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Design, Redesign, and Continuous Refinement of an Online Graduate Course: A Case Study for Implementing Universal Design for Learning

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Abstract
This paper explains how a graduate online course has been designed, redesigned and continuously refined in the last decade, applying the Quality Matters (QM) Framework and Universal Design for Learning Principles (UDL). To improve the course design, the course designers and instructors are engaged in a reflective process of examining relevant factors, including external contexts that demanded changes in the course, the course's existing features, learner characteristics and needs, and the nature and requirements of the course content, activities, assessments. The paper provides detailed descriptions of the design process, as well as the modifications and changes made for the course over years and demonstrates how the design features adheres to the UDL principles.

Keywords Universal Design for Learning · Quality Matters · Course redesign · Graduate online course

Background

In the past two decades, online learning has been growing exponentially in higher education (Crawley, 2012). Many institutions are motivated to grow their online programs to increase enrollment at a lower cost (Green, 2010). At Towson University, resources are allocated to support the development of online courses. For example, faculty can apply for a university grant to transform face-to-face courses to be fully online. During the course conversion process, faculty receive instructional design support provided by the university's Office of Technology Services (OTS). In 2010, two faculty members from the Department of Educational Technology and Literacy successfully received the university grant to convert a 3-credit graduate course, *Instructional Development*, to be an online course. This course design project involved several phases that spanned over multiple years. Several faculty members have served as both instructors and instructional designers at different stages of the process and continuously redesigned and refined this course with a particular focus on incorporating the Universal Design for Learning (UDL) framework to enhance students' course experiences. The goal of this study is to document the course design process and examine how the different roles and factors, such as the faculty members, the learners, and the course requirements, influenced the specific design features related to UDL.

Research Design

Considerable efforts have been made to study the course design practices in recent years (e.g., Gardner & Carder, 2018; Lowell & Moore, 2020), but only a few studies have examined the design process over an extensive period of time (e.g., Honebein & Honebein, 2014). To address this gap, we conducted a longitudinal inquiry about the complicated process of design, redesign, and continuous refinement of the online course that began in 2010. Compared with the research methods such as surveys, interviews, or focus groups that capture snapshots of a process, a case study design (Yin, 2014) is more appropriate for this study. The researchers are instructors and designers of the course and serve as participant-observers. One of them has been involved in the course design since 2010, and the other joined the process in fall 2019. Data of the study are from the following sources: (1) the artifacts of the design process (e.g., the course planning charts, design templates, notes from design meetings), (2) the course materials and learning objects (e.g., syllabi, videos on course topics, instructions for assignments, projects, and activities), (3) reflection notes from instructors, and (4) student assignments.

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Table 1 Course planning chart

Module #	Course Level Objectives	Module Level Objectives	Readings	Content	Activities	Assessments
-	-	-	-	-	-	-

Phase I: Online Course Design

Design Frameworks

The design project began in 2010 with a meeting between the course instructors and the OTS staff. During the meeting, two frameworks were identified to guide the design efforts. The first one was Quality Matters (QM) Higher Education Rubric (2008). The QM framework includes specific standards across eight categories essential to successful online learning. The second one was the Universal Design for Learning (UDL) framework identified as a complement to the QM rubric (Robinson & Wizer, 2016). UDL emphasizes multiple means of representation, action, and expression, as well as engagement across three primary brain networks (Recognition, Strategic, and Affective) in order to optimize the "what," "how," and "why" of learning (CAST, 2018). Cited within this case study are Standards from the Quality Matters Higher Education Rubric, Sixth Edition (Quality Matters Program, 2018) with a QM designation (e.g., QM 1.1) and UDL Guidelines (CAST, 2018) with a UDL designation (e.g., UDL 7.1). Appendix 1 and 2 present the QM Standards and UDL guidelines.

Design Templates

In the beginning stage of the design project, the instructional designer from OTS shared a variety of templates. These included a course planning chart (Table 1) for aligning course- and module-level objectives, assessments, learning activities, and media content (QM 2.2, 3.1, 5.1, and 6.1; UDL 3.2, 6.4, and 8.1), and a course syllabus template where information for academic and technical support services were embedded (QM 7.1–7.4; UDL 1.2–1.3). The course was delineated into nine modules, each designed based on a template (Fig. 1) to enhance consistency (QM 1.1–1.2, 2.2–2.4, 4.2, and 5.3—5.4; UDL 3.2–3.4). These templates were then deployed in the university's Blackboard Learning Management System so that its "built-in" features (e.g., Course Modules, Discussions, Grade) could be utilized to support accessibility and usability (QM 8.1; UDL 6.1 and 6.3).

