UDL Final Project

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IDT 7110: Universal Design for Learning in Online & Blended Contexts

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Part I: Online Learning Module: Hourly Wages

Student Learning Targets

By the end of the module, learners will be able to (a) identify hourly wages, hours worked, and total wages and (b) use the given information to solve for missing information (hourly wages, hours worked, or total wages).

Module Overview

The module is housed in Canvas in the sandbox_UC18-IDT7110 course. This module is adapted from the SchoolsPLP Consumer Math B curriculum (SchoolsPLP, 2021) used by Great Oaks Career Campuses (GOCC) and is designed to be online, self-paced and asynchronous as part of a distance learning curriculum. Learners must have access to a computer and internet connection, both of which are provided by GOCC to enrolled students. This module is intended to be used with 11th and 12th grade GOCC high school students enrolled in Financial Algebra.

Activities

1. Module Overview: This page gives the learner the learning goals, as well as the module tasks they will complete.
2. Introduction: This page includes an embedded interactive element to engage the learner with information about the current federal and Ohio minimum wage, as well as a brief history of the federal minimum wage. Optional additional information is provided through an embedded Youtube video from TIME about the history of the federal minimum wage (TIME, 2014).
3. Wages & Salaries: This page includes an embedded interactive Opinion Stage poll asking for learner input about whether learners have a job and how they are paid to connect the learner with the topic (Opinion Stage Ltd., 2021). A vocabulary overview of the

difference between a wage and a salary is also included. An audio narration of the page is available.

4. Hourly Wages: This page provides the learner with additional vocabulary (hourly wage, minimum wage), as well as the general formula for total wages. Learners are then given a choice in how they want to learn about calculating hourly wages.
    a. Choice #1: Calculating Hourly Wages – Worked Examples: The worked examples show both the mathematics and a written explanation of the process needed to identify and then solve for total wages, hourly wage, and hours worked. Three different examples are included with explanations and formulas.
    b. Choice #2: Calculating Hourly Wages – Video: The video is a YouTube video by factswithfowler called "Lesson 2 – Hourly Wages" (factswithfowler, 2015) that has been trimmed using the EdPuzzle platform (EdPuzzle Inc., 2021). Multiple choice questions (using both symbols and written descriptions) have been added throughout the video using the EdPuzzle platform to help learners process what is happening in the video. Learners are given immediate feedback, as well as explicitly given formulas at the end of the video.
    c. Learners are able to determine the direction of their own learning after completion of each choice. They can either continue to the Hourly Wages Practice page, or they can choose to continue to the other option to see more examples.
5. Hourly Wages Practice: Learners will complete thirteen embedded Hourly Wages Practice Boom Cards (Boom Learning, 2021). Boom Cards give learners multiple attempts to complete practice problems with in-the-moment feedback about their

accuracy. Learners can choose to skip a question, give up (to see the answer), and replay decks so they are able to build their skill and fluency with concepts.

6. Hourly Wages Check-In: Learners are given a choice in how they want to show their understanding about calculating hourly wages (type, draw, or audio record). Learners will complete three open-ended questions using the Nearpod platform (Nearpod, n.d.). The question itself is presented textually, as well as with an audio narration. Learners have the ability to choose to draw or type their response or record an audio explanation. After they have submitted their responses, learners are shown the solution with an explanation with an available audio narration of the solution.
7. Hourly Wages Questions Discussion Board: Learners are encouraged to post any questions that weren't answered in the module, as well as any helpful links for their classmates. Both classmates and the instructor can respond to learner questions.

Part II: Rationale

Learning Goals

Meyer et al. (2014) define effective learning goals as "goals that separate the means from the end; consider all three learning networks; challenge all learners; [and] actively involve learners" (p. 71). The initial goal from the SchoolsPLP curriculum was written as, "You will determine amount earned based on number of hours worked" (SchoolsPLP, 2021, n.p.). While this goal does separate the means from the end, which is a UDL principle, the goal poses several problems. At the most basic level, the learning goal is problematic because it does not actually encompass the content covered in the lesson; learners are not just required to calculate the total wages earned based on the number of hours worked, but are instead required to fluently solve for hourly wages, hours worked, and total wages in different real-world scenarios. To better align

with the principles of UDL, the learning goal was modified to be that learners will be able to (a) identify hourly wages, hours worked, and total wages and (b) use the given information to solve for missing information (hourly wages, hours worked, or total wages).

