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ABSTRACT

Online learning has been gaining widespread adoption due to its success in enhancing student-learning outcomes and improving student academic performance. This paper describes an online tutorial to teach resource-event-agent (REA) data modeling in an undergraduate accounting information systems course. The REA online tutorial reflects a self-study application designed to help students improve their understanding of the REA data model. As such, the tutorial acts as a supplement to lectures by reinforcing the concepts and incorporating practices to assess student understanding. Instructors can access the REA online tutorial at http://smu.sg/rea. An independent survey by the University's Centre for Teaching Excellence found a significant increase in students' perceived knowledge of REA data modeling after using the REA online tutorial compared to their knowledge prior to using the tutorial. Students also rated their overall satisfaction with and the effectiveness of the REA online tutorial as high.

Keywords:
Resource-Event-Agent, Data Modeling, Online Learning, E-Learning

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INTRODUCTION

Individuals often perceive accounting education as a traditional and conservative discipline, with accountants not as accepting of change and challenges as individuals do in other fields, such as bio-technology and computer science (Holtzblatt and Tschakert, 2011). However, educational pedagogies have changed significantly in recent times, with accounting professionals and educators calling for a broader and more flexible approach to the teaching of accounting, such as the incorporation of information and communication technology (ICT) in the curriculum (Wessels, 2010). Furthermore, the accounting profession has recommended the use of computers in classrooms to enhance student learning and to better prepare students for accounting careers (Lusher et al., 2012).

Online learning facilitates the educator-learner relationship through the use of various types of ICT and electronic resources. Educators have widely regarded the use of the Internet and multimedia applications in teaching and learning activities as a vital tool for effectively delivering educational content (Alsadhan et al., 2014; Gavira and Omoteso, 2013; Perera and Richardson, 2010). Multimedia e-learning, defined as the "dissemination of material in a computer-based presentation by combining text, graphics, video, animation and sound through the Internet (Cheng and Swanson, 2011)", reflects an established method to enrich student learning. It has transformed conventional modes of delivering educational content such as books and written material into online, readily available interactive forms (Alsadhan et al., 2014). Wells et al. (2008) also found that the use of technology in educational settings assists in the achievement of learning outcomes.

The positive experience of engaging in online learning applies to the accounting curriculum. Wong (2012) surveyed first-year accounting students about their attitudes towards e-learning and their perceptions of the effectiveness of online options in facilitating their learning in an introductory accounting subject, and reported positive findings. Both Apostolou et al. (2011) and De Lange et al. (2003) highlighted the importance of incorporating the effective use of technology in enhancing accounting education.

This paper presents an innovative teaching methodology that involves an online tutorial to teach resource-event-agent (REA) modeling (McCarthy, 1982) in an undergraduate accounting information systems (AIS) course. We were motivated to develop the REA online tutorial as students indicated that they find REA modeling to be a challenging subject and would like to have more learning resources available to study it outside the classroom. As it is a self-study application designed to help students improve their understanding of REA modeling, the tutorial acts as a supplement to lectures. It reinforces the concepts and incorporates practices to assess student understanding. This paper intends to benefit other students by sharing the REA online tutorial with AIS instructors who may then incorporate it into their classes.

We organize the remainder of the paper as follows. First, we discuss the benefits of online learning as a pedagogical tool. Then a description of the online tutorial that was used to teach REA in an AIS course follows. Next, we discuss the feedback provided by the students who participated in the REA online tutorial.

ONLINE LEARNING AS A PEDAGOGICAL TOOL

Instructors have widely adopted online learning due to its success in improving student academic performance and enhancing student-learning outcomes (Baxter and Thibodeau, 2011; Hiralaal, 2012; Perera and Richardson, 2010; Sargent et al., 2011; Teo and Wong, 2013). In multimedia-based online learning courses especially, students engage in and devote full attention to the online instruction due to the vividness of the presentation and sound as well as the hands-on interactive activities, all of which optimize the student's capacity to capture information and engender better learning outcomes (Cheng and Swanson, 2011).