Course Content and Assessments

The instructors met weekly to design the specific components of the course. Course content was primarily based on two textbooks: *The Essentials of Instructional Design* (Brown & Green, 2010) introduced the key concepts and tasks of the instructional design process. *The ID casebook* (Ertmer & Quinn, 2006) provided case studies in authentic instructional design settings (QM 4.2, 4.4, 4.5, y 5.1–5.2; UDL 4.1, 5.2, 7.2, 8.3). *The ID cases* were directly related to and supported the readings in Brown and Green, (2010).

Among the nine course modules (Fig. 2), Modules 1–8 were designed to last one week, providing building blocks to the final project in Module 9 (QM 1.1–1.2, 4.2, and 5.3–5.4; UDL 3.2–3.4, 6.2, 6.4, 7.2, and 8.4). During each of the first eight modules, students were asked to read the assigned textbook chapters and perform an instructional design task (e.g., needs analysis, learner analysis) covered in that module to prepare

Fig. 1 Module design template

Module Calendar

Calendar

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Module 2 Begins						**Module 2 Ends**
Module 2 Begins - brief video introduction available in BB.	Module 2 Online Discussion		Complete PITP Organizer			Module 2 CAT due All module 2 materials due.

for their final projects. At the end of the module, students completed a case study group discussion using Blackboard Discussion Forums. They also individually turned in a brief paper, called Classroom Assessment Techniques (CATs), to reflect on personal experiences in relation to the module readings and activities (QM 3.1, 3.3–3.5; UDL 9.1–9.3). The CATs provided a mode of direct communication with the instructor on a weekly basis (QM 5.3; UDL 9.3). In the last module, students were required to complete the final project, where they identified their own topics and audience, and applied the content from previous modules to design a comprehensive instructional plan (QM 2.2, 2.4; UDL 3.1–3.4, and 6.1–6.3).

Pilot Implementation

In the summer of 2011, the fully online version of the course was piloted with a cohort of teachers from a local school system. A face-to-face orientation meeting was first held to walk students through the course and solicit their feedback (QM 1.1, 1.2, 5.4, 8.1, and 8.2; UDL 7.2 and 8.3). One pressing concern from the cohort was that it appeared the course required daily participation, which was actually not the intended design. Upon reflection, the instructors adapted each module checklist to include specific dates for learning activities, for example, having a discussion starting on a Tuesday and concluding on a Thursday (QM 5.4; UDL 6.3 and 7.3). This measure alleviated much of the anxiety among cohort members. Mid-way through the course pilot, one of the students developed a day-by-day calendar for the course based on the module checklists (QM 1.1; UDL 1.3). The calendar was warmly received by other students in the course and was incorporated into the course's future implementations (Fig. 3)

Upon conclusion of the pilot implementation, the instructors made the following adjustments:

- Screencast videos were created to accompany the text instructions for each module to guide the students through the module checklists, while navigating Blackboard (QM 8.4; UDL 1.3).
- Rubrics were added for the case study discussions (QM 3.5; UDL 5.2 and 6.4).
- A process of having the students reflect on their group discussions was instituted (QM 3.5; UDL 7.1 and 9.3).