The new learning goal better aligns with UDL principles for several reasons. As before, the goal separates the means from the ends, but unlike before, the learning goal now offers some flexibility in the methods. Instead of only "determ[ining] amount earned based on number of hours worked" (SchoolsPLP, 2021, n.p.), which is prescriptive, learners instead are focusing on the relationships between the three variables (hourly wages, hours worked, and total wages). Secondly, the new learning goal challenges all learners by balancing "demands and resources" (Meyer et al., 2014, p. 71). The original learning goal required learners to solve for the amount earned, but did not incorporate the resources needed for learners to identify and interpret the given information. The adjusted learning goal identifies an additional resource that learners must have in order to successfully solve for missing information: identifying the given information. Once students have successfully identified the information given in the scenario, they are then able to use that information to solve. While the learning goal itself does not prescribe active involvement of the learner, the learning activities included in the module are designed to help learners "to become self-directed, independent learners" (Meyer et al., 2014, p. 71) through opportunities for learner choice, in-the-moment feedback, and learner engagement through polls.

The final component of effective goals deals with the three learning networks: affective, recognition, and strategic (Meyer et al., 2014). The three networks work in tandem during the learning process and so must be considered together for an effective learning goal. The affective network is used to "set priorities, to motivate, and to engage learning behavior" (Meyer et al., 2014, p. 31). The topic of this module, hourly wages, is generally a naturally engaging topic for

learners, who are interested in understanding how they can calculate wages from a job as they consider their options both in high school and after graduation. In this module, the affective network is accessed when learners are motivated to learn through participation in a poll about their own experiences with hourly wages or salaries. Additionally, the use of choice in the module allows learners to make their own decisions about how they would like to "engage in learning behavior" (Meyer et al., 2014, p. 31). The recognition network takes the sensory inputs from learning and changes it into knowledge (Meyer et al., 2014). In this module, learners use their recognition network through the identification and use of patterns as they identify information from a situation and determine how to use that information to solve for hourly wages, hours worked, and total wages. The final network, the strategic network, is used to make decisions and organize information (Meyer et al., 2014). In this module, learners access the strategic network through repeated, mixed practice, which allows learners multiple opportunities to connect the information they have learned with the scenarios when it is most applicable and demonstrate their mastery of the material.

Assessments

Meyer et al. (2014) state that "effective assessments are ongoing and focused on learner progress; measure both product and process; are flexible, not fixed; are construct relevant; [and] actively inform and involve learners" (p. 74). These characteristics apply to both of the two types of assessments: formative and summative. Formative assessments are part of the learning process and give instructors information about a learner's progress, the effectiveness of teaching methods and techniques, and allow the instructor to adjust instruction as needed based on their results (Meyer et al., 2014). Summative assessments, in contrast, as used to "measure educational

performance once instruction is completed, usually for accountability purposes" (Meyer et al., 2014, p. 73).

The original summative assessment in the SchoolsPLP curriculum was a five-question assessment that required learners to answer multiple-choice questions, reorder text, or give a written response to a word problem. While the lesson and practice activities offered text-to-speech options, there was not a text-to-speech option in the final assessment, which was a barrier for students. Additionally, the only formative assessment opportunities for learners to receive feedback before the final assessment were two questions, only one of which was related to the learning goal. The assessments included in the original lesson did not effectively measure all students' learning, nor did they provide learners opportunities for reflection and feedback before the graded, summative assessment at the end of the lesson.

This new module includes both a formative assessment through Boom Cards, as well as a summative assessment using Nearpod. The formative assessment takes the form of a practice activity, called Boom Cards, which are a type of electronic task card that give learners immediate feedback about their responses (Boom Learning, 2021). As a formative assessment, the Boom Cards are effective because they are focused on overall mastery, not specific attempts, and they give learners immediate feedback about how they are doing. Unlike traditional task cards, Boom Cards can give in-the-moment data, as well as valuable reports, about students' mastery or challenges with concepts in a way that can be challenging to gauge quickly with a traditional worksheet. These types of analytics allow the formative assessment to "measure both product and process" (Meyer et al., 2014, p. 74). The data from the formative assessment is a measure of student progress and a touchpoint to determine any needed adjustments to instruction, as well as a measure of the effectiveness of the learning module itself.

Since this lesson is designed to be delivered asynchronously, Boom Cards were selected as a formative assessment tool because it provides learners with instant feedback and gives learners multiple opportunities for engagement. Boom Cards do not require learners to use a mouse and can be used with only a keyboard to both answer and navigate through the questions (Boom Learning Support, 2020). Additionally, while there is not a built-in screen-reading function currently in Boom Cards, it can be used with screen reader (Boom Learning Support, 2020). This particular deck, which I created, is correctly formatted to allow a screen reader to read the information on each card in the correct order. Since the potential barrier of text can be ameliorated using a screen-reader and using the keyboard can reduce barriers for learners with fine motor skill difficulties, Boom Cards create an assessment that is "on-target to measure the construct – the affect, concept knowledge, or skill – they intended to measure" (Meyer et al., 2014, p. 75).

