

Customization of Web-Based Assessment: An Application to McGraw-Hill Connect Finance

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ABSTRACT

Instructors utilizing software programs as assessment tools may wish to customize assignments in an effort to more appropriately evaluate student learning. Although perhaps not readily apparent, such customization can be accomplished using, for example, McGraw-Hill's Connect web-based assignment and assessment platform, including McGraw-Hill Connect Finance for finance instructors. In this paper, we illustrate how McGraw-Hill Connect Finance can be used to create unique questions and assignments that best meet both the instructor's and students' needs. Our hope and expectation is that greater awareness of customization techniques inherent to McGraw-Hill Connect Finance will provide the instructor with sufficient flexibility to create assignments that promote the highest degree of student learning.

I. INTRODUCTION

Despite the present-day freedom of choice among a number of online assessment tools, instructors may perceive that there exists inadequate freedom when it comes to customizing such assessment tools. We propose that this perception is largely due to a lack of awareness and understanding of the customization options available in software platforms such as in, for example, McGraw-Hill's Connect. For the finance instructor, we aim to counter these deficiencies by providing guidance and examples of customization techniques in McGraw-Hill Connect Finance (hereafter, "Connect"). However, since we do not claim to provide an exhaustive guide to all possible customization techniques, we refer the reader to the online "Help" content within Connect itself, which is also an excellent source of knowledge for learning the essential operational properties of Connect.¹ Furthermore, we do not advocate for web-based assessment over paper homework, nor do we advocate for Connect over other web-based assessment platforms. Instead, our focus is to enlighten the reader about customization techniques available within a software platform that have the potential to enhance student learning.

The paper is structured as follows. In Section II, we briefly review some of the extant literature regarding the effectiveness of web-based assessment. Section III provides an overview and broad guidance about assignment design and customization techniques available in Connect. Section IV illustrates application of these techniques using two examples presented in a step-by-step approach. We conclude in Section V.

II. EXISTING EVIDENCE ON THE EFFECTIVENESS OF WEB-BASED ASSESSMENT PLATFORMS

A substantial amount of research has been conducted on the effectiveness of web-based assessment platforms in enhancing student learning. When examining the effectiveness of web-based homework within the context of principles of accounting courses, Dillard-Eggers, Wooten, Childs and Coker (2008) determine that online homework not only increases student performance, but is also considered an effective method of study by students. Based on personal experience gained while teaching operations management courses, Heizer, Render and Watson (2009) find that the Prentice-Hall Grade Assist Software (PHGA) – a platform similar to McGraw-Hill’s Connect – does act to improve student learning and that students favor the software for its immediate feedback and thorough, clear explanations. Similarly, Doorn, Janssen and O’Brien (2010) generally find a positive reaction to the use of online homework systems across all software platforms studied for their sample of students enrolled in economics courses. In the context of developing mathematical problem solving skills, Razzaq, Mendicino and Heffernan (2008) determine that web-based intelligent tutoring systems (ITS), where students can receive direct, customized feedback when solving problems outside of the classroom, are superior to in-class problem solving in instances where there is little or no feedback. In a study of fifth grade students, Mendicino, Razzaq and Heffernan (2009) find that students learn significantly more from web-based homework feedback when compared to feedback pursuant to paper-and-pencil homework. However, it is important to acknowledge that instructor experience and student academic ability play a significant role on overall student performance, as concluded in the Palocsay and Stevens (2008) study contrasting traditional, textbook-based homework assignments with three web-based homework technologies for undergraduate business statistics courses.

With extensive positive evidence on the effectiveness of web-based assessment platforms in mind, we find that further examination into the customization and enhancement of one such assessment platform is warranted.

III. ASSIGNMENT DESIGN & CUSTOMIZATION

As with similar software platforms, Connect is full of options geared to satisfy instructor and student needs. A sample of the features available in Connect include the following: the option to provide students with instant or delayed feedback; the ability to select from end-of-chapter, test bank or AACSB-categorized questions, or to create your own question, with algorithmic or static question design therein; scrambled answer and question order, if desired; the option to choose one of multiple assessment modes, including “practice”, “homework”, “quiz”, or “exam”; the opportunity to integrate Connect with popular course management systems, such as Blackboard; and the ability to capture and distribute instructor lectures, if enabled. Many of these features now available in Connect are additions or improvements to those presented in McGraw-Hill’s predecessor platform, Homework Manager. We next provide an overview of some of the more fundamental features and options available in Connect, with a focus on assignment design and customization.

Question type. Connect allots several options for question type, including “Multiple Choice”, “Fill in the Blank”, “Worksheet”, and “Check All That Apply”, to name a few. Where applicable, answer choices can be presented in a scrambled order so that the response order will

be unique across students and attempts (and the answer values themselves will be unique if the question is algorithmic in format).² In Section IV, we demonstrate customization in Connect using the “Worksheet” question type.

Algorithmic versus static. Questions of all types may be set up as either “algorithmic” or “static.” Algorithmic questions utilize random variables that will generate a unique value with each iteration of the question. Static questions utilize fixed variables that will generate a constant value with each iteration of the question. Due to the large number of unique values generated for a random variable, it is likely the case that each student will see a different “version” of an algorithmic question from another student (in addition to a different version on a subsequent attempt, if applicable). Hence, algorithmic questions can be considered superior to static questions in regard to their applicability in circumventing academic misconduct.

Defining a variable. Regardless of question type, a critical step in creating a unique question is the process of defining a variable. Variables are defined by clicking the “New Variable” button located immediately below the question editor. There are three variable types: (1) local variables, which are “local” to the question being edited; (2) global variables, which are “global” across all questions within the active assignment; and (3) calculated variables, which generate values based on existing local and/or global variables (and are “local” to the question being edited). In Section V, we illustrate the process of defining a variable.

