groups
 - Force group mode: No
 - Default grouping: None
- Role renaming:**
 - Your word for 'Manager': [Empty field]
 - Your word for 'Course creator': [Empty field]
 - Your word for 'Teacher': [Empty field]
 - Your word for 'Non-editing teacher': [Empty field]
 - Your word for 'Student': [Empty field]
 - Your word for 'Guest': [Empty field]
 - Your word for 'Authenticated user': [Empty field]
 - Your word for 'Authenticated user on frontpage': [Empty field]
 - Your word for 'Question sharer': [Empty field]

Figure 1. Sample MOODLE course settings.

The default settings for the rest of the course setup are used as demonstrated in Figure 1. If any unused settings are determined to be beneficial to the project, they can be utilized at a later date.

Course Content

Once the shell of the course is built, it is named “1. Knowledge Unit Mapping, effective fall 2018.” Next, the content can be added.

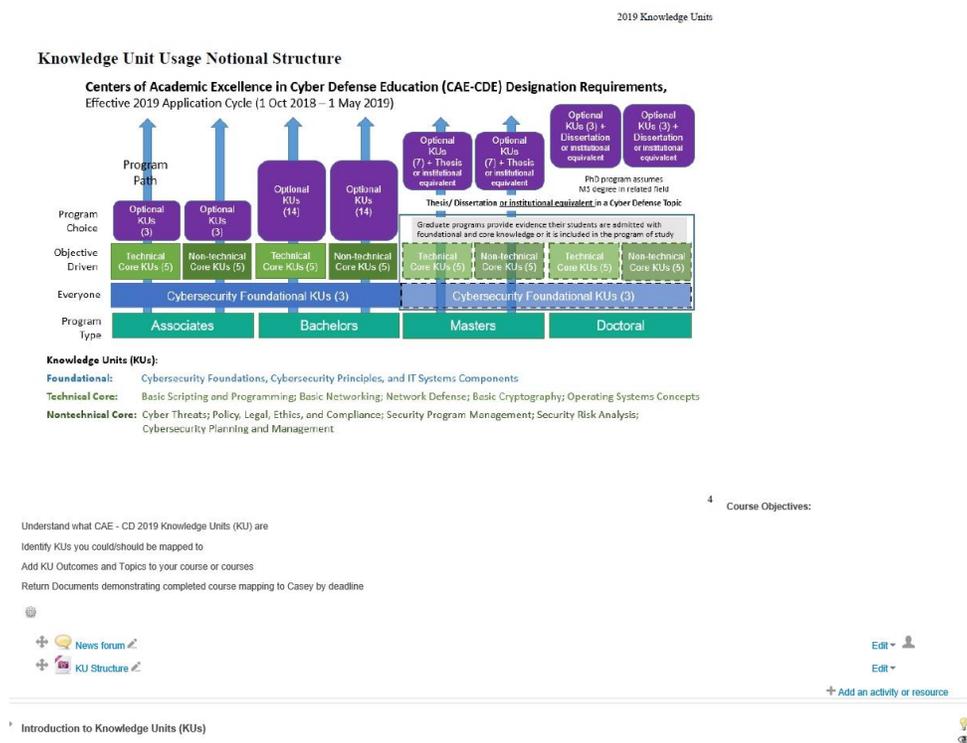


Figure 2. “Topic 0” demonstrates graphic and objectives. Adapted from Centers of Academic Excellence in Cyber Defense (CAE-CD) 2019 Knowledge Units, n.d. Retrieved from <https://www.iad.gov/NIETP/CAERrequirements.cfm>

“Topic 0,” demonstrated in Figure 2, is the first container in any course. It often contains a graphic of the textbook used for the course. The only graphic contained in the KU guidelines is one demonstrating the KU Notional Structure, so this graphic can be used as a visual to augment the accompanying Course Objectives.

The objectives are:

- Understand CAE-CD 2019 (KU)
- Relate KU to Bloom’s taxonomy.

- Identify which KU could/should be mapped to courses, and which courses.
- Add KU outcomes and topics to identified course or courses.
- Return documents demonstrating completed course mapping to the lead teacher by deadline

“Topic 1” demonstrates a Model KU Structure. Topics 2-20 have a single KU and its outcomes, from the three CyberSecurity Foundational KUs, the five Technical Core KUs, and the five Non-Technical Core KUs. The process for building this course is repeated, and this course is similarly named “2. Knowledge Unit Mapping – Optional KUs for Fall 2018.” “Topic 0” has the same graphic, and “Topic 2” has a complete summary of all of the Optional KUs.