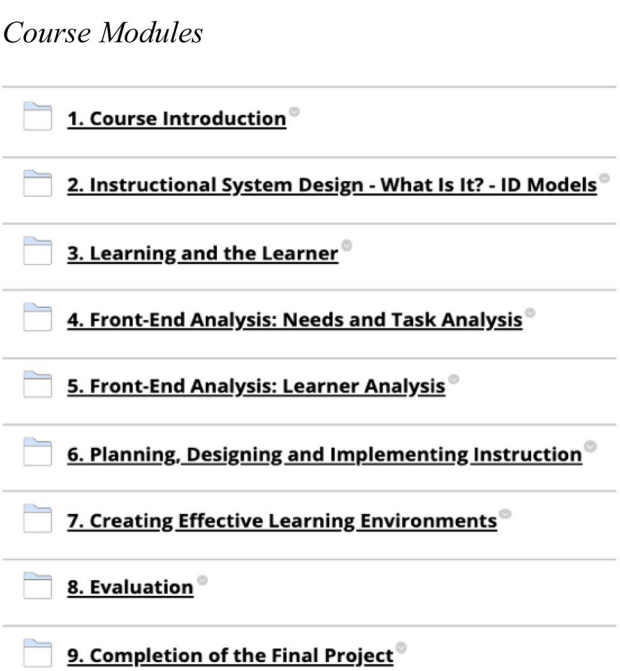

Fig. 2 Course modules

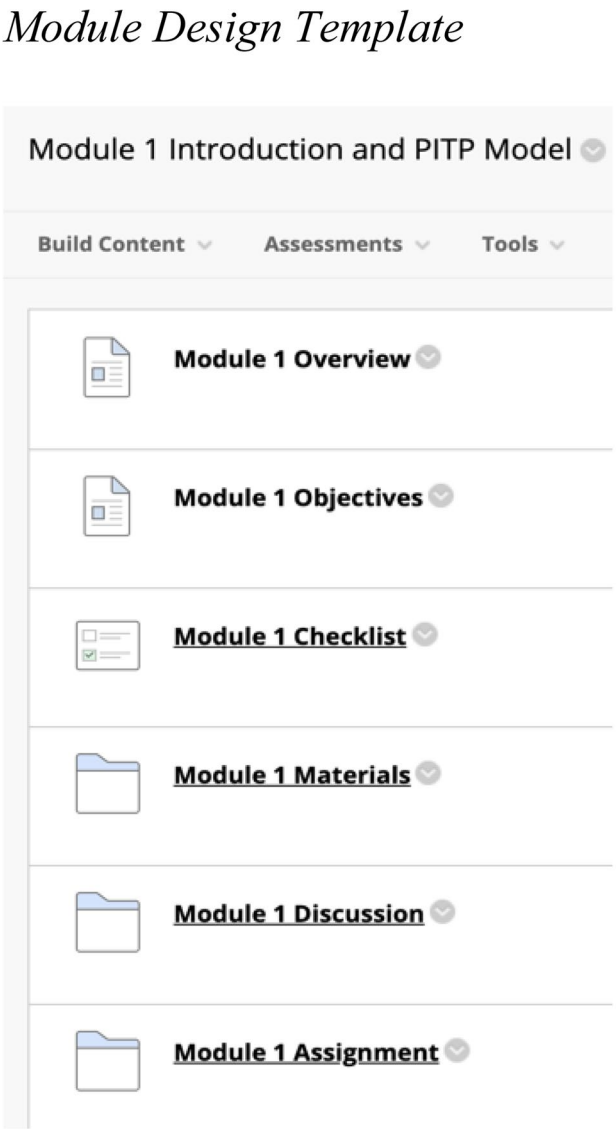

Fig. 3 Module calendar

From 2011 to 2018, annual incremental changes were made to the course based on instructor reflections on the course design and implementation, student feedback from the course evaluation forms, performance data from the final project, peer assessments on teaching effectiveness, and conversations with other faculty members. Another important factor that drove the course changes was the updates of the design frameworks. For example, newer editions of Rubric were published Quality Matters Program (2015, 2018), with a stronger emphasis on supporting accessibility. Therefore, information on and links to the university's accessibility policies and services (QM 7.2) were added as part of the course overview.

Phase II: Online Course Design Revisited

In 2018, the Towson University Instructional Technology Program obtained permission from the Maryland Higher Education Commission to offer the program in a fully online format. All the courses (including those already delivered online) were required to be formally reviewed by the university's QM review team. Additionally, the program decided to redesign courses to be delivered on a 7-week schedule. To meet these new requirements, two faculty members from the program, including one instructor from the 2010 design project, completed a substantive re-examination and revision to the course. The changes made impacted the course objectives, structure, content, and materials. Specifically, from spring 2019, the course objectives were edited to be aligned with the most recent professional standards, including American Association of School Librarians (AASL) School Librarian Standards (2019), Association for Educational Communications and Technology (AECT) Standards (2012) and International Society for Technology in Education (ISTE) Coaches Standards (2016). The previous nine modules were consolidated into seven modules. New editions of the textbooks (Brown & Green, 2016; Ertmer et al., 2014) were adopted. Particularly, the new case studies (Ertmer et al., 2014) provided scenarios more inclusive for different individuals and cultures. The course then went through the QM review process, and further minor modifications were made based on the reviewer's feedback.

As of the summer of 2019, the revised online course ran on two threads: (a) a systematic review and application of the instructional design (ID) process and (b) analysis of a series of ID cases. Students have opportunities to work both individually and collaboratively on assignments, discussions, and projects. The course has several salient features to enhance online learning including the following:

- Clear alignment among course objectives, module objectives, learning activities, and assessments.
- Consistent structure in each module that includes learning objectives, checklist, readings, activities, and assessments.
- Weekly calendar to guide students to plan and manage their learning of each module.
- Scaffolds to help students complete the final project, including detailed project instructions and rubric, sample projects, and opportunities for drafting certain portions of the project to receive formative feedback.

Phase III: Continuous Refinement

Fall 2019

In the fall of 2019, a new faculty member joined the program and was assigned to teach one section of the course in the first 7-week of the semester. The new instructor had designed and taught the same course at a different institution, but this was her first time to teach the course designed by others. This was a great opportunity for the instructor to be more conscious and reflective about her own practice and for the course to be cross-examined by fresh eyes.