Defining an answer. Connect features several options for answer types, including “True/False”, “Multiple Choice”, “Number”, and “Word or Phrase”, to name a few. If choosing, for example, the “Multiple Choice” or “Check All That Apply” answer type, there is an option to scramble the response order – a technique that serves as a further line of defense against academic misconduct. If choosing the “Number” answer type, the instructor can specify a required precision level in exact, absolute or percentage terms. In Section IV, we illustrate the process of defining an answer.

Formatting. There happen to be many formatting options available in Connect. The Connect question editor enables the instructor to edit fonts, copy and paste text or objects, and insert tables or equations – features and options that parallel those available in the Microsoft application “WordPad.” Furthermore, a defined variable (local, global or calculated) can be formatted to include a dollar sign (\$), a percentage symbol (%), a specified number of decimal places (e.g., 0.00), or a comma (,) using the script listed in Table 1. It is worth noting that these formatting options and symbols can be implemented on any variable in the question editor window or when defining variables and answers; additionally, these options can be used in combination.

Table 1: Scripts for formatting options and symbols	
We use the defined variable [cash] to illustrate the options below.	
<u>Format/Symbol</u>	<u>Script</u>
Dollar sign (\$)	<code>\$\$\$[cash]</code>
Percentage symbol (%)	<code>\$\$\$[cash]%</code>
Decimal places (e.g., two decimal places)	<code>\$\$\$[cash]:0.00</code>
Comma (,)	<code>\$\$\$[cash]:#,###</code>

Adding a hint. The instructor may include a hint using one of two primary approaches. The more conventional of these approaches is to include the hint directly within the text of the question itself. A second approach is to enter the hint into the “Optional Hints” box, located below the question editor window. Using this method, the hint will be made available to the student by clicking on a “View Hint” link located below the question and answer choices.

Common mistakes. We find it worthwhile to share some common mistakes encountered as part of our own attempts at creating customized assignments in Connect. First, additional precautions must be taken when defining “global” (as opposed to “local”) variables; more precisely, we must use global variables in a very systematic fashion, always being mindful of their pervasiveness throughout the active assignment. As an example, suppose we begin an assignment by creating a *global* variable named “Cash” having a range of \$5,000 to \$10,000 in increments of \$100 as part of Question #1. We proceed to Question #2 and define a *local* variable named “Cash” having a range of \$20,000 to \$30,000 in increments of \$200. A conflict arises when using the variable name “Cash” in editing Question #2 – that is, Connect will, by default, transform the newly-created “Cash” variable into “Cash2” and, as a result, each instance of “Cash” used in Question #2 will rely on the *global* “Cash” variable’s properties as defined in Question #1, despite the fact that we intended for the *local*, newly-defined “Cash” variable to be used. Perhaps the best method to prevent such conflict is to use local variables (the default option in Connect), despite the comparatively greater amount of time and effort required to create a new local variable for each question.

Another common mistake is defining a calculated variable based on another calculated variable. For example, suppose we define a random “calculated” (as opposed to “local” or “global”) variable, “Net_Income” as the sum of income less expense items (e.g., “Net_Income” = “Sales_Revenue” – “Cost_of_Goods_Sold” – “Administrative_Expense”). Further suppose that we would like to establish that the company pays a fixed percentage dividend every year equal to 5% of net income. If we define the variable “Dividends_Paid” as 5% of “Net_Income”, we will encounter an error in Connect because we have created a new calculated variable (“Dividends_Paid”) that depends on an existing calculated variable (“Net_Income”). To circumvent this error, the instructor can define the 5% fixed percentage dividend as “Dividends_Paid” = .05 * (“Sales_Revenue” – “Cost_of_Goods_Sold” – “Administrative_Expense”) – i.e., we avoid the error by forcing the newly-created calculated variable “Dividends_Paid” to depend on “local” and/or “global” variables exclusively.

IV. APPLICATIONS

We illustrate how to customize assessment in Connect using questions that pertain to basic accounting knowledge expected of a college business student entering the core financial management course. Basic knowledge of financial statements and their interpretation is necessary for a student’s understanding of financial management concepts. We believe that assessment of accounting knowledge at the onset of a course using a software platform such as Connect will prove helpful in this regard. We note, however, that the process illustrated below can easily be adapted to an assessment of any concept the instructor chooses. Complete custom examples covering the concepts of financial forecasting, the time value of money, amortization tables, risk and return, capital budgeting, and the normal distribution are available by request from the authors.

Once logged in to your course section on the Connect platform, the first step in creating a customized assignment is to click “Add Assignment” followed by “Create New from Question Bank.” Enter an assignment name, then click “Next: Add Questions.” The next window that appears will prompt the instructor to “Select a Question Source.” Since we would like to create an assignment consisting exclusively of our own self-created questions, close this window by clicking “Close Window” (upper right-hand corner) or “Cancel” (lower center).

The screen that remains should include a prompt near the bottom that states: “Don’t see what you want? Create your own question.” By clicking on this link, the instructor may now choose a question type. For this illustration, we will use “Worksheet” questions, so we select “Worksheet.” The question editor screen will now appear.