In accounting education, Gavira and Omoteso (2013) found that students learning financial accounting experienced positive learning experiences by using computerized tutorial systems. Most accounting students viewed virtual learning favorably, and Sargent et al. (2011) found their

learning outcomes improved with the increased use of supplementary online materials. For example, the use of e-tutoring systems across business disciplines, such as finance and management information systems, boosted student-learning outcomes by 12% relative to students who used text-based resources (Cheng and Swanson, 2011). Perdisco, a highly customized e-learning tool that utilized an e-workbook and required students in a financial accounting course to use computers and the Internet, also improved student-learning outcomes (Bolt and Flynne, 2009). Other studies further indicated that the use of technology in teaching and learning motivates students to learn (Hiralaal, 2012; Jebeile and Abeysekera, 2010; Suwardy et al., 2013; Tan and Ferreira, 2011). Sargent et al., (2011) found increased motivation to learn in students enrolled in introductory accounting courses because students readily accessed the learning materials through digital media that responded to students' expectations for immediate access to flexible learning activities.

Similarly, the Durban University of Technology supported this view by identifying online learning as one of the objectives in reforming their curriculum. Thus, they implemented it along with face-to-face interaction as a teaching approach in accounting education (Hiralaal, 2012). The university made additional resources easily accessible online, and the students received instant feedback regarding their online assessments. Consequently, students saw a marked improvement in their performance in accounting classes and their motivation to learn increased (Hiralaal, 2012). Students involved in a virtual accounting lab also exhibited greater motivation through real world simulation and willingly spent more time practicing their accounting skills (Guo and Cai, 2013).

Online learning improves the flexibility of working hours for both students and teachers as they manage their time more effectively by taking greater control of their learning outside the class (Gavira and Omoteso, 2013). For example, tertiary students use multimedia-based Accounting e-Tutor learning modules to access accounting materials without time and place restrictions, which helps them cultivate new skills and professional knowledge outside the conventional classroom (Cheng and Swanson, 2011). Furthermore, the use of an online environment can potentially increase on-task time through the intrinsic motivation produced by immediate feedback and minimize the time spent on other tasks, such as commuting to brick-and-mortar institutions (Bolt and Flynne, 2009).

THE REA ONLINE TUTORIAL

This paper describes a teaching innovation that involves an online tutorial to teach REA modeling in an undergraduate AIS course. The design of this self-study application helps students improve their understanding of the REA data model by acting as a supplement to lectures to reinforce the concepts and incorporate practices to assess student understanding.

Scope and Learning Objectives

The REA online tutorial, accessible at http://smu.sg/rea (see Appendix for selected screenshots), allows students to review and apply the concepts that they have learned in class through interactive storytelling and exercises.

We organized the REA online tutorial into the following six sections:

1. REA Data Model: Students review an overview of the REA data modeling technique.
2. Revenue Cycle: Students view a revenue cycle and apply the REA data modeling.
3. Expenditure Cycle: Students view an expenditure cycle and apply the REA data modeling.
4. Combined REA Model: Students learn how to integrate the revenue cycle and the expenditure cycle in a combined REA data model.

5. Implementing REA Diagram: Students learn how to implement and incorporate the combined REA data model in the data tables. Students also view video demonstrations to apply the combined REA data model in Microsoft Access.
6. Summary and Quiz: After going through the above content, students take a quiz based on the business processes of another company.

The learning objectives of the REA online tutorial include: (1) students explaining the steps to develop an REA data model, (2) students applying the rules to combine REA data models, (3) students explaining the steps of an REA data model, and (4) students translating an REA data model into a Microsoft Access database. The students develop an understanding of REA data modeling by completing an online tutorial.

Intended Audience and Time Requirement

We assigned the REA online tutorial as part of an undergraduate AIS course. These full-time university students range in ages between 19 and 21 years. Students typically take the AIS course during their second year at the university. We structure the REA online tutorial in six sections, and students require approximately one hour to complete the entire tutorial. Students can pause at any time while going through the online tutorial and can complete the six sections in several sittings.

Implementation Guidance

Instructors can assign the REA online tutorial as a supplementary learning resource after covering the REA data modeling topic in the AIS course. Students can complete the online tutorial after class as a review exercise to consolidate their level of knowledge about REA data modeling. Different exercises are embedded at various points throughout the lesson, and students are not allowed to proceed until they have provided the correct responses. For selected exercises, the online tutorial displays the correct responses after several unsuccessful attempts. Instructors are not required to conduct any manual grading.

FINDINGS AND DISCUSSION

The University's Centre for Teaching Excellence (CTE) conducted an online survey to evaluate the project and provided the results. Over a period of three semesters, 257 voluntarily participated in the survey.

Perceived Knowledge of REA Data Modeling

Students rated their knowledge of REA data modeling before and after using the REA online tutorial. We conducted a paired-samples t-test to compare the perceived knowledge of REA data modeling before and after viewing the REA online tutorial.