The summative assessment uses Nearpod, which gives learners the option of responding to questions using text, drawing, or audio (Nearpod, n.d.). The summative assessment gives learners three questions that are directly aligned to the learning goal, unlike the original assessment from SchoolsPLP. For each question, learners are able to read or hear a narration of the question, and then they can choose how they would like to demonstrate their learning. Since the assessment gives the learner flexible means of demonstrating their knowledge, it removes potential barriers that might impact the accuracy of the assessment in measuring true learner mastery of the content (Meyer et al., 2014). Additionally, since each question asks learners to explain their thinking in their chosen format, instructors are able to understand not only what students understand, but also to understand their thinking process, which means it "measure[s] both product and process" (p. 74). Finally, after each question on the Nearpod assessment, the

learner is provided with a detailed solution and optional audio narration of the solution to give feedback so learners are "more engaged with improving their learning and more motivated to take action to improve their learning" (p. 75).

Teaching Methods

Instructional methods are the choices about what and how material is taught to learners (Meyer et al., 2014). As Meyer et al., (2014) note, "learners vary in the way they become and stay motivated to learn, comprehend information, and strategically approach tasks" (p. 77) which requires varied methods of teaching. In order to ensure that the teaching methods appropriately covered all content necessary for mastery on the summative assessment, the summative assessment was created before the methods were determined. The summative assessment, which is aligned to the learning goal for the module, assesses if learners are able to identify what information they are given (hourly wages, hours worked, and/or total wages) in a scenario and then if they are able to solve for the missing piece of information (hourly wages, hours worked, and/or total wages). Based on the knowledge necessary for learner mastery on the assessment, the best instructional methods were then determined.

Effective instructional methods are "methods than can be continually adjusted to meet learner needs; [and] include all students within a collaborative environment" (Meyer et al., 2014, p. 78). Since learners have variable needs for engagement, comprehension, and expression, multiple instructional methods are needed to reach all learners. In order to address learners' multiple means of perception, the module includes the same content presented as text (worked examples), as audio narration (of the worked examples), and as video (with optional closed captions). Additionally, through the Canvas platform, learners are able to choose "Alternative Formats" of any page, which allows downloading the page in ePub, electronic braille, audio, or

BeeLine Reader. The formative assessment in the module also provides both learners and instructors with in-the-moment feedback about learner progress to adjust instruction as needed. Learners are able to choose which method they would prefer to engage with the content, then choose an additional method if they feel like they still need more information. Learners also have a few different ways to collaborate with peers, in the form of a poll at the start of the lesson, as well as an Hourly Wages Questions discussion board, where they are able to post questions or helpful links to share with their peers. Providing the opportunity for learners to act as teachers or mentors to their peers helps "mentors gain confidence and reinforce[s] their skills by teaching others, and peers benefit from individualized coaching" (Meyer et al., 2014, p.78).

Teaching Materials

Just as with teaching methods, learners benefit from varied teaching materials. The materials included in the module are aligned to the learning goal, while also providing opportunities to reach all learners. Throughout the module, information is provided in three different ways: text, audio, and video. Learners can access audio recordings of module pages by either selecting the audio narration on the screen or by downloading the audio under "Alternative Formats" on each page. Examples of the math content are provided as written worked examples, with clear textual explanations, and as an audio narration of the worked examples, as well as a separate interactive video with optional closed captions. All images (including formulas) have alternative text, which allows screen readers to read the images as well. Tables have header rows, which have been marked during the Canvas course creation, so that screen readers are able to help learners make sense of the table.

Design Choices and Revisions

The original format of this lesson was for an asynchronous, distance learning course using SchoolsPLP's Consumer Math coursework. Since there is such uncertainty about the future of K-12 education due to the current COVID-19 pandemic, this module also utilizes an asynchronous, self-paced format. The SchoolsPLP platform did not allow for any modifications of the lesson, so an alternative platform was needed. Schoology is the LMS for Great Oaks Career Campus, and while it does not have the same features that SchoolsPLP has, it does have many of the same features. However, due to restrictions about users outside the district accessing the GOCC Schoology LMS, this module has been created in Canvas. Canvas also lacks some of the features of SchoolsPLP (and Schoology), so work-arounds or browser add-ons have had to be used in some situations. Since GOCC provides all learners with a district-issued Chromebook device, suggested add-ons are for the Chrome browser and are all free via the Chrome Web Store.