Simulation #1: Assessing understanding of general journal entries using the purchase, depreciation and sale of a building. To begin with something relatively simple, we wish to pose a question that requires computing and recording journal entries and amounts pursuant to the purchase, depreciation and sale of a company’s building. The creation of this algorithmic question can be accomplished using the following three steps:

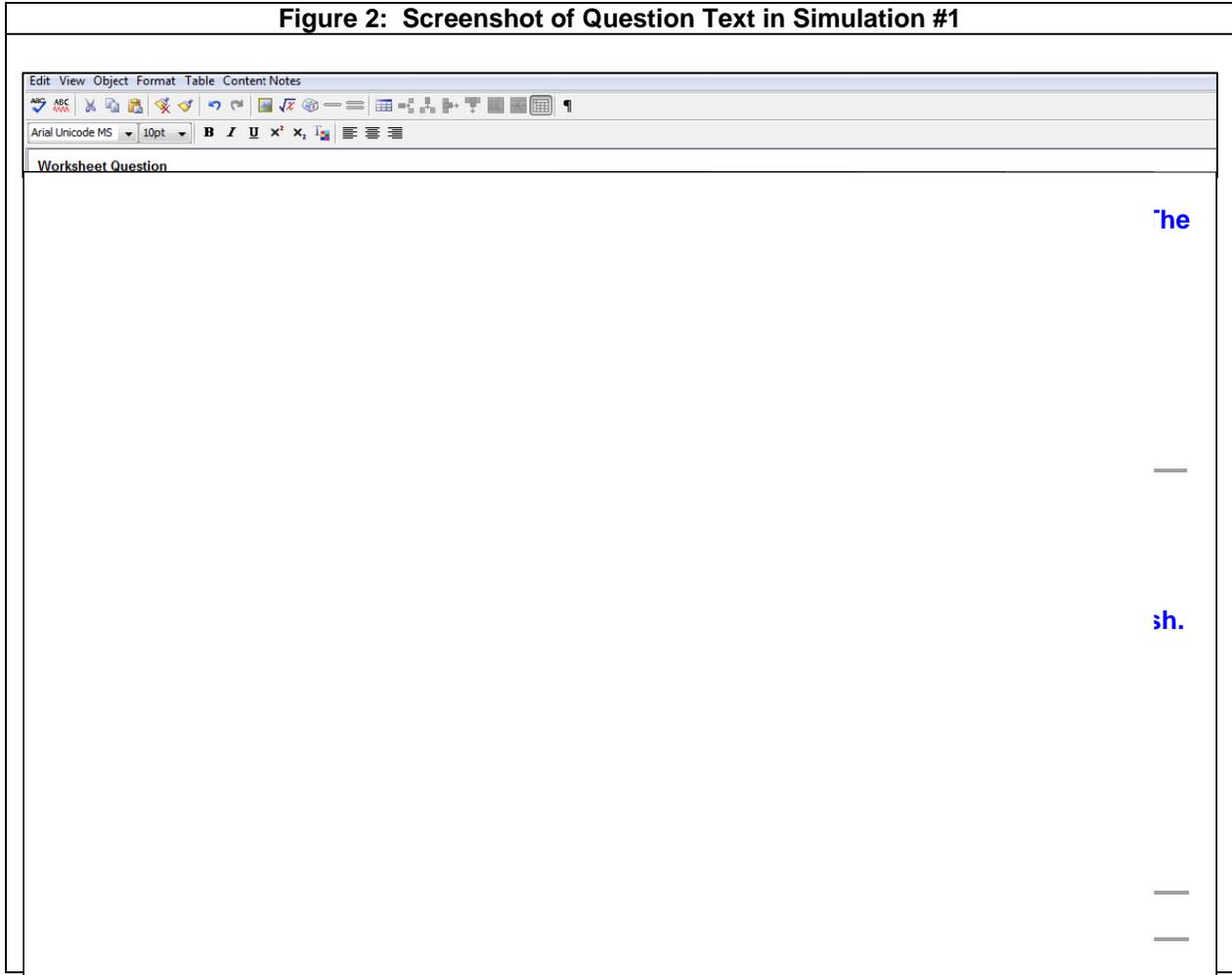
Step 1: *Define variables.* In this algorithmic question example, we will utilize three random variables: (1) a building purchase price (“bldg_purchase_price”) defined as a local variable; (2) a building salvage value (“bldg_salvage_value”) defined as a calculated variable; and (3) a building selling price (“bldg_selling_price”) defined as a calculated variable. In this example, the building is purchased on 1/1/X1 at a price between \$300,000 – 900,000 and has a salvage value equal to 10% of purchase price. The building is sold on 1/1/X3 at 115% of purchase price (so, the building is sold at a gain). The building has a depreciable life of 30 years and is sold after 2 years. The variable properties we used are identified in Table 2 and the resulting screenshot is provided in Figure 1.

Table 2: Properties of Defined Variables in Simulation #1			
Panel A: Local variables			
Description	Name	Type	Range and Increments
Building purchase price	bldg_purchase_price	Local	300,000 – 900,000 in increments of 3,000
Panel B: Calculated variables			
Description	Name	Type	Calculated as
Building salvage value	bldg_salvage_value	Calculation	.1*[bldg_purchase_price]
Building selling price	bldg_selling_price	Calculation	1.15*[bldg_purchase_price]

Figure 1: Screenshot of defined variables in Simulation #1			
Name	Type	Info	New Variable
bldg_salvage_value	calculation	.1*[bldg_purchase_price]	
bldg_selling_price	calculation	1.15*[bldg_purchase_price]	
bldg_purchase_price	local	generated in increments of 3000 over the range 600000 to 900000	

Step 2: *Compose question text.* In the “Worksheet Question” area, we can now begin composing the question. In Figure 2, we provide a screenshot of the question text. In the next step, we will define answer choices; for the time being, we may ignore the answer prompts (e.g., “__ans1__”, “__ans2__”, etc.) that appear in the question text below. Note that in parts (1a.) and (1c.), we have used a table (with invisible borders) and inserted lines in order to simulate general journal entries.