Week 1

Fourteen students were enrolled in the course. Following the original design of the Week 1 activities, students introduced themselves in the discussion forum, reviewed, and asked questions about the instructions of the final project. Since there were several group assignments, the instructor decided to create another discussion forum "Greet Your Group" for students to also interact within their groups to discuss their shared learning goals, group norms, and collaboration tools. Students were reminded that besides the Blackboard discussion forum, there were other collaboration platforms available, such as Google Doc and OneDrive. Based on students' Week 1 learning, the instructor identified a few areas of potential needs and opportunities:

Students' Diverse Backgrounds. The course's primary audience was assumed to be K-12 teachers and school librarians. However, over the past years, this course has been attracting an increasing number of students from other fields. In the fall 2019, about 50% of this course section was non-K12 educators, which included a full-time student and seven professionals from the training industry, higher education, and the human resources development field. The changing characteristics of learners suggested that it was necessary to revisit the course design to ensure its content, instruction, and assessments are relevant and meaningful to all students.

Students' Technology Preferences. The "Greet Your Group" discussions revealed that students were quite flexible with collaboration tools. Some had preferences to using either the Google Doc or the Blackboard forum, but they were also fine with other technologies. Some voluntarily shared their cellphone numbers, suggesting to their peers they could send group texts for the logistical pieces of collaboration. It showed

students were open to use different technologies, and mobile devices seemed to be part of their online learning tools. Therefore, it might be beneficial to provide opportunities for students to select the technologies they prefer and to use mobile devices in their learning experiences.

Course Learning Activities and Projects. In this course, students learn the ID process and apply it to specific learning contexts by analyzing ID cases and completing a final project. The project, taking about 50% of the course grade, requires learners apply the pebble-in-the pond (PITP) model (Merrill, 2015) to create a comprehensive instructional plan, demonstrating the key steps of instructional design, including needs analysis, learner analysis, task analysis, and planning for instructional strategies, materials, and assessments. As mentioned, the course had already provided scaffolding resources to guide students through the project, but students suggested that they need more support. For example, they would like to know how to manage the complicated requirements of the project; the non-K12 educators need help connecting the project to their professional settings.

The three aspects above were viewed as interrelated rather than independent to each other. It is essential to address learners' backgrounds and technology preferences when developing additional scaffolds for the course activities and the final project. On the other hand, students' diverse experiences and technology expertise are great assets that can be leveraged to design the social process of online learning (Vygotsky, 1978). The potential needs and opportunities identified from Week 1 helped inform how to design and implement new course features in the remaining weeks.

Week 2

In Week 2, there is already an ungraded learning task for students to identify and analyze the central problem of their final projects by creating a PITP graphic organizer. In the previous course offerings, a template and sample works, along with a video explaining the sample works, were provided as scaffolding resources. Built on the Week 1 reading, this task is an important starting point of the final project. It requires high-level thinking and several ID competencies in that students identify a learning problem from their own context, define the problem to specify learning goals or learning gaps, apply the PITP model to dissect the problem into a progression of sub-components, and represent them using a graphic organizer. A particular challenge is that students have to apply the PITP model to their own context, which is a far transfer of learning (Macaulay & Cree, 1999).

Considering the above task analysis, as well as the needs identified from Week 1, the instructor created a 10-min video explaining the required reading on the PITP model (Merrill, 2015). The video reflects the UDL principles by providing multiple means of representation. Using highlighters, figures, and auditory information, the video not only demonstrated the key components of the PITP model but clarified how they relate to the different sections of the final project.

Additionally, a discussion forum was created on Blackboard for students to post their graphic organizers. Both the instructor and the students provided formative feedback to the shared works, so that learners could promptly adjust their project plans to stay on the right track. More importantly, the discussion forum fostered communication and exposed students to multiple examples, which substantially expanded learning opportunities. Particularly, since students were bringing different professional backgrounds to the course, they would be able to compare sets of varied context examples, which are effective for facilitating far-transfer learning (Gentner et al., 2003). For the same reason, discussion forums were set up for the following weeks, encouraging students to share, review, and provide feedback on a small portion of the final project they completed. For example, in the subsequent weeks, students drafted and discussed the needs analysis section and the learner analysis section of their projects.

Week 3

From Week 3, students started to manage the two course activities threads simultaneously, not only continuing to learn the ID models and apply it to their final projects, but also analyzing the ID cases from the textbook. Following the original design, students were divided into groups and provided with the guiding questions for each case analysis. Discussion threads were created on Blackboard for each group. The expectation was that the group would examine how the ID concepts, theories, and models were actually implemented in various scenarios.