The results indicate that students' mean perceived knowledge of REA data modeling differs between the two time periods, specifically, before using the REA online tutorial ($M = 3.97$, $SD = 1.021$) and after using the REA online tutorial ($M = 5.29$, $SD = 0.832$) at the 0.01 level of significance ($t = -23.469$, $df = 256$, $p < 0.01$). Because the sample included students over three semesters, we conducted additional paired-samples t-tests for each of the three semesters, and the results did not differ. For each of the three semesters, a significant difference existed in the perceived knowledge of REA data modeling of students before and after using the REA online tutorial.

Table 1. Results of t-test and descriptive statistics for growth in perceived knowledge of REA data modeling due to the online tutorial

Outcome	Before online tutorial M	Before online tutorial SD	After online tutorial M	After online tutorial SD	n	95% CI for Mean Difference	t	df	p-value
Perceived Knowledge of REA [a]	3.97	1.021	5.29	0.832	257	-1.319, 0.901	-23.469	256	0.000

a. Survey scale: 1 = Very Low; 2 = Fairly Low; 3 = Somewhat Low; 4 = Average; 5 = Somewhat High; 6 = Fairly High; and 7 = Very High

Student Feedback

We asked students to rate their overall satisfaction with the REA online tutorial on a four-point Likert scale ranging from very dissatisfied (= 1) to very satisfied (= 4). The mean satisfaction rating of 3.19 (SD = 0.488) indicates that a large majority of respondents were satisfied with the REA online tutorial (see Table 2), as 193 students (75.1 percent) said they were satisfied and 57 students (22.2 percent) were very satisfied with the REA online tutorial. The remaining seven students (2.7 percent) indicated that they were dissatisfied or very dissatisfied.

Table 2. Student survey feedback regarding the REA online tutorial

	Questions	Mean (n=257)	Standard Deviation
1	Overall, how satisfied are you with this learning object? [a]	3.19	0.488
2	Overall, how would you rate this learning object in terms of helping you to learn effectively? [b]	3.15	0.445

a. Survey scale: 1 = very dissatisfied; 2 = dissatisfied; 3 = satisfied; and 4 = very satisfied.
b. Survey scale: 1 = very ineffective; 2 = ineffective; 3 = effective; and 4 = very effective.

We asked students to rate the effectiveness of the REA online tutorial in enhancing their learning of REA data modeling on a four-point Likert scale ranging from very ineffective (= 1) to very effective (= 4). The mean effectiveness rating of 3.15 (SD = 0.445) indicates that the REA online tutorial was effective in helping students to learn REA data modeling (see Table 2), as 202 respondents (78.6 percent) rated the REA online tutorial as effective and 46 respondents (17.9 percent) rated it as very effective with respect to facilitating their learning about REA data modeling. Six students (2.3 percent) found it ineffective, and one student indicated it was very ineffective.

We then asked students about the instructional design of the REA online tutorial (see Table 3). The results indicate that students were positive about the REA online tutorial. A large majority of respondents indicated that the REA online tutorial was engaging (M = 3.34, SD = 0.585). Of the 257 respondents, 148 students (57.6 percent) agreed and 99 students (38.5 percent) strongly agreed that the tutorial was engaging. Only ten students (3.9 percent) did not agree that the REA online tutorial was engaging.

Table 3. Student survey feedback regarding the instructional design of the online tutorial

	Questions [a]	Mean (n=257)	Standard Deviation
1	Pop-up windows were un-intrusive.	2.84	0.832
2	Supplementary materials were easily accessible.	3.29	0.628
3	Online activities were conducive to learning.	3.32	0.722
4	Quizzes were conducive to learning.	3.39	0.635
5	Demonstrations were conducive to learning.	3.38	0.698
6	Stories were conducive to learning.	3.34	0.655
7	Audio was conducive to learning.	2.79	0.960
8	Video was conducive to learning.	3.17	0.835
9	The design was appealing and highly motivating.	3.25	0.724
10	The process for moving through the learning object was intuitive, easy and free from excessive delay.	3.25	0.717
11	The instructions were clear and easy to follow.	3.36	0.659
12	The learning object was well organized, thus enhancing learning.	3.33	0.762
13	The learning object was engaging.	3.34	0.585

a. Survey scale: 0 = not applicable; 1 = strongly disagree; 2 = disagree; 3 = agree; and 4 = strongly agree.