Figure 2: Screenshot of Question Text in Simulation #1



Step 3: *Define answers*. In Figure 2, we have included answer prompts (e.g., “__ans1__”, “__ans2__”, etc.) that are not yet defined. To define these answers, scroll to the bottom of the window to the box appearing below the list of defined variables. Using the drop-down menu of answer type choices (e.g., “True/False”, “Multiple Choice”, “Check All That Apply”, etc.), we will next define nine answer prompts using the “Multiple Choice” answer type. Choices for each defined answer are identified in Table 3 and the resulting screenshot is provided in Figure 3. Note that for this exercise, we have used Connect’s default settings for all other options (e.g., default answer weights, presentation using a standard drop-down menu, scrambled answers,³ etc.). Choosing to scramble answers will result in a different order of the same choices (with unique values if random variables are used); therefore, although the correct answer is “A” for each of the defined answers below, this pattern is highly unlikely to hold for students when taking the assessment.

Table 3: Choices for Defined Multiple Choice Answers in Simulation #1 ^a	
Answer 1: Debited account title in 12/31/X1 journal entry	
Name:	ans1 Correct answer: A
Choice A:	Depreciation Expense
Choice B:	Accumulated Depreciation
Choice C:	Building
Choice D:	Cash
Answer 2: Credited account title in 12/31/X1 journal entry	
Name:	ans2 Correct answer: A
Choice A:	Accumulated Depreciation
Choice B:	Depreciation Expense
Choice C:	Cash
Choice D:	Building
Answer 3: Debited dollar amount in 12/31/X1 journal entry	
Name:	ans3 Correct answer: A
Choice A:	{{([bldg_purchase_price]-[bldg_salvage_value])/30:#,###}}
Choice B:	{{[bldg_purchase_price]/30:#,###}}
Choice C:	{{([bldg_purchase_price]-[bldg_salvage_value]:#,###}}
Choice D:	{{[bldg_purchase_price]:#,###}}
Answer 4: Credited dollar amount in 12/31/X1 journal entry	
Name:	ans4 Correct answer: A
Choice A:	{{([bldg_purchase_price]-[bldg_salvage_value])/30:#,###}}
Choice B:	{{[bldg_purchase_price]/30:#,###}}
Choice C:	{{([bldg_purchase_price]-[bldg_salvage_value]:#,###}}
Choice D:	{{[bldg_purchase_price]:#,###}}
Answer 5: Carrying (book) value of Building at 1/1/X2	
Name:	ans5 Correct answer: A
Choice A:	{{([bldg_purchase_price]-([bldg_purchase_price]-[bldg_salvage_value])/30:#,###}}
Choice B:	{{29/30*[bldg_purchase_price]:#,###}}
Choice C:	{{([bldg_purchase_price]-[bldg_salvage_value])/30:#,###}}
Choice D:	{{[bldg_purchase_price]:#,###}}
Answer 6: Dollar amount for debit to Cash account in 1/1/X3 journal entry	
Name:	ans6 Correct answer: A
Choice A:	{{[bldg_selling_price]:#,###}}
Choice B:	{{((([bldg_purchase_price]-[bldg_salvage_value])/30)*2:#,###}}
Choice C:	{{[bldg_purchase_price]:#,###}}
Choice D:	{{[bldg_selling_price]+ (([bldg_purchase_price]-[bldg_salvage_value])/30)*2-[bldg_purchase_price]:#,###}}
Answer 7: Dollar amount for debit to Accumulated Depreciation account in 1/1/X3 journal entry	
Name:	ans7 Correct answer: A
Choice A:	{{((([bldg_purchase_price]-[bldg_salvage_value])/30)*2:#,###}}
Choice B:	{{[bldg_purchase_price]:#,###}}
Choice C:	{{[bldg_selling_price]+ (([bldg_purchase_price]-[bldg_salvage_value])/30)*2-[bldg_purchase_price]:#,###}}
Choice D:	{{[bldg_selling_price]:#,###}}
Answer 8: Dollar amount for credit to Building account in 1/1/X3 journal entry	
Name:	ans8 Correct answer: A
Choice A:	{{[bldg_purchase_price]:#,###}}
Choice B:	{{[bldg_selling_price]+ (([bldg_purchase_price]-[bldg_salvage_value])/30)*2-[bldg_purchase_price]:#,###}}
Choice C:	{{[bldg_selling_price]:#,###}}
Choice D:	{{((([bldg_purchase_price]-[bldg_salvage_value])/30)*2:#,###}}
Answer 9: Dollar amount for credit to Gain on Sale account in 1/1/X3 journal entry	
Name:	ans9 Correct answer: A
Choice A:	{{[bldg_selling_price]+ (([bldg_purchase_price]-[bldg_salvage_value])/30)*2-[bldg_purchase_price]:#,###}}
Choice B:	{{[bldg_selling_price]:#,###}}
Choice C:	{{((([bldg_purchase_price]-[bldg_salvage_value])/30)*2:#,###}}
Choice D:	{{[bldg_purchase_price]:#,###}}
a. We suggest using "None of these." as a fifth choice ("Choice E") for each of the above defined answers.	