Considering the students' diverse backgrounds and the potential challenge for making connections between the context-specific ID cases and the general ID models, the instructor added two features to the case study discussion. First, besides the guiding questions, the instructor provided a summary and a list of learning goals for each case. The learning goals contain the key words and concepts from the case, which could guide students' conversations, and help them understand that their learning should go beyond responding to the discussion questions. Essentially, they were expected to demonstrate deductive or inductive reasoning to identify the central issues of the cases and analyze how the key roles or contextual factors affect the prioritization and the execution of the ID steps and the impact of the solution designed.

The second feature was to provide a shared Google Doc on each group discussion thread. The Google Doc served two purposes: (a) to present the case summary and learning goals described above and (b) to function as an optional workspace for each group. Based on Week 1's "Greet Your Group" activity,

students were open to use different collaboration technologies. Now that students had two options, they could choose between Google Doc and the Blackboard forum whichever worked better for their group. Certain advantages with Google Doc were that students could directly type in the document without logging into Blackboard, and use the embedded features, such as "comment" and "voice typing," to enhance group interactions. Students could also download the Google Doc app to their mobile devices which could promote continuous and ubiquitous access and participation in the case discussions. It was found that all groups decided to use Google Doc to conduct collaborative case analysis, showing that the new option was well received.

Week 5

In Week 5, a few new components were designed to support students' final projects. By Week 5, students had already completed several components of their final projects, including the PITP graphic organizer from Week 2, needs analysis from Week 3, and learner analysis from Week 4. Students were getting ready to design content, strategies, and assessments to address the learning problems identified. To clarify project expectations and help learners understand the relationships among the different pieces of the project, the instructor created a video in Week 5 walking through the project instructions and explaining how students could use the findings from needs analysis and learner analysis to support their design of strategies and assessments.

The instructor also offered optional one-on-one virtual meeting opportunities starting from Week 5. Each meeting was designed to be a 30-min, semi-structured session for providing individualized support. Before the meeting, the instructor prepared a shared document, summarizing the student's project sections already completed. In the first half of the meeting, the instructor and the student looked through the shared document together. The instructor asked probing questions to guide the students to articulate the audience, context, and learning problems of their projects and gave feedback and suggestions on students' design. After that, the student could ask questions about the project or about the course in general. About 70% of the students voluntarily participated in the one-to-one sessions, suggesting these meeting opportunities were perceived to be necessary.

In summary, the refinement of the fall 2019 section was achieved through the application of several UDL principles:

- More videos were offered as alternatives for audio and visual information (UDL 1.2 and 1.3).
- Through more video and text instructions, key vocabulary, concepts, and relationships were clarified and highlighted to enhance understanding (UDL 2.1 and 3.2).
- For case study discussions, learning goals were explicitly stated to complement the existing guiding questions to motivate students to make continuous effort (UDL 8.1).
- More discussions and meetings were designed to encourage interactions that promoted social and cognitive engagement and peer support (UDL 8.3). Particularly, during discussions, students' background experiences were activated to serve as relevant, context-specific examples to enrich others' understandings (UDL 3.1) and facilitate far-transfer learning (UDL 3.4) (Gentner et al., 2003).
- Opportunities for students to choose the preferred technology for collaboration support learner autonomy (UDL 7.1).

Spring 2020

The course was offered again in the spring of 2020. The section had 15 students taught by the same instructor. The course design and implementation mostly followed the fall 2019 format, but some changes were made to the weekly Classroom Assessment Techniques (CATs).

Based on the experiences from last semester, as well as Week 1's "Greet Your Group" discussion, the instructor found that most students were already familiar with some digital tools and were open to learning new technology. Since this is an instructional design course, it seemed essential to expand the students' toolbox by exposing them to various digital tools commonly used in instructional design. Therefore, the CATs were modified to provide opportunities for students to practice new tools. The learning goals and writing prompts of CATs stayed the same, but in addition to sharing reflections in writing, students had the options to create multimedia content. In order not to overwhelm learners with too many changes, graduated levels of options were added across the weekly CATs.

In Week 1, students were still asked to address the prompt in writing, but the instructor added a note on the CAT instruction sheet, indicating that in the remaining weeks, students can submit either a paper or a multimedia version for this assignment. The instructor explained the rationale for including the new option, encouraged students to explore how to apply digital tools to create multimedia content, but ensured that no points will be deducted for choosing either option.

In Week 2, students could choose either writing a paper or creating an online presentation. Two presentation software were suggested, Google Slides and Prezi, since many students were already familiar with them. The Week 1 note was also included in the Week 2 instruction sheet to remind students why it would be helpful to explore the multimedia option.