We also asked students about the learning content of the REA online tutorial (see Table 4). The results indicate that students were satisfied with the learning content of the REA online tutorial. A large majority of respondents indicated that the content was logical (M = 3.48, SD = 0.6), well-developed (M = 3.4, SD = 0.661) and appropriate to their skill level (M = 3.37, SD = 0.696). Of the 257 respondents, only seven students (2.7 percent) did not agree that the activities, content and assessments in the REA online tutorial met the stated learning goals. Of the remaining 250 respondents, 136 students (52.9 percent) agreed and 114 students (44.4 percent) strongly agreed that the activities, content and assessments met the stated learning goals.

Table 4. Student survey feedback regarding the learning content of the online tutorial

	Questions [a]	Mean (n=257)	Standard Deviation
1	The content was logical and coherent.	3.48	0.600
2	The content was well supported / developed.	3.40	0.661
3	The content was appropriate to my skill level.	3.37	0.696
4	The learning goals were clear.	3.45	0.636
5	The activities, content and assessments in the learning object met the stated learning goals.	3.39	0.641
6	The learning object provided sufficient supplementary content.	3.19	0.770
7	The use of technology was appropriate for this content.	3.34	0.667
8	The length of the learning object was appropriate.	3.15	0.763

a. Survey scale: 0 = not applicable; 1 = strongly disagree; 2 = disagree; 3 = agree; and 4 = strongly agree.

Regarding limitations of this study, many of the student survey questions currently appear in a positive form rather than in a reverse coded format. This implies that the likelihood that some respondents may simply select one value exists and this may affect the outcome of the questions.

Student feedback was unusually positive in this study. This may be due to the Asian culture, which generally discourages people from criticizing authorities. In many East and Southeast Asian cultures, Confucian ideals, which include respect for elders, strongly influence behavior, and most Asian parents teach their children to respect authority and to conform to expected behaviors. That said, students give teachers in Asian cultures a higher status than students provide teachers in Western countries (Baruth and Manning, 1992).

Respondents also provided qualitative feedback. Students valued the REA online tutorial as a useful supplementary resource outside the classroom. They claimed that the tutorial sustained their interest in the course materials and assisted them in understanding the REA data model. Table 5 provides selected student comments. Findings of this study corroborate the findings of prior studies that online tutorials facilitate and enhance student learning.

Table 5. Selected student comments regarding the REA online tutorial

Selected student comments
"It is a useful and innovative way to teach a complex topic. The learning object teaches me step-by-step to construct and implement the REA diagram into relational database tables. Yes, it enhanced and cemented my knowledge on REA diagrams."
"The learning object helps to improve understanding about the subject by reinforcing and clearly illustrating what has been taught in class."
"The learning object was very well done. The illustrations were very attractive and made the learning process enjoyable. The click/drag-and-drop exercises were also well-designed with ease of use. Explanations were also very clear in the learning object. I enjoyed using the learning object."
"In my opinion, this REA learning object gives a very good recap of what the topic is about. It is very simple and straightforward and, hence, is only meant for people who need to recap the basic concepts. It was definitely beneficial for me because I almost forgot all of my REA concepts after not looking at it for almost two weeks, but this learning object helped refresh my concepts again."
"I was impressed. The step-by-step learning tabs were very useful and practices along the way helped us apply what we have learned."
"It was helpful because I was able to rewind back several times if there was a point that I did not understand. Unlike class, this could be done at my own pace and could be paused when I needed to. The pace was good and the content was fairly comprehensive."
"I liked that it allows us to return to the last visited page so we don't have to finish everything in one go. This allows for more flexibility in time. Learning everything at one go might be very tiring and boring and we get disinterested, so the continuing function helped me a lot."
"Enjoyed the visuals and effort put in to make it interactive. Also good that there are tabs to give user control of what they want to view again and navigate freely to aid revision."

CONCLUSION

This paper presents an online tutorial that teaches REA data modeling in an undergraduate AIS course. We introduced the REA online tutorial in an attempt to allow students to recap and apply the concepts that they have learned in class through an interactive storytelling and exercise approach. The results of an independent survey conducted by the University's CTE confirm that the REA online tutorial effectively facilitates and improves

student learning and understanding of the REA data model. The results further indicate that students significant increased their perceived knowledge of REA data modeling when comparing students' knowledge before and after they viewed the REA online tutorial. Students also exhibited high overall satisfaction with the tutorial and rated it as highly effective.