Figure 3: Screenshot of Defined Answers in Simulation #1

Name	Type	Weight	Info	New
ans1	m/c	100	(Depreciation Expense, Accumulated Depreciation, Building, Cash)	
ans2	m/c	100	(Accumulated Depreciation, Depreciation Expense, Cash, Building)	
ans3	m/c	100	{{{([bldg_purchase_price]-[bldg_salvage_value])/30:#,###}}, {[bldg_purchase_price]/30:#,###}}, {{{[bldg_purchase_price]-[bldg_salvage_value]#,###}}, {[bldg_purchase_price]#,###}}	
ans4	m/c	100	{{{([bldg_purchase_price]-[bldg_salvage_value])/30:#,###)}, {[bldg_purchase_price]/30:#,###}}, {{{[bldg_purchase_price]-[bldg_salvage_value]#,###}}, {[bldg_purchase_price]#,###}}	
ans5	m/c	100	{{{([bldg_purchase_price]-([bldg_purchase_price]-[bldg_salvage_value])/30:#,###)}, {[29/30* [bldg_purchase_price]#,###)}, {{{[bldg_purchase_price]-[bldg_salvage_value]}/30:#,###}}, {{{[bldg_purchase_price]#,###}}}	
ans6	m/c	100	{{{([bldg_selling_price]#,###)}, {{{([bldg_purchase_price]-[bldg_salvage_value])/30}*2:#,###)}, {{{[bldg_purchase_price]#,###}}, {[bldg_selling_price]+ ([bldg_purchase_price]-[bldg_salvage_value])/30*2-[bldg_purchase_price]#,###}}	
ans7	m/c	100	{{{([bldg_purchase_price]-[bldg_salvage_value])/30*2:#,###)}, {[bldg_purchase_price]#,###)}, {{{[bldg_selling_price]+([bldg_purchase_price]-[bldg_salvage_value])/30*2-[bldg_purchase_price]#,###)}, {{{[bldg_selling_price]#,###}}}	
ans8	m/c	100	{{{([bldg_purchase_price]#,###)}, {[bldg_selling_price]+ ([bldg_purchase_price]-[bldg_salvage_value])/30*2-[bldg_purchase_price]#,###)}, {{{[bldg_selling_price]#,###)}, {{{([bldg_purchase_price]-[bldg_salvage_value])/30*2:#,###}}}	
ans9	m/c	100	{{{([bldg_selling_price]+([bldg_purchase_price]-[bldg_salvage_value])/30*2-[bldg_purchase_price]#,###)}, {{{[bldg_selling_price]#,###)}, {{{([bldg_purchase_price]-[bldg_salvage_value])/30*2:#,###)}, {{{[bldg_purchase_price]#,###}}}	

With the question composed and variables and answers defined, we can now preview the question. In the question editing screen, the instructor can scroll to the top of the window and select “Preview.” The question will appear as it would for students with the exception that in instructor preview mode, the correct answers have automatically been selected from the drop-down answer menus (and indicated with a right-arrow, →). See Figure 4 for a preview of the final question in instructor preview mode.

Once satisfied with the question, click “Save & Exit” (in the upper-right hand corner of the question editor window). Next, the instructor will again see the question in instructor preview mode. If the question is algorithmic in format, the instructor can choose to “See Another Version”, an option located above the question and near a circular arrow. After processing through all assignment creation steps (i.e., “Name Your Assignment”, “Add Questions”, “Set Policies”, and “Review & Assign”), the instructor can then preview the assignment as it will appear to students by selecting the assignment from the course home page and clicking “Student Assignment View”, a link located above the question itself.

Figure 4: Screenshot of Final Question in Instructor Preview Mode, Simulation #1

Refresh
algorithmic
Close Window

1a. On 1/1/X1, ABC Corp. purchases a new building for \$729,000. The building will be depreciated on a straight-line basis to a salvage value of \$72,900 over its depreciable life of 30 years. Provide the journal entry for the annual depreciation of this building.

<u>Date</u>	<u>Account Title</u>	<u>Debit</u>	<u>Credit</u>
12/31/X1	→Depreciation Expense ▾	→21,870 ▾	
	→Accumulated Depreciation ▾		→21,870 ▾

1b. What will be the carrying (book) value of ABC's building at 1/1/X2?

→707,130 ▾

1c. On 1/1/X3, ABC elects to sell its existing building for \$838,350 cash. Provide the journal entry for the sale of the building (including the removal of its accumulated depreciation and recognizing the gain on sale).

<u>Date</u>	<u>Account Title</u>	<u>Debit</u>	<u>Credit</u>
1/1/X3	Cash	→838,350 ▾	
	Accumulated Depreciation	→43,740 ▾	
	Building		→729,000 ▾
	Gain on Sale		→153,090 ▾

Simulation #2: Assessing financial statement literacy using a balance sheet. It is essential that students enter their core financial management course with a solid understanding of financial statements and their interpretation. When studying basic concepts such as cash flow from assets or changes in retained earnings, any deficiency in this context will most certainly interfere with a student's ability to understand the material and succeed in the course. Using a three-step process that parallels that which was outlined in Simulation #1, we now illustrate assessment of financial literacy using a balance sheet.

Step 1: Define variables. In this algorithmic question example, we provide the student with a list of accounts followed by a series of questions that require the student to correctly identify each account as a balance sheet or income statement item, and furthermore, if a balance sheet item, the appropriate balance sheet category in accordance with the account's liquidity (i.e., current versus long-term assets and liabilities, as well as shareholders' equity). This example utilizes 18 random variables as defined in Table 4 and displayed in the screenshot of Figure 5.