In Week 3 through Week 5, one more option was added to the previous week's list, with one or two suggested new tools (Table 2). These tools were chosen because they are relatively easy to use and students can use their basic features for free. The Week 6 CAT offered the same options with Week 5. Week 7's CAT provided a word document template for students to reflect on their collaborative

Table 2 Suggested multimedia tools for CATs from week 2 through week 5

Week 2	Week 3	Week 4	Week 5
Text	Text	Text	Text
Online presentation -Google slides -Prezi	Online presentation –Google slides -Prezi Video -Screencast-O-Matic	Online presentation -Google slides -Prezi Video -Screencast-O-Matic Infographic -Canva -Venngage	Online presentation -Google slides -Prezi Video -Screencast-O-Matic Infographic -Canva -Venngage Website -Weebly -Wix

Table 3 Number and percentage of students choosing text or multimedia options

	Multimedia submissions	Text submissions	Total submissions
Week 2 CAT	4 (30.8%)	9 (69.2%)	13
Week 3 CAT	4 (26.7%)	11 (73.3%)	15
Week 4 CAT	10 (66.7%)	5 (33.3)	15
Week 5 CAT	8 (53.3%)	7 (46.7%)	15
Week 6 CAT	8 (53.3%)	7 (46.7%)	15
Total	34 (46.6%)	39 (53.4%)	73

experience, so students submitted their last CATs in writing. Table 3 shows that the percentage of students choosing the multimedia options increased over the weeks, which seems to suggest that gradually increasing options for learners (UDL 5.3) could encourage them to use multiple tools to demonstrate learning in different ways (UDL 5.2).

Discussions and Conclusions

The purpose of this paper is to explain the complicated process of designing, redesigning, and refining a graduate course. Three themes have emerged from our experiences:

The Importance of Design Frameworks

At the beginning of the design project, Quality Matters and Universal Design for Learning were adopted as the guiding frameworks, which we believe was a crucial step. Due to the time and resource constraints, we were unable to connect with prospective students to conduct a full-scale needs analysis or learner analysis to identify the specific design elements for the online course. Aligning our design efforts with the QM and UDL frameworks is beneficial because they indicate many essential components an effective online course should have (QM) and help us anticipate the potential needs of students and make plans accordingly (Edyburn, 2010). By applying these frameworks that have been widely used in different disciplines (e.g., Harkness, 2015; Kwon et al., 2017), the design team could efficiently create course templates and embed them to the Blackboard Learning Management System and make sure the course includes the features required or recommended by the design frameworks.

Table 4 ULD guidelines addressed over time

I. Provide multiple means of representation	II. Provide multiple means for action and expression	III. Provide multiple means for engagement
Provide options for	Provide options for	Provide options for
Perception (1) 1.1 1.2[c] 1.3[a,b,c]	Physical action (4) 4.1[a] 4.2	Recruiting interest (7) 7.1[b,c] 7.2[ab] 7.3[c]
Language and symbols (2) 2.1[c] 2.2 2.3 2.4 2.5	Expression and communication (5) 5.1 5.2[a,b,c] 5.3[c]	Sustaining effort and persistence (8) 8.1[ac] 8.2 8.3[a,b,c] 8.4[a]
Comprehension (3) 3.1[a,c] 3.2[a,c] 3.3[a] 3.4[a,c]	Executive functions (6) 6.1[a] 6.2[a] 6.3[a,c] 6.4[a,c]	Self-regulation (9) 9.1[a] 9.2[a] 9.3[a,c]

[a]The design efforts in the summer 2010

[b]The modifications immediately after the pilot implementation in the summer 2011

[c]The refinement in the fall 2019 and the spring 2020

Two-Dimensional Efforts to Address UDL Guidelines

The UDL Guidelines include 31 points organized under nine categories (CAST, 2018). During the design process in the summer 2010, the instructional designers made extensive efforts to embed strategies to address 19 guidelines across eight categories. After the pilot implementation in the summer 2011, the design team modified the course to address nine points, two of which were not previously addressed (UDL 7.1 and 7.3). In 2019–2020, the new instructor refined the course, meeting 11 UDL guidelines, two of which were new (UDL 2.1 and 5.3). By the fall 2019, all the nine categories of UDL were addressed.

Our efforts to apply the UDL framework included two dimensions: horizontally meeting an increasing number of guidelines and vertically addressing each guideline in-depth. For example, UDL 1.3 (offer alternatives for visual information) was addressed in the initial design through the Blackboard interface. It was revisited in the summer 2011 and in 2019. Each time, the designers developed more visual information, such as the course calendar, module checklist, and graphic organizer, to complement the text content. Our experiences suggest it requires sustained efforts to meet more UDL guidelines and address the existing guidelines to a greater extent (see. Table 4).