Though many students have found such online tutorials useful, certain drawbacks exist that instructors must consider. For example, learners may feel a sense of isolation (O'Donoghue et al., 2004) because online learning, for the most part, results in a solo act in which the learner may feel that he or she is acting completely alone. Additionally, a lack of flexibility with respect to online tutorials may exist, as instructors may not easily adjust the course in response to student reaction once the course begins (Alexander et al., 2012).

Future studies can examine the effectiveness of an online tutorial in accounting courses other than AIS. Future studies could also compare the effectiveness of the online learning approach with other learning interventions.

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Appendix: Selected Screenshots of the REA Online Tutorial

Figure 1 displays the welcome screen of the resource-event-agent (REA) online tutorial. The REA online tutorial is presented in multimedia format to fully engage students in the learning process through the use of graphics, video, animation and sound. The lesson takes approximately 60 minutes.

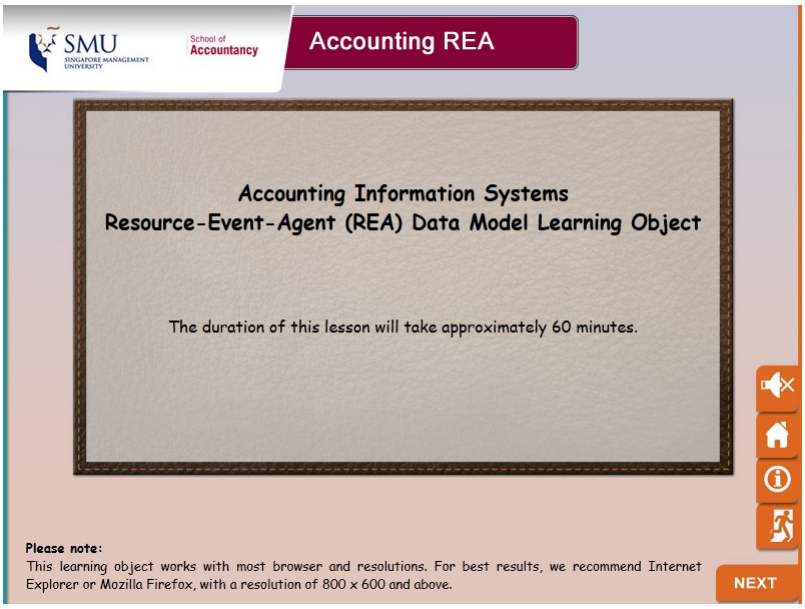

Figure 1: Welcome screen of the REA online tutorial

There are six sections in total. Figure 2 presents the home screen of the first REA Data Model section. The narrative centers around a company called YY Yoghurt, which sells yogurt-related products and also has its own online store.

Figure 2: First screen of the REA Data Model section

The REA online tutorial adopts a step-by-step approach to assist students. We narrate the background of the company through a series of colorful graphics and dialogue as presented in Figure 3 below.

Figure 3: Subsequent screen of the REA Data Model section

After the narration of the company, we introduce the students to the concept of REA as presented in Figure 4 below.

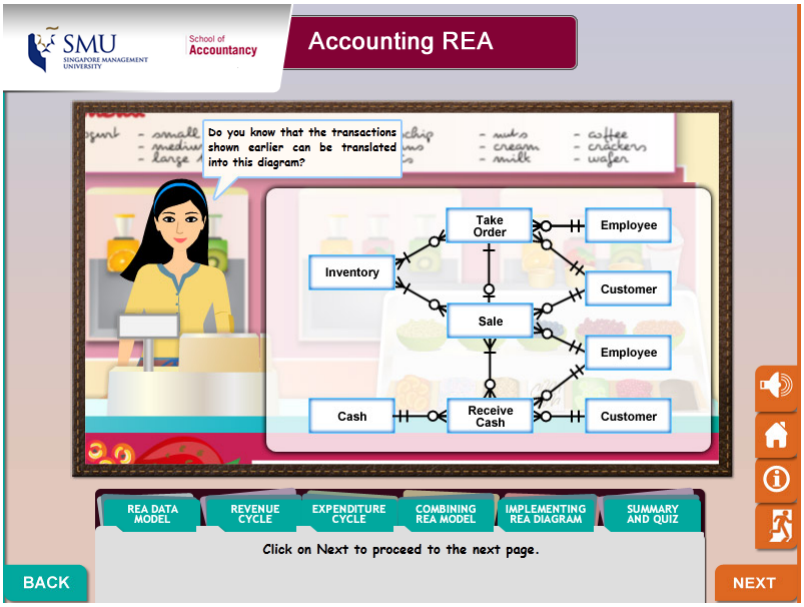

Figure 4: Introduction to the REA data model

The last screen of the REA Data Model section states the learning objectives of the REA online tutorial (see Figure 5).