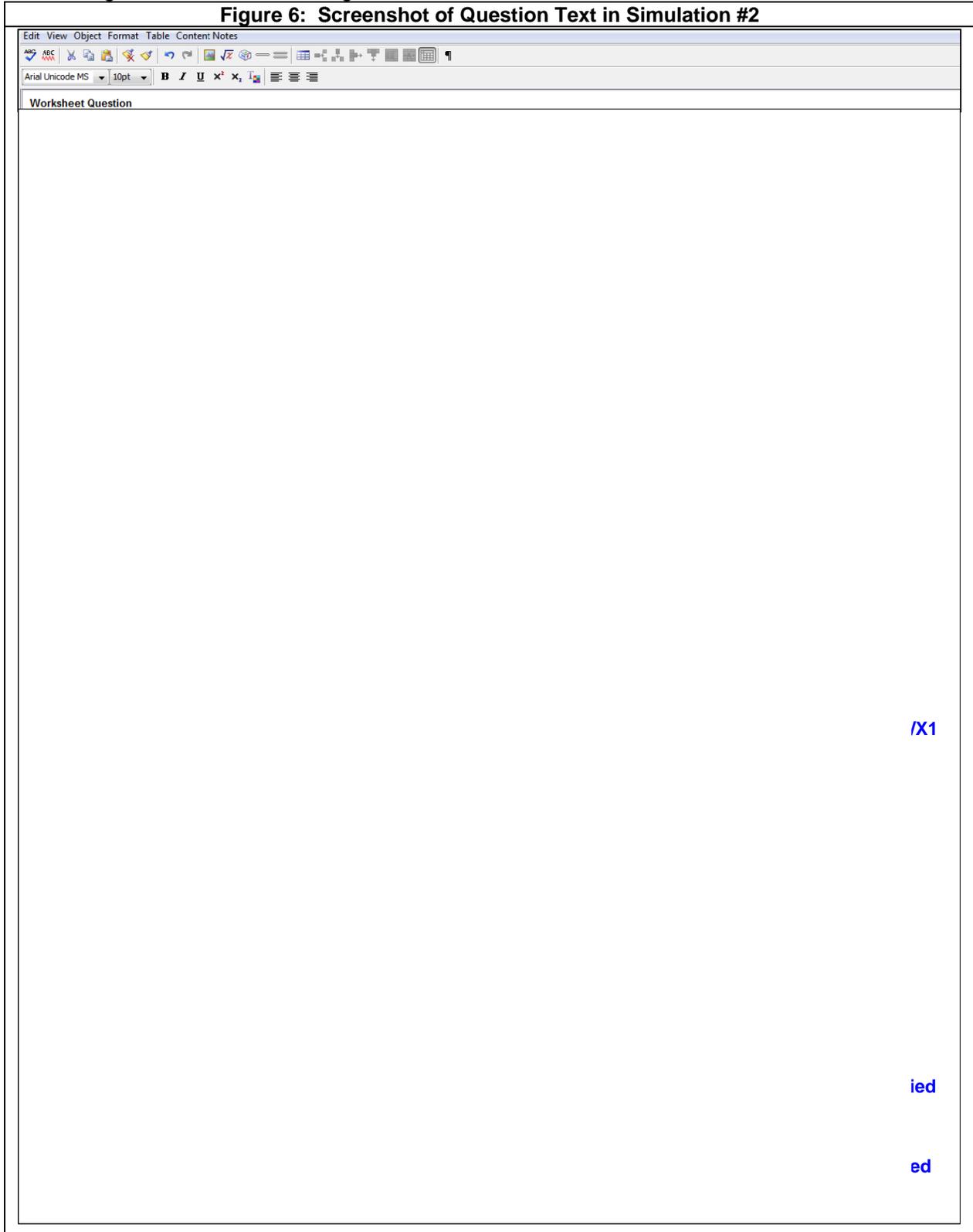
Table 4: Properties of Defined Variables in Simulation #2			
Panel A: Local variables			
Description	Name	Type	Range and Increments
Accumulated depreciation	ad	Local	34,000 – 39,000 in increments of 200
Accounts payable	ap	Local	15,000 – 20,000 in increments of 200
Additional paid-in-capital	apic	Local	14,000 – 20,000 in increments of 200
Building	bldg	Local	280,000 – 310,000 in increments of 500
Bonds payable	bp	Local	40,000 – 60,000 in increments of 200
Cash	cash	Local	12,000 – 17,000 in increments of 200
Cost of goods sold	cogs	Local	45,000 – 55,000 in increments of 200
Common stock	cs	Local	80,000 – 90,000 in increments of 200
Depreciation expense	deprexp	Local	40,000 – 50,000 in increments of 200
Dividends paid	divspd	Local	5,000 – 8,000 in increments of 100
Insurance expense	insexp	Local	1,000 – 4,000 in increments of 200
Retained earnings, beginning balance	begre	Local	150,000 – 170,000 in increments of 200
Salaries expense	salarexp	Local	25,000 – 30,000 in increments of 200
Sales revenue	salesrev	Local	175,000 – 185,000 in increments of 200
Tax expense	taxexp	Local	20,000 – 30,000 in increments of 200
Panel B: Calculated variables			
Description	Name	Type	Calculated as
Land	land	Calculation	[cs]+[begre]+[salesrev]-[cogs]-[deprexp]-[insexp]-[salarexp]-[taxexp]-[divspd]+[ap]+[bp]-[ar]+[ad]-[bldg]-[cash]
Retained earnings, ending balance	endre	Calculation	[begre]+[salesrev]-[cogs]-[deprexp]-[insexp]-[salarexp]-[taxexp]-[divspd]

Figure 5: Screenshot of defined variables in Simulation #2			
Name	Type	Info	New Variable
endre	calculation	[begre]+[salesrev]-[cogs]-[deprexp]-[insexp]-[salarexp]-[taxexp]-[divspd]	
land	calculation	[cs]+[begre]+[salesrev]-[cogs]-[deprexp]-[insexp]-[salarexp]-[taxexp]-[divspd]+[ap]+[bp]-[ar]+[ad]-[bldg]-[cash]	
ad	local	generated in increments of 200 over the range 34000 to 39000	
ap	local	generated in increments of 200 over the range 15000 to 20000	
apic	local	generated in increments of 200 over the range 14000 to 20000	
ar	local	generated in increments of 200 over the range 14000 to 26000	
begre	local	generated in increments of 200 over the range 150000 to 170000	
bldg	local	generated in increments of 500 over the range 280000 to 310000	
bp	local	generated in increments of 200 over the range 40000 to 60000	
cash	local	generated in increments of 200 over the range 12000 to 17000	
cogs	local	generated in increments of 200 over the range 45000 to 55000	
cs	local	generated in increments of 200 over the range 80000 to 90000	
deprexp	local	generated in increments of 200 over the range 40000 to 50000	
divspd	local	generated in increments of 100 over the range 5000 to 8000	
insexp	local	generated in increments of 200 over the range 1000 to 4000	
salarexp	local	generated in increments of 200 over the range 25000 to 30000	
salesrev	local	generated in increments of 200 over the range 175000 to 185000	
taxexp	local	generated in increments of 200 over the range 20000 to 30000	

Step 2: *Compose question text.* Next, we compose the question in the “Worksheet Question” area, as depicted in Figure 6. As in Simulation #1, we will wait to define answer

choices until Step 3, so the answer prompts (e.g., “__ans1__”, “__ans2__”, etc.) may be ignored for the time being.