Need for Flexibility with Implementing UDL

The UDL framework is learner-centered. It is pivotal to consider the learner needs, characteristics and preferences before designing specific strategies to address the UDL guidelines. As mentioned earlier, the course was first taken by mostly K-12 teachers, but in the most recent offerings, students enrolled had different professional backgrounds and technology preferences. The changing profiles of learners suggest a need for being flexible about the UDL implementation, as the previously designed features may need to be revised or expanded in order to better meet student needs. Our efforts to provide flexibility to facilitate student learning have been in line with the existing literature (Smith, 2012; Tobin, 2014). For example, the Blackboard discussion forum helps "foster collaboration and community" (UDL 8.3). However, since some students indicated their preference to Google Doc as a collaboration tool, it would be beneficial to provide Google Doc as a second option.

In conclusion, we will continuously improve the course design by applying the UDL framework. Our future efforts will be two-folded: we will design new features to address the UDL principles that have not been addressed before (e.g., 2.2–2.5). We will also examine the guidelines previously met and reflect on how we can address them more thoroughly. We plan to regularly conduct needs analysis and learner analysis and use the findings to determine whether and how to refine the course design in order to address the UDL principles and meet student needs.

Appendix 1

Standards from the Quality Matters Higher Education Rubric

	2008–2010 edition	2018 edition
Course overview and introduction	1.1 Instructions make clear how to get started and where to find various course components 1.2 A statement introduces the student to the purpose of the course and to its components; in the case of a hybrid course, the statement clarifies the relationship between the face-to-face and online components 1.3 Etiquette expectations (sometimes called "netiquette" for online discussions, email, and other forms of communication are stated clearly 1.4 The self-introduction by the instructor is appropriate and available online 1.5 Students are asked to introduce themselves to the class 1.6 Minimum student preparation, and, if applicable, prerequisite knowledge in the discipline are clearly stated 1.7 Minimum technical skills expected of the student are clearly stated	1.1 Instructions make clear how to get started and where to find various course components 1.2 Learners are introduced to the purpose and structure of the course 1.3 Communication expectations for online discussions, email, and other forms of interaction are clearly stated 1.4 Course and institutional policies with which the learner is expected to comply are clearly stated within the course, or a link to current policies is provided 1.5 Minimum technology requirements for the course are clearly stated, and information on how to obtain the technologies is provided 1.6 Computer skills and digital information literacy skills expected of the learner are clearly stated 1.7 Expectations for prerequisite knowledge in the discipline and/or any required competencies are clearly stated 1.8 The self-introduction by the instructor is professional and is available online 1.9 Learners are asked to introduce themselves to the class

	2008–2010 edition	2018 edition
Learning objectives	2.1 The course learning objectives describe outcomes that are measurable 2.2 The module/unit learning objectives describe outcomes that are measurable and consistent with the course-level objectives 2.3 All learning objectives are stated clearly and written from the students' perspective 2.4 Instructions to students on how to meet the learning objectives are adequate and stated clearly 2.5 The learning objectives are appropriately designed for the level of the course	2.1 The course learning objectives, or course/program competencies, describe outcomes that are measurable 2.2 The module/unit-level learning objectives or competencies describe outcomes that are measurable and consistent with the course-level objectives or competencies 2.3 Learning objectives or competencies are stated clearly, are written from the learner's perspective, and are prominently located in the course 2.4 The relationship between learning objectives or competencies and learning activities is clearly stated 2.5 The learning objectives or competencies are suited to the level of the course
Assessment and measurement	3.1 The types of assessments selected measure the stated learning objectives and are consistent with course activities and resources 3.2 The course grading policy is stated clearly 3.3 Specific and descriptive criteria are provided for the evaluation of students' work and participation 3.4 The assessment instruments selected are sequenced, varied, and appropriate to the content being assessed 3.5 "Self-check" or practice assignments are provided, with timely feedback to students	3.1 The assessments measure the achievement of the stated learning objectives or competencies 3.2 The course grading policy is stated clearly at the beginning of the course 3.3 Specific and descriptive criteria are provided for the evaluation of learners' work, and their connection to the course grading policy is clearly explained 3.4 The assessments used are sequenced, varied, and suited to the level of the course 3.5 The course provides learners with multiple opportunities to track their learning progress with timely feedback
Instructional materials	4.1 The instructional materials contribute to the achievement of the stated course and module/unit learning objectives 4.2 The relationship between the instructional materials and the learning activities is clearly explained to the student 4.3 The instructional materials have sufficient breadth, depth, and currency for the student to learn the subject 4.4 All resources and materials used in the course are appropriately cited	4.1 The instructional materials contribute to the achievement of the stated learning objectives or competencies 4.2 The relationship between the use of instructional materials in the course and completing learning activities is clearly explained 4.3 The course models the academic integrity expected of learners by providing both source references and permissions for use of instructional materials 4.4 The instructional materials represent up-to-date theory and practice in the discipline 4.5 A variety of instructional materials is used in the course
Learning activities and Learner interaction	5.1 The learning activities promote the achievement of the stated learning objectives 5.2 Learning activities foster instructor-student, content-student, and if appropriate to the course, student–student interaction 5.3 Clear standards are set for instructor responsiveness and availability (turnaround time for email, grade posting, etc.) 5.4 The requirements for student interaction are clearly articulated	5.1 The learning activities promote the achievement of the stated learning objectives or competencies 5.2 Learning activities provide opportunities for interaction that support active learning 5.3 The instructor's plan for interacting with learners during the course is clearly stated 5.4 The requirements for learner interaction are clearly stated