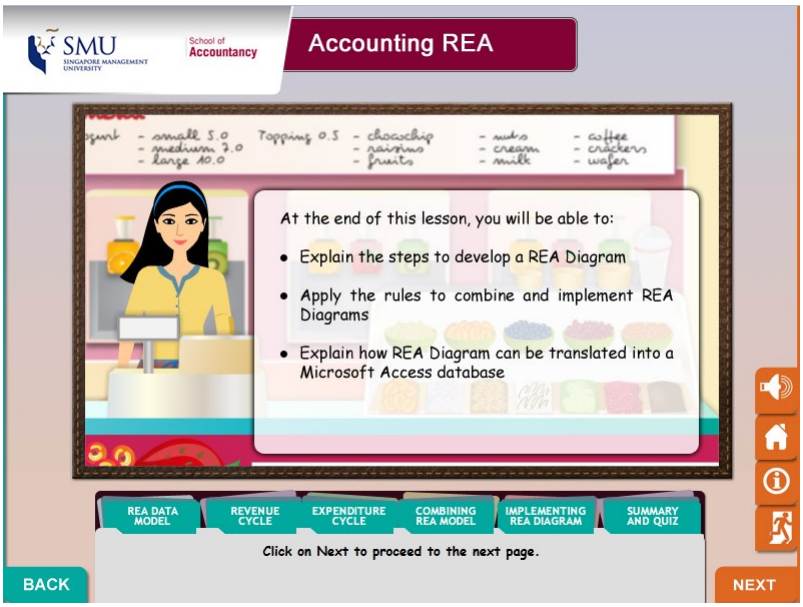

Figure 5: Learning objectives of the REA online tutorial

Students then complete the revenue cycle in the next section. The tutorial explains the basic principles, thus allowing students to build up their knowledge before proceeding to more difficult tasks. The tasks are embedded in this section, and students must complete them before continuing. For example, students will first click on the screen to identify the resource, event and agents (Figure 6).

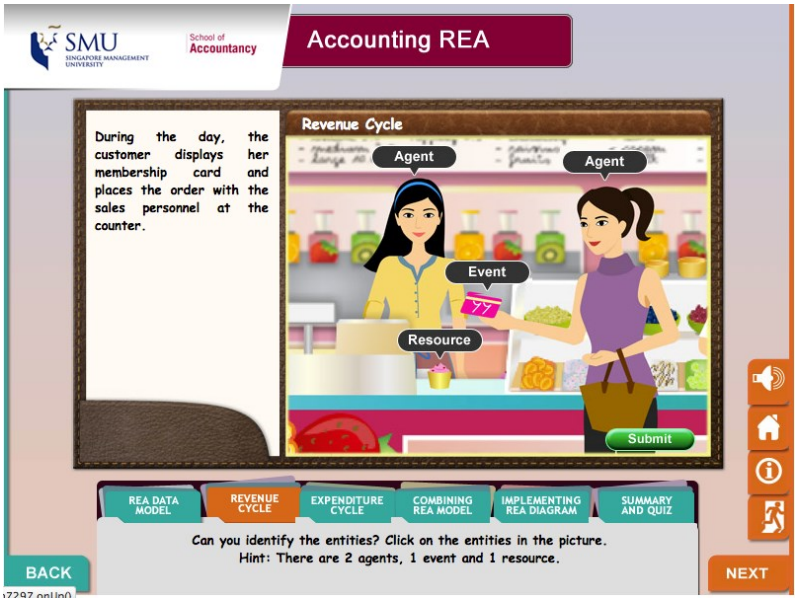

Figure 6: Task within the revenue cycle

The tutorial immediately provides feedback upon completion of the task (Figure 7) before the students proceed to construct a full REA model (Figure 8).

