

Assignment 3 - Project Documentation: Creating a Content Module for Calculus 12

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Assignment 3

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### **Theme**

Our group will be continuing to explore and experiment with the affordances and limitations of Moodle in developing our content module for a Calculus 12 course. For Assignment 3, we will be specifically developing Unit 4 - Differentiation and continue to integrate multimedia tools in order to create an interactive and engaging online course for students. We will continue to be guided by three central pedagogical frameworks of learning 1) creating a student-centred learning environment (SCLE), 2) creating technology that is sound in pedagogy, content, and knowledge (TPCK), and 3) incorporating collaborative tools to foster a social learning environment. In addition, we will continue to base our prescribed learning outcomes as outlined by the Saskatchewan Ministry of Education (Saskatchewan Ministry of Education 2012).

### **Rationale**

When developing a content module, we need to be cognizant of creating technology that is sound in pedagogy, content, and knowledge (TPCK). It is imperative that we are guided by theory in best practices for developing content and knowledge related to teaching mathematics as we are developing a Calculus 12 course. Donovan (2005) states the importance of “designing instructional activities that can effectively bridge commonly held conceptions and targeted mathematical understandings” (p. 223). By providing a questionnaire at the beginning of the unit, we will allow students to express their prior learning in order to draw out misconceptions that need to be addressed before beginning the unit. Including this questionnaire, students will also build a foundation as to which specific mathematical skills they will be required to use throughout the unit of study. Donovan (2005) emphasizes “both the need to build on existing

knowledge and the need to engage students' preconceptions— particularly when they interfere with learning” (p 218). By including a pre-unit assessment we will uncover any of these preconceptions that can interfere with learning and attempt to remedy them as early as possible. It is likely that many students' prior knowledge will be valid and thus the pre-assessment will serve as a refresher while for those students who have misconceptions, we will be able to address those before they become a barrier to learning the content to be presented. We have also included an exit survey to allow students to reflect on their current learning and provide the instructors with feedback on how to improve the course.

Continuing with our goal of creating a Student-centred Learning Environment (SCLE's), we will strive to “draw out and build on student thinking” (Donovan, 2005, p 242). Throughout our unit, opportunities will be provided for students to test their understanding with practice questions and online practice quizzes. “All operations are actions when they are first performed because they require conscious effort. With practice and internalization, activities collapse into actions and eventually into operations, as they become more automatic, requiring less conscious effort” (Jonassen, 2012. p 99). This is an essential component of learning mathematics as “concepts, rules and theories that are not associated with activity have no meaning” (Jonassen, 2012. p 105). Especially so in Calculus, as differentiation is an essential concept for understanding the power nature and uses of calculus. In this particular course, each of the next three units of study (Units 5 through 7) have differentiation as the cornerstone of understanding the higher level content that will be presented. Automaticity in differentiation becomes essential to learning new and novel content later on. As well, we will strive to provide opportunities for students to continue to connect their previously learned concepts to current learning, such as in

Section 4.1, where “we will review slopes and equations of lines and begin to make the connections between previously studied algebra and the Calculus we will be studying throughout the unit”. Because the lessons are audio/video recorded, students can preview lesson material at home to address any gaps in learning that took place during a lesson and take the necessary time required to grasp concepts. As the recordings are made incrementally, students have the ability to go back and review very specific content pieces, without having to navigate through other content.

In addition, “learning occurs most naturally and meaningfully within sociocultural, activity-oriented contexts” (Jonassen, 2012, p 98). Therefore, it is necessary to continue to provide opportunities for students to engage in dialogue with their classmates to further their understanding and clear up misconceptions. SCLE’s provide “access to shared information and knowledge building tools to help learners to collaboratively construct socially shared knowledge.” (Jonassen, 2012. p 96). We will achieve this by using Moodle forums to create learning opportunities for students to both construct their own understandings and to scaffold their understandings with those of their classmates. Some of the most powerful learning occurs in those interactions between students. By seeing multiple perspectives from multiple sources (students, teachers, etc.) students can cement their understanding in deeper ways than through a single source without a social component. Donovan (2005) states that “If mathematics learning is not grounded in an understanding of the nature of the problem to be solved and does not build on a student’s own reasoning and strategy development, then solving problems successfully will depend on the ability to recall memorized rules.” (p 222).

Overall, the assessment tools that we integrate into the LMS Module will allow the instructor to address the following areas outlined by Bates (2014): 1) to improve and extend students' learning, 2) assess students' knowledge and competence in terms of desired learning goals and outcomes, 3) to provide the teacher/instructor with feedback on the effectiveness of their teaching and how it might be improved. Assessment tools are also necessary in creating effective learning environments:

*Quality online learning provides many opportunities for assessment – opportunities that involve the teacher, but also ones that exploit the influence and expertise of peers and external experts, others that use simple and complex machine algorithms to assess student learning, and perhaps most importantly, those that encourage learners to reflectively assess their own learning (Anderson, 2008. p. 49).*

### **Learning Objectives**

Following the completion of the Content Module Unit 4 - Differentiation, students will be able to...

- demonstrate understanding of differentiation based on slope as a rate of change.
- express prior learning and address misconceptions
- socially construct learning through collaboration with classmates
- continue to connect their previously learned concepts to current learning
- reflect on their current learning and provide feedback of their learning experience
- complete the expectations and norms assignment, and adhere to these expectations throughout the course

- complete the test assignment and upload multiple files into a single assignment shell

### **Functionality of its elements**

Our Calculus 12 content module contains the following module structure and sections:

#### 1. Assessment methods/tools - formative/summative assessment collected

- questionnaire to assess prior learning
- formative practice questions
- online practice quizzes
- Formative mid-unit review
- Final review practice exam
- Final unit test
- exit survey to allow students to reflect and share their learning throughout Unit 4 as well as provide instructors with feedback

#### 2. Communication methods/tools

- Students will use the News Forum to collaboratively share their learning
- Students have been asked to post questions to each other, as well as the instructor, if they need further clarification to understand concepts.

#### 3. Content elements

- skeleton notes
- lessons recorded in video format;
- final unit practice test for review purposes

#### 4. Graphic and/or media elements.

- image of a toolbox included at beginning of Unit 4 to draw students attention
- incorporates multimedia; lessons are in video format
- resources section includes Internet links to online tutorial sites that support learning

5. Navigation elements.

- students are encouraged to use Firefox as a browser, as this browser is most compatible with Moodle.
- resources include FAQ questions/answers

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