	2008–2010 edition	2018 edition
Course technology	6.1 The tools and media support the learning objectives, and are appropriately chosen to deliver the content of the course 6.2 The tools and media support student engagement and guide the student to become an active learner 6.3 Navigation throughout the online components of the course is logical, consistent, and efficient 6.4 Students have ready access to the technologies required in the course 6.5 The course components are compatible with current standards for delivery modes 6.6 Instructions on how to access resources at a distance are sufficient and easy to understand 6.7 The course design takes full advantage of available tools and media	6.1 The tools used in the course support the learning objectives or competencies 6.2 Course tools promote learner engagement and active learning 6.3 A variety of technology is used in the course 6.4 The course provides learners with information on protecting their data and privacy
Learner support	7.1 The course instructions articulate or link to clear description of the technical support offered 7.2 Course instructions articulate or link to an explanation of how the institution's academic support system can assist the student in effectively using the resources provided 7.3 Course instructions articulate or link to an explanation of how the institution's student support services can help students reach their educational goals 7.4 Course instructions answer basic questions related to research, writing, technology, etc., or link to tutorials or other resources that provide the information	7.1 The course instructions articulate or link to a clear description of the technical support offered and how to obtain it 7.2 Course instructions articulate or link to the institution's accessibility policies and services 7.3 Course instructions articulate or link to the institution's academic support services and resources that can help learners succeed in the course 7.4 Course instructions articulate or link to the institution's student services and resources that can help learners succeed
Accessibility and usability	8.1 The course incorporates ADA standards and reflect conformance with institutional policy regarding accessibility in online and hybrid courses 8.2 Course pages and course materials provide equivalent alternatives to auditory and visual content 8.3 Course pages have links that are self-describing and meaningful 8.4 The course ensures screen readability	8.1 Course navigation facilitates ease of use 8.2 The course design facilitates readability 8.3 The course provides accessible text and images in files, documents, LMS pages, and web pages to meet the needs of diverse learners 8.4 The course provides alternative means of access to multimedia content in formats that meet the needs of diverse learners 8.5 Course multimedia facilitate ease of use 8.6 Vendor accessibility statements are provided for all technologies required in the course

Appendix 2

Universal Design for Learning Guidelines Version 2.2

I. Provide multiple means of representation	II. Provide multiple means for action and expression	III. Provide multiple means for engagement
1. Provide options for perception	4. Provide options for physical action	7. Provide options for recruiting interest
1.1 Offer ways of customizing the display of information	4.1 Vary the methods for response and navigation	7.1 Optimize individual choice and autonomy
1.2 Offer alternatives for auditory information	4.2 Optimize access to tools and assistive technologies	7.2 Optimize relevance, value, and authenticity
1.3 Offer alternatives for visual information		7.3 Minimize threats and distractions
2. Provide options for language, mathematical expressions, and symbols	5. Provide options for expression and communication	8. Provide options for sustaining effort and persistence
2.1 Clarify vocabulary and symbols	5.1 Use multiple media for communication	8.1 Heighten salience of goals and objectives
2.2 Clarify syntax and structure	5.2 Use multiple tools for construction and composition	8.2 Vary demands and resources to optimize challenge

I. Provide multiple means of representation	II. Provide multiple means for action and expression	III. Provide multiple means for engagement
2.3 Support decoding of text, and mathematical notation, and symbols	5.3 Build fluencies with graduated levels of support for practice and performance	8.3 Foster collaboration and community
2.4 Promote understanding across language		8.4 Increase mastery-oriented feedback
2.5 Illustrate through multiple media		
3. Provide options for comprehension	6. Provide options for executive functions	9. Provide options for self-regulation
3.1 Activate or supply background knowledge	6.1 Guide appropriate goal setting	9.1 Promote expectations and beliefs that optimize motivation
3.2 Highlight patterns, critical features, big ideas, and relationships	6.2 Support planning and strategy development	9.2 Facilitate personal coping skills and strategies
3.3 Guide information processing, visualization, and manipulation	6.3 Facilitate managing information and resources	9.3 Develop self-assessment and reflection
3.4 Maximize transfer and generalization	6.4 Enhance capacity for monitoring progress	

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