The original SchoolsPLP lesson on Hourly Wages provided multiple options for perception through the use of tools such as text-to-speech, translation, dictionary, sticky notes, and highlighting. The UDL guidelines state that "multiple representations not only ensure that information is accessible to learners with particular sensory and perceptual disabilities, but also easier to access and comprehend for many others" (CAST, 2011d, para. 1). One of the major strengths of the initial SchoolsPLP lesson was that there were several different opportunities for learners to perceive and engage with the provided information, including multiple modalities (text, audio) and customizable features (highlighting, reading speed, translating). Alternative text was available for all images throughout the lesson. The Canvas platform allows for multiple modalities, which are accessible on each page by clicking the Alternative Formats icon next to the title. Available alternative formats include audio, as well as BeeLine Reader, which allows

alternative colors for fonts and increased contrast. All images, including formulas, include alternative text. However, highlighting is not a built-in feature of the Canvas platform, and users must use a browser add-on such as Super Simple Highlighter (Dexterous Logic, 2019) or Weava Highlighter – PDF & Web (Weava, 2021) to highlight within the browser. Similarly, there is no built-in sticky notes feature in Canvas, so a browser add-on such as Weava Highlighter – PDF & Web (Weava, 2021), which also allows sticky notes, or Note Anywhere (LanceHub, 2015) is required to add sticky notes within a browser.

One of the strengths of the original SchoolsPLP platform was that it provided multiple means of representation through "options for language, mathematical expressions, and symbols" (CAST, 2011c). In the SchoolsPLP platform, vocabulary was clearly indicated, along with definitions. Learners were able to access another dictionary at any time to clarify terminology, and there was a robust, customizable translation feature. The math formulas themselves were written and explained verbally, while the examples that were given showed the correct work and textually explained the steps and thinking. These explanations, combined with the mathematical representations, "ensure that alternative representations are provided not only for accessibility, but for clarity and comprehensibility across all learners" (CAST, 2011c, para. 1). Some of these same features can be replicated in the Canvas platform, while others require an additional browser add-on. Vocabulary terms are indicated with bold text, and all formulas are written and explained textually with clearly explained examples. While there is no built-in dictionary or translator in the Canvas platform, a browser add-on such as Dictionary All Over (Winkleman, 2021), which offers both a dictionary as well as a translator in English, French, German, and Spanish, or Google Translate (Google, 2021), allows for translations and definitions.

CAST (2011b) suggests that the construction of knowledge is not a passive process, but an active one, where learners use "active 'information processing skills' like selective attending, integrating new information with prior knowledge, strategic categorization, and active memorization" (para. 1) to make sense of the information they are being provided. The SchoolsPLP lesson gives learners multiple different scaffolds as they learn the skill of calculating hourly wage, beginning with applying the formula, then having learners complete self-grading and check-it-yourself problems to build up their fluency. The final activity in the lesson was an Assess It (summative assessment) that tests for learners' mastery of the content through a variety of multiple choice, ordering, and open response questions. The lesson text activated learners' prior knowledge by helping them to connect to their own experiences. Worked examples with clear, detailed explanations helped the learner identify patterns and big ideas, while guiding them through the steps to process the algorithm and bigger concept. Multiple different types of problems, including opportunities for students to complete interactive questions (multiple choice and identification) allowed learners to get quick in-the-moment feedback on what they have learned. In the Canvas module, the same lesson text from SchoolsPLP has been included, although it has been supplemented with additional means of representation, including video and audio. The formative assessment via Boom Cards gives learners multiple opportunities to get in-the-moment feedback, with a larger quantity and variety of problems than the SchoolsPLP lesson offered.

CAST (2011c) concludes, "there is no medium of expression that is equally suited for all learners or for all kinds of communication" (para. 1). In the SchoolsPLP lesson, all of the methods of showing learning were text-based; learners were either choosing multiple-choice options, reordering text, or giving a written response to a word problem. Additionally, while

there were text-to-speech options throughout the lesson and practice, there was not a text-to-speech option in the final assessment. In order to better meet the UDL principles, the Canvas module allows learners to use multiple media for communication. In the summative assessment using Nearpod, learners are able to record an audio explanation of how they thought through solving the problem, type an explanation of their work, or draw to pictorially represent their work. Additionally, text-to-speech (or an equivalent audio narration) of each problem on the assessment removes potential decoding barriers and increases both the accessibility and validity of the assessment in measuring learners' ability to solve problems with hourly wages.