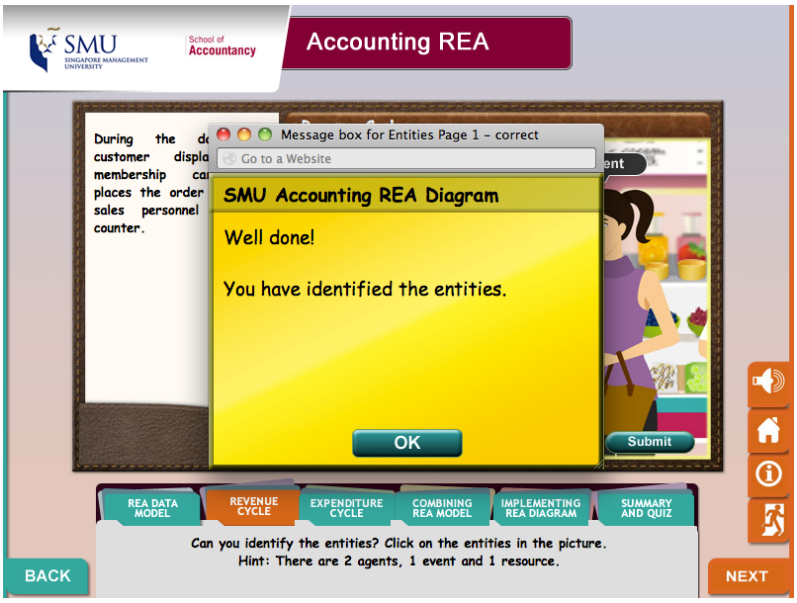

Figure 7: Feedback after attempting the task

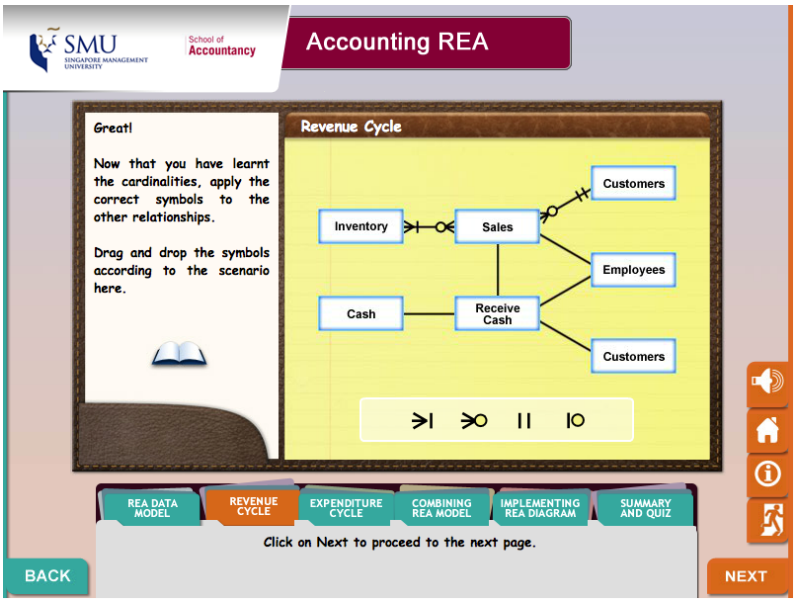

Figure 8: Further task within the revenue cycle

After the revenue cycle, students proceed to complete the expenditure cycle (Figure 9).

Figure 9: Expenditure cycle section

After completing both the revenue and expenditure cycles, students proceed to the "Combining REA Model" section (Figure 10). This section teaches students how to combine the REA diagrams of both the revenue and expenditure cycles, and guides students to identify the common resources and learn the rules for merging redundant resources and redundant events in a combined REA model.