Figure 6: Screenshot of Question Text in Simulation #2



Step 3: *Define answers.* As in Simulation #1, the last step is to define answer choices. We do so by scrolling below the question editor window and creating a new “Multiple Choice” answer type. Choices for each defined answer are identified in Table 5 and the corresponding spreadsheet is provided in Figure 7. Also consistent with Simulation #1, we use Connect’s default settings for all other answer options including the option to scramble answers. Again, we emphasize that although the correct answer is “A” for each of the defined answers in Table 5, this pattern is not likely to hold for students due to the scrambling of answers.

Table 5: Choices for Defined Multiple Choice Answers in Simulation #2^a	
Answer 1: Total Current Assets to be reported on 12/31/X1 Classified Balance Sheet	
Name:	ans1 Correct answer: A
Choice A:	$\{[cash]+[ar]:\#\,\#\#\}$
Choice B:	$\{[ar]:\#\,\#\#\}$
Choice C:	$\{[cash]:\#\,\#\#\}$
Choice D:	$\{[cash]+[ar]+[bldg]+[land]-[ad]:\#\,\#\#\}$
Answer 2: Total Non-Current Assets to be reported on 12/31/X1 Classified Balance Sheet	
Name:	ans2 Correct answer: A
Choice A:	$\{[land]+[bldg]-[ad]:\#\,\#\#\}$
Choice B:	$\{[land]+[bldg]:\#\,\#\#\}$
Choice C:	$\{[land]:\#\,\#\#\}$
Choice D:	$\{[bldg]-[ad]:\#\,\#\#\}$
Answer 3: Total Current Liabilities to be reported on 12/31/X1 Classified Balance Sheet	
Name:	ans3 Correct answer: A
Choice A:	$\{[ap]:\#\,\#\#\}$
Choice B:	$\{[ap]+[divspd]:\#\,\#\#\}$
Choice C:	$\{[ap]+[bp]:\#\,\#\#\}$
Choice D:	$\{[cash]+[ar]:\#\,\#\#\}$
Answer 4: Total Non-Current Liabilities to be reported on 12/31/X1 Classified Balance Sheet	
Name:	ans4 Correct answer: A
Choice A:	$\{[bp]:\#\,\#\#\}$
Choice B:	$\{[ap]:\#\,\#\#\}$
Choice C:	$\{[divspd]:\#\,\#\#\}$
Choice D:	$\{[bp]+[ap]:\#\,\#\#\}$
Answer 5: Net Income for the year ended 12/31/X1	
Name:	ans5 Correct answer: A
Choice A:	$\{[salesrev]-[salarexp]-[taxexp]-[cogs]-[deprexp]-[insexp]:\#\,\#\#\}$
Choice B:	$\{[salesrev]-[salarexp]-[taxexp]-[cogs]-[deprexp]-[insexp]-[divspd]:\#\,\#\#\}$
Choice C:	$\{[salesrev]-[salarexp]-[taxexp]-[cogs]-[insexp]:\#\,\#\#\}$
Choice D:	$\{[begre]-[divspd]:\#\,\#\#\}$
Answer 6: Addition to Retained Earnings for the year 20X1	
Name:	ans6 Correct answer: A
Choice A:	$\{[salesrev]-[cogs]-[deprexp]-[insexp]-[salarexp]-[taxexp]-[divspd]:\#\,\#\#\}$
Choice B:	$\{[begre]:\#\,\#\#\}$
Choice C:	$\{[divspd]:\#\,\#\#\}$
Choice D:	$\{[salesrev]-[cogs]-[deprexp]-[insexp]-[salarexp]-[taxexp]:\#\,\#\#\}$
Answer 7: Ending balance in Retained Earnings to be reported on 12/31/X1 Classified Balance Sheet	
Name:	ans7 Correct answer: A
Choice A:	$\{[begre]+[salesrev]-[cogs]-[deprexp]-[insexp]-[salarexp]-[taxexp]-[divspd]:\#\,\#\#\}$
Choice B:	$\{[begre]+[salesrev]-[cogs]-[deprexp]-[insexp]-[salarexp]-[taxexp]+[divspd]:\#\,\#\#\}$
Choice C:	$\{[begre]+[salesrev]-[cogs]-[deprexp]-[insexp]-[salarexp]-[taxexp]:\#\,\#\#\}$
Choice D:	$\{[begre]:\#\,\#\#\}$
Answer 8: Total Shareholders' Equity to be reported on 12/31/X1 Classified Balance Sheet	
Name:	ans8 Correct answer: A
Choice A:	$\{[cs]+[endre]+[apic]:\#\,\#\#\}$
Choice B:	$\{[cs]+[begre]+[apic]:\#\,\#\#\}$
Choice C:	$\{[cs]+[begre]+[ap]+[bp]:\#\,\#\#\}$
Choice D:	$\{[cs]:\#\,\#\#\}$
a. We suggest using "None of these." as a fifth choice ("Choice E") for each of the above defined answers.	

