

Capstone Courses and Projects – An Overview

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Definition

A capstone occurs at the end of a course or program and allows students to demonstrate that they can apply and integrate prior learning in new and more advanced ways. It involves “culminating experiences in a course or program, in which students are given opportunity to synthesize prior learning and demonstrate their readiness for graduation” (Lee and Loton, 2019, p. 134). Similarly, Rowles et al. describe it as a culminating set of experiences that “captivate, encapsulate, synthesize, and demonstrate learning.” The plan, processes and products involve student independence and responsibility and are unique for each student or student team.

Types

The style, scope and scale of capstone experiences in Higher Education “...vary considerably, resulting in significant differences in student learning experiences and outcomes.” (Lee, N. and Loton, D., 2019, p. 134). They may take on the form of

- real or simulated work experiences (e.g. work placement, internship, community-based learning, community/industry partnership project),
- research opportunities (various forms of delivery)
- design and build projects,
- a synthesis essay or report,
- an analysis and reporting (variety of forms) using data not seen before,
- or any number of other forms.

They may be individual or group based. They may be one experience within a course, or more commonly, a “course” unto themselves, lasting 1 or 2 semesters.

Purposes of Capstone Experiences

The purposes reported by faculty responsible for Capstone experiences vary greatly. Every program should clearly define what purpose(s) their capstone should serve and design and evaluate the capstone based on that definition. Lee and Loton (2019) identified 43 purposes for Capstone experiences from the literature and from instructor reports. Each can be classified within the following five categories.

1. Evaluation of Student Achievement and/or Application of Program Knowledge & Skills

The most common purposes are related to student evaluation: testing disciplinary knowledge and skills, specifically, the students’ ability to synthesize and integrate knowledge and skills from previous courses with higher order cognitive processing, such as critical analysis (Durel, 1993; Lee and Loton, 2019). According to Young, Chung, Hoffman, & Bronkema (2017), a well-designed capstone course should *“...facilitate the pinnacle of students’ ability to engage and demonstrate critical thinking, communication, problem-solving, and team building.”* The opportunity to integrate knowledge and skills opens new pathways in the brain, new connections are formed between learnings, and students are more engaged and more creative. Capstones provide opportunities for more thoughtful student reflection in contrast to traditional assessment and enable students to make sense of their graduate program in a systematic way (Brown and Benson, 2005). Students can start to see the bigger pictures in the discipline, make their own new connections, and ask and answer their own novel questions (Camenga, 2013). As students raise questions of their own rather than merely “receiving” the so-called wisdom of the ages, they take a new and more active role in their own learning” (Brown and Walter, 2005).

2. Affective Pedagogy

Capstones are sometimes tasked with advancing students’ attributes, dispositional and personal aspects, such as independence, responsibility, resilience, self-efficacy, diligence and confidence. (Lee and Loton, 2019). McNamara et al. (2011) describe the intention for Capstone experiences to consolidate students’ lifelong learning attributes, such as resilience, self-confidence and self-efficacy, enhancing their future professional and personal lives. Schermer and Gray (2012, p. 56) explain that Capstones *“engender self-sufficiency and independence, perseverance and self-understanding....confidence is built through the complexity and scale of capstone activities... students often end [the capstone] confident that they can achieve more than they thought.”*

3. Transferable Skills and Employment Preparation Pedagogy

Increasingly, the literature is identifying that Capstone experiences serve pedagogical purposes of developing heightened capability in students for what are often thought of as transferable skills and employment preparation (Lee and Loton, 2019). These skills include communication, management (including project management), decision-making, creativity, critical thinking, leadership, entrepreneurship, developing a professional identity, and collaborative problem-solving (Keller, Parker, and Chan 2011; McNamara et al. 2012; Schermer and Gray 2012). Many authors cite using real or simulated work experiences as Capstones as a vehicle for providing real-world and professional context experience that will better prepare them to enter the workforce (Kachra and Schnietz 2008; Ryan, Tews, and Washer 2012).

UBC co-op experiences can be treated as Capstone experiences. Several questions worth pursuing further include: are coop experiences assessed as capstone experiences? Is there oversight to ensure that Program Level Learning Outcomes are both articulated and met? Are alternatives to formal coop experiences available and visible to students?

4. Research Pedagogy

When programs anticipate some of their graduates will go on to advanced research studies, they may identify the strengthening of student research capacity as a purpose of their Capstone options for some, if not all their students (Hauhart and Grahe 2012; Schermer and Gray 2012).

There are many benefits of undergraduate research experiences, with plenty of literature on the issue; Google "Research Experiences for Undergraduates" or REU. For example, the National Science Foundation includes a whole category of funding opportunities in the USA to promote and encourage REU (<https://www.nsf.gov/crssprgm/reu/>).

5. Program Evaluation and Quality Assurance

Increasingly, Capstone experiences are being designed to serve as data sources for program evaluation and quality assurance. Student achievement can be benchmarked and audit activities can be designed (Group of Eight 2014; Krause et al. 2014).

Benefits of Capstone Experiences

Participating in capstone experiences have been linked to engagement in deep learning and gains in personal and social development, practical competence, and general education (Young, Chung, Hoffman, & Bronkema, 2017). Each of the purposes listed above can be thought of as a benefit. To summarize, Capstone experiences can:

- Develop in the students a heightened capacity to apply and integrate previous learning in complex and novel ways.
- Help students to improve various attributes and dispositions such as resilience, confidence and independence that will serve them in their personal and professional lives.
- Improve students' transferable and employment skills such as team work, communication, leadership and problem-solving.
- Develop students' research abilities. Associated skills and experiences are beneficial for all future occupations, and (of course) are important for those students hoping to engage in more advanced research studies after graduating.
- Provide data for program evaluation and quality assurance and improvement.
- Anecdotally, capstone experiences are also important for enhancing motivation, both before and during capstone activities. Instructors invariably remark on how much more focused and energetic students become when tackling a meaning project with peers.

Keys for Effective Capstone Experiences

The University of Hawaii (n.d.) suggests several keys to effective Capstone experiences, including:

- Students demonstrate mastery and integration of previous learning, instead of learning new content knowledge and skills
 - Student ownership, responsibility and engagement is central
 - The learning outcomes of the Capstone should be defined based on the program/discipline needs and (ideally) fitted to specific needs/contexts of each student. Capstones experiences are less about gaining new skills or knowledge and more about applying, creating, or synthesizing.
 - Student evaluation should be based on their ability to meet the Learning Outcomes, assuming these outcomes articulate the criteria that characterize and optimal capstone “product”.
 - Satisfactory completion of the Capstone should be a requirement for graduation.
 - Full time, experienced faculty should facilitate, mentor and coordinate the Capstone.
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