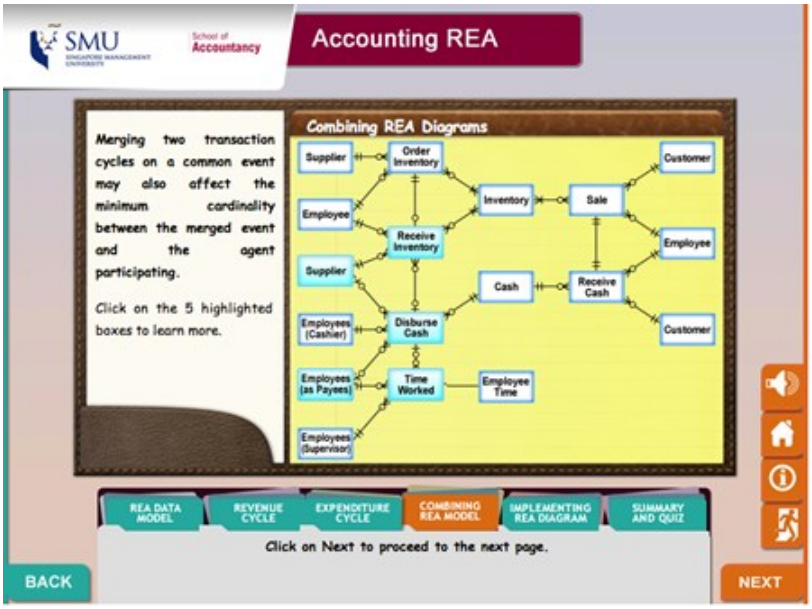

Figure 10: Combining REA model section

The next section relates to the implementation of the REA model (Figure 11). This section explains the implementation steps to convert the REA diagram to a relational database. This section explains the number of tables required, the attributes required in each table, and the various keys (e.g., primary keys and foreign keys) in the tables. The section ends with a video illustration that provides a step-by-step guide of implementing the relational database in Microsoft Access.

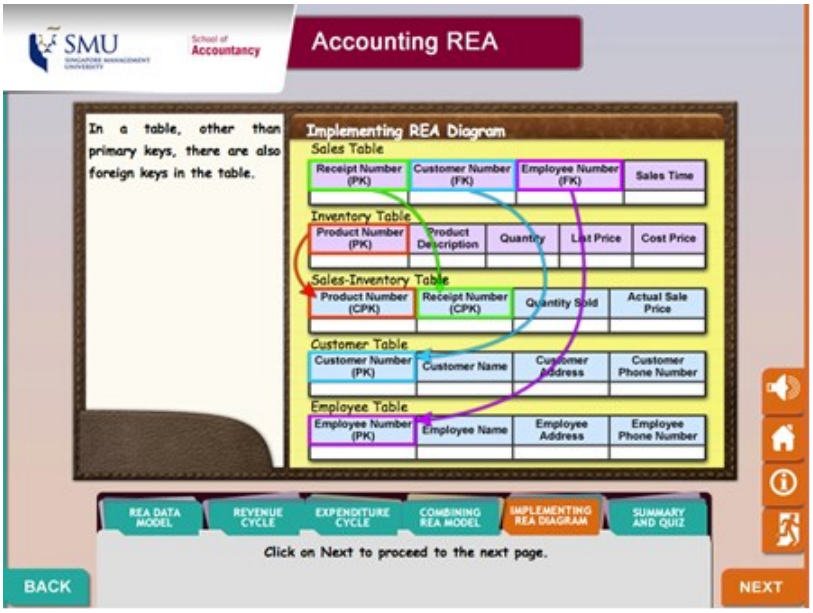

Figure 11: Implementing REA model section

After completing the five sections, students can review any of the earlier sections, or they may proceed to take the assessment (Figure 12).

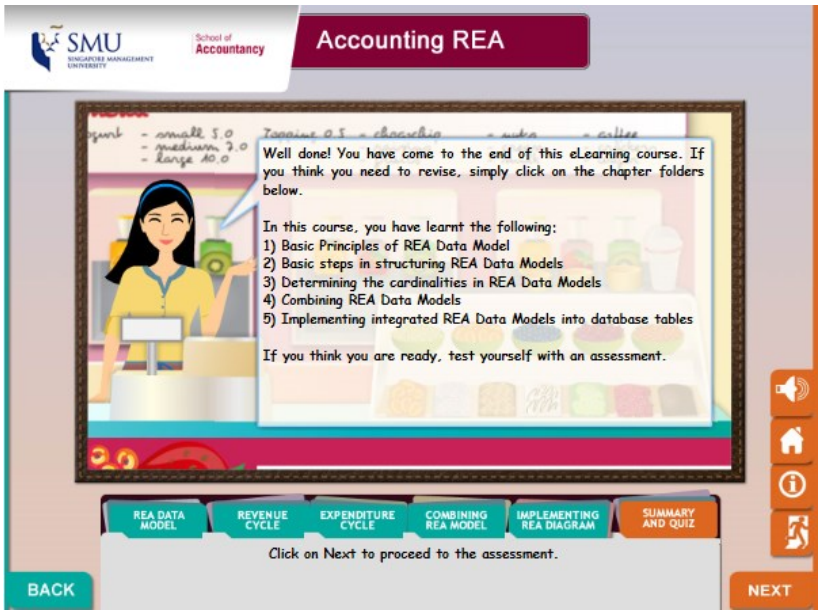

Figure 12: Summary and Quiz section