Figure 7: Screenshot of Defined Answers in Simulation #1

Name	Type	Weight	Info	
ans1	m/c	100	$(\${{[cash]+[ar]:#}}), \${{[ar]:#}}, \${{[cash]:#}}, \${{[cash]+[ar]+[bldg]+[land]-[ad]:#}}$	
ans2	m/c	100	$(\${{[land]+[bldg]-[ad]:#}}, \${{[land]+[bldg]:#}}, \${{[land]:#}}, \${{[bldg]-[ad]:#}}$	
ans3	m/c	100	$(\${{[ap]:#}}, \${{[ap]+[divspd]:#}}, \${{[ap]+[bp]:#}}, \${{[cash]+[ar]:#}}$	
ans4	m/c	100	$(\${{[bp]:#}}, \${{[ap]:#}}, \${{[divspd]:#}}, \${{[bp]+[ap]:#}}$	
ans5	m/c	100	$(\${{[salesrev]-[salarexp]-[taxexp]-[cogs]-[deprexp]-[insexp]:#}}, \${{[salesrev]-[salarexp]-[taxexp]-[cogs]-[deprexp]-[insexp]-[divspd]:#}}, \${{[salesrev]-[salarexp]-[taxexp]-[cogs]-[insexp]:#}}, \${{[begre]-[divspd]:#}}$	
ans6	m/c	100	$(\${{[salesrev]-[cogs]-[deprexp]-[insexp]-[salarexp]-[taxexp]-[divspd]:#}}, \${{[begre]:#}}, \${{[divspd]:#}}, \${{[salesrev]-[cogs]-[deprexp]-[insexp]-[salarexp]-[taxexp]:#}}$	
ans7	m/c	100	$(\${{[begre]+[salesrev]-[cogs]-[deprexp]-[insexp]-[salarexp]-[taxexp]-[divspd]:#}}, \${{[begre]+[salesrev]-[cogs]-[deprexp]-[insexp]-[salarexp]-[taxexp]+[divspd]:#}}, \${{[begre]+[salesrev]-[cogs]-[deprexp]-[insexp]-[salarexp]-[taxexp]:#}}, \${{[begre]:#}}$	
ans8	m/c	100	$(\${{[cs]+[endre]+[apic]:#}}, \${{[cs]+[begre]+[apic]:#}}, \${{[cs]+[begre]+[ap]+[bp]:#}}, \${{[cs]:#}}$	

With all steps completed, we can now preview the question (see Figure 8). In accordance with directions provided in Simulation #1, we conclude the process by selecting “Save & Exit” in the upper right-hand corner of the question editor window.

Figure 8: Screenshot of Final Question in Instructor Preview Mode, Simulation #2

Refresh
algorithmic
Close Window

Following is a complete list of accounts (in alphabetical order) taken from ABC Corp. for the year of 20X1. Use this information to answer questions (a) through (h) below. (Hint: Prepare a Classified Balance Sheet as of 12/31/X1.)

Accounts Payable	\$16,600
Accounts Receivable	\$21,600
Accumulated Depreciation	\$39,000
Additional Paid-in-Capital	\$15,200
Bonds Payable, due in 30 years	\$42,600
Building	\$296,000
Cash	\$14,600
Common Stock	\$84,000
Cost of Goods Sold	\$47,600
Depreciation Expense	\$45,200
Dividends Paid	\$6,700
Insurance Expense	\$3,800
Land	\$28,500
Retained Earnings, <i>beginning of year</i>	\$155,200
Salaries Expense	\$28,000
Sales Revenue	\$179,200
Tax Expense	\$24,600

2a. What is the total amount of Current Assets to be reported on ABC Corp.'s 12/31/X1 Classified Balance Sheet?

→\$36,200

2b. What is the total amount of Non-Current (Long-Term) Assets to be reported on ABC Corp.'s 12/31/X1 Classified Balance Sheet?

→\$285,500

2c. What is the total amount of Current Liabilities to be reported on ABC Corp.'s 12/31/X1 Classified Balance Sheet?

→\$16,600

2d. What is the total amount of Non-Current (Long-Term) Liabilities to be reported on ABC Corp.'s 12/31/X1 Classified Balance Sheet?

→\$42,600

2e. What is ABC Corp.'s Net Income for the year ended 12/31/X1?

→\$30,000

2f. What is ABC Corp.'s *Addition* to Retained Earnings for the year 20X1?

→\$23,300

2g. What is the *Ending Balance* in Retained Earnings to be reported on ABC Corp.'s 12/31/X1 Classified Balance Sheet?

→\$178,500

2h. What is the total amount of Shareholders' Equity to be reported on ABC Corp.'s 12/31/X1 Classified Balance Sheet?

→\$277,700

V. CONCLUSION

In this paper, we have demonstrated how to customize assessment within the McGraw-Hill Connect Finance software platform. We acknowledge that such customization processes are not readily apparent and in some respects, not entirely intuitive. However, we hope the benefits pursuant to tailoring assessments *are* apparent and considered feasible using the material we

have presented. Our hope is that customization in Connect and similar web-based software programs will be implemented in such a way that the highest degree of student learning is achieved. Future research could address customization techniques in other software platforms and/or subject areas. Further study on the impact of such platforms' features (e.g., instant and delayed feedback, static and algorithmic question formats, etc.) on student learning could also be investigated.

ENDNOTES

¹ For those unfamiliar with McGraw-Hill Connect Finance, we suggest referring to introductory demo material available at <http://www.mcgrawhillconnect.com/demofinance/>.

² Yourstone, Krave and Albaum (2010) search for the optimal number of attempts for quantitative assignments administered through the McGraw-Hill Homework Manager platform – the predecessor system to McGraw-Hill's Connect. They find that students allowed only two attempts outperform students who are given four attempts.

³ The default option in Connect is to scramble multiple choice answers. We agree with this choice as it further serves to counteract academic misconduct opportunities.

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