Participants and Roles

Once the courses have been constructed, participants can be added. All instructors who are teaching courses that have KUs are added, labeled with their appropriate roles. The roles include manager, teacher, non-editing teacher, and student. Unless one of the participants needs to edit the courses, all roles can be set to student. In this case, the student role is used for all professors who will map courses. Additionally, there are three teacher roles: 1) One teacher creates and teaches the class; 2) to each KU identified for mapping, the second teacher adds a MOODLE activity called an assignment (a drop box in which a student can attach a document or documents demonstrating the KU topics and objectives); and 3) one teacher takes the mapping proof assignments and submits them to the National IA Education & Training Programs (NIAETP) database.

Preparing for Class

Before the class is taught, individual meetings of five to ten minutes are held with each participant, the Fountainhead College Director of Education, and Fountainhead’s CEO. These meetings are used to set a date for class and give a brief overview of what will be covered and needs to be accomplished.

Class resources include a copy of the Centers of Academic Excellence in Cyber Defense (CAE-CD) 2019 Knowledge Units journal, copies of a Bloom’s taxonomy graphic, laptop, projector, cell phones, dry-erase boards, and ink pens.

In Class

To initiate the process of putting the above-described protocols into practice, participants and the instructors met in a classroom on the morning of April 5, 2018. The LMS Course was opened, and class began. All stated course objectives were covered, and the Centers of Academic Excellence in Cyber Defense (CAE-CD) 2019 Knowledge Units journal was reviewed with the team cover to cover. When connecting the KUs to the college's courses, the lead teacher made edits to the MOODLE course, while another teacher made analog notes on his copy of the journal. These notes identified the course and corresponding instructor responsible for completing each assignment.

The team decided that the proof for each KU was to be a course syllabus, which would be submitted as "the assignment" in the MOODLE course's corresponding KU. The team members agreed to set June 28, 2018, as the deadline date. They also agreed to an on-campus meeting if not all assignments were submitted by that date. All KUs remaining without proof were to be completed at the second meeting. The timeframes provided substantial opportunity to make adjustments to courses and complete the assignments, as well as giving the incentive of "free time" on the second meeting date if all work were complete.

OUTCOMES

Collaborative Participation

Certainly, the singular outcome of mapping each course was met with this process. A number of additional outcomes have been realized. The framework includes a much larger group of participants than the prior methods, and the participants all have gained knowledge of the inner workings of the mapping process. More KU overlaps have been discovered by their being discussed as a group. The participants have had more buy-in with the process than before, and they seem to find the collaborative environment more fun.

CAE-CD Criteria

As with any strong curriculum, there are overlaps in terminal and enabling objectives. Fountainhead's associate degrees in computer programming, information technology, and electronics have a significant number of KUs mapped. This framework enabled the discovery of the Bachelor of Applied Science in Application Development as a potential new academic curriculum path. It encompasses all but three required KUs. Additional consultation with the NSA liaison, faculty meetings, and course adjustments may prove fruitful toward capturing those remaining KUs and having another baccalaureate degree mapped.

After using the nontechnical core KU toward the fourteen required, Fountainhead needed nine additional KUs. With this process, twenty additional KUs were mapped.

The first criterion for becoming a Center of Academic Excellence in Cyber Defense, from the current CAE CDE Criteria - 2018, is to have a "Cyber Academic Curriculum Path" that feasibly could award an additional five points. If the second path does not evolve fully, points instead may be gained with respect to the fifth criterion, i.e., "Cyber Defense is a Multidisciplinary Practice at the Institution."

Certificates

With the newly organized KUs comes a need to divest from the current CNSS standard mapped certificates in order to develop a new certificate or certificates that incorporate the changes. During the collaborative process, a brief discussion of this future task took place. Once the assignments were all turned in for the mapping process, the brainstorming began on the wording, aesthetics, and utilization of future certificates. Due to the synergy derived from the framework, a number of ideas were submitted for discussion.

Badges

Using the MOODLE course framework as described, the process gains the plug-in tools the LMS offers. Most notably, MOODLE has badges. "Badges are a good way of celebrating achievement and showing progress. Badges may be awarded based on a variety of chosen criteria" (MOODLE, 2015). Course badges and/or site-wide badges can be earned by students completing activities in a course and/or completing a group of courses respectively. Figure 3 represents a sample badge based on another college CAE logo established in 2006.



Figure 3. Draft of MOODLE badge based on Foundational Core KU.

CAE-CD Criteria – Curriculum Sharing

This framework can be shared easily with other CAEs and applicant CAEs. The basic process is documented and can be demonstrated simply. In a matter of minutes, the LMS course backups easily can be created, renamed and restored without user data. Manual participant accounts can be configured quickly so that instructors from other organizations can access the courses. Edits can be made to customize the courses to suit the needs of new participants. The new courses can be accessed from the internet or possibly restored on another MOODLE instance.

CONCLUSION

The LMS framework makes an excellent tool for mapping the newest Knowledge Units to courses. With seemingly the same amount of effort as put forth in past cycles, this framework can additionally promote the development of additional benefits, the strongest of which could be building blocks for the criteria needed to become an NSA- and DHS-designated Center of Academic Excellence.

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