In the original SchoolsPLP lesson, the only way for a learner to interact with this lesson was by using their mouse, which posed problems for individuals with some types of disabilities. As CAST (2011e) notes, "properly designed curricular materials provide a seamless interface with common assistive technologies through which individuals with movement impairments can navigate and express what they know" (para. 1). In order to remove this barrier, alternative methods of navigation were incorporated into the Canvas module. Both Canvas and the embedded Boom Cards allow for keyboard navigation (Boom Learning, 2020; Instructure, 2021). Keyboard navigation allows learners to navigate the lesson and materials in a way that allows them to fully participate in the lesson and its components.

One of the components of providing multiple means for engagement is "providing options for recruiting interest" (CAST, 2011f, para. 1). The SchoolsPLP lesson hooked students by engaging them with a question about jobs and how they might be paid; however, after this question, there was very little engagement or interaction. Much of the lesson required learners to read text and internalize worked-out examples of the math being taught. Additionally, while there were two quick questions that required some learner interaction, the majority of the lesson

was passive. The topic of the lesson (hourly wage) is in itself a very relevant topic to the audience (high school seniors who are a few months from graduation), but it was not presented in a way that "provide(s) options that optimize what is relevant, valuable, and meaningful to the learner" (CAST, 2011a, para. 1). In order to increase interest and engagement, resulting in better retention of the content, the Canvas module gives learners options with how they can interact with the material. The content is presented using a variety of different methods of learning (including audio, video, and text), as well as multiple different choices from which learners can select to maximize their learning opportunities. Additionally, learners have a choice of how to respond to the summative assessment which helps learners "develop self-determination, pride in accomplishment, and increase[s] the degree to which they feel connected to their learning" (CAST, 2011a, para. 1).

Learners and Reduction of Barriers

Recent research has led to new understanding about the variability of learners. In particular, research has focused on the impact the affective, recognition, and strategic networks have on learning, as well as the variability in these networks between different learners (Meyer et al., 2014). The affective network deals with an individual's ability "to set priorities, to motivate, and to engage learning and behavior" (Meyer et al., 2014, p. 31). In UDL principles, providing learners with multiple means of engagement addresses learners' affective networks (Meyer et al., 2014). In the module, learners are given choices in how they want to learn the content, as well as how they want to show their mastery of the content, which allows learners to control their learning process. The recognition network converts inputs (including as sensory information) into usable information (Meyer et al., 2014). This network is addressed by the UDL principle of multiple means of representation, which is addressed in several ways in the module: learners are

given the same information in multiple ways (text, audio, video) that can be customized to their needs (closed captions, size, speed, etc.), the formulas are given pictorially as well as with written descriptions that help to clarify the vocabulary, mathematical notation, and symbols, and patterns are highlighted throughout the module. Finally, the strategic networks, which "plan, organize, and initiate purposeful actions in the environment" (Meyer et al., 2014, p. 31) are addressed using the UDL principle of multiple means of action and expression. This principle is visible in the module through the use of multiple means of navigation through the module (keyboard, mouse), opportunities for learners to show their mastery of the content through multiple means of communication (draw, type, audio record), and the feedback that is provided throughout the activities of the module to allow learners to monitor their own progress. By accessing the three networks, expert learners, who are "continually growing and developing through introspection and guided feedback from other experts and peers" (Meyer et al., 2014, p. 19), are developing. When learners are given choices to direct their learning and options for practice and assessment, as well as continual feedback that they can use to adjust their learning to meet their individual needs, learners are active participants in the ongoing learning process. This active participation in the learning process is key to the development of learners as expert learners (Meyer et al., 2014).

Revisions

Feedback from the UDL Proposal was incorporated in the design and creation of the Canvas module. Feedback was given about creating clear learning goals and assessments in the final project. In the design of the module, the learning goals were written to incorporate all of the UDL principles for effective learning goals: "goals that separate the means from the end; consider all three learning networks; challenge all learners; [and] actively involve learners"

(Meyer et al., 2014, p. 71). Additionally, both formative and summative assessments were created that are directly aligned to the learning goal, are "ongoing and focused on learner progress; measure both product and process; are flexible, not fixed; are construct relevant; [and] actively inform and involve learners" (Meyer et al., 2014, p. 74). Finally, feedback was given to be specific about the learning tools that would be utilized in the module and how they would address specific barriers to learning. One note from peer feedback cautioned about the additional costs and potential challenges of integrating third-party browser add-ons with the Canvas module. In designing the module, special care was taken that all add-ons were free, easy to access (via the Chrome Web Store) and would work with the browser most learners will be using (Chrome). While this does not guarantee that the add-ons will function without any problems, the likelihood of smooth integration seems higher due to the criteria used in selecting the items.

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