USING THE SAMR MODEL TO TRANSFORM MOBILE LEARNING IN A HISTORY OF ART AND ARCHITECTURE CLASSROOM

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Abstract. This paper presents the progress of a pilot classroom, which uses mobile devices to enhance instructor-student classroom interactions and students’ learning of the History of Art and Architecture. The main objective of this research was to find a way of improving classroom activities, for the coming year, by making the best possible use of technology to enable students to learn more successfully and improve their understanding of the lesson content. In this paper, classroom activities during 2014 and 2015 are analysed using the SAMR Model coupled with Bloom’s revised taxonomy and the EdTech Quintet Model. In addition, a plan for the redesign and improvement of activities in 2016 is proposed, the effectiveness of the SAMR model at improving in class activities is discussed and a perspective on how to develop the classroom using the “SAMR ladder” is included. The results show that in 2015, 25% of the students in the class achieved an A grade, and less than 5% were graded F compared to 26% in 2012.

Keywords. Design education; mobile-based learning; History of Art and Architecture; SAMR model

1. Introduction

1.1. BACKGROUND

This paper presents the progress of a pilot classroom, which uses mobile devices to enhance instructor-student classroom interactions and students’ learning of the History of Art and Architecture (Nakapan, 2014). This academic year (2015) is the third consecutive year that Rangsit University has implemented its policy of providing freshmen with tablets. Over the past three years, more than 24,000 tablets have been distributed to students. The
School of Architecture continues to use mobile devices/tablets to augment the learning process. Initially, in 2013, Mobile Learning (Koole, 2009) was used to characterise the pilot classroom. The model comprised of a three-circle Venn diagram, which represented the ‘Learner aspect’, the ‘Social aspect’, and the ‘Device aspect’. These aspects distinguished the course from a traditional lecture-based one: the Learner aspect, where no lecture was given and no exam was taken; the Social aspect, where the class was activity-based and students worked in groups; and the Device aspect, where students used mobile devices and social media as part of the learning process.

1.2. PROBLEMS ENCOUNTERED, RESEARCH QUESTIONS, AND METHODOLOGY

The main problem encountered was cramming a lot of content, ranging from pre-historic to contemporary art and architecture, into 16 weeks. Instead of organising the material in the traditional way, i.e. by era (Pre-historic, Egyptian, Greek, Roman and Byzantine) the content was organised by theme: Ancient Civilizations, Great Artists, Great Designers, and 20th Century architects. Each week by focusing on a different theme, the students could expand their knowledge through a series of activities using mobile devices. The activities included searching for information, organising knowledge, preparing presentations and taking quizzes. As a result, mobile learning has greatly enhanced instructor-student classroom interaction and the students have readily accepted mobile learning in the classroom; however, some activities could be improved on. Therefore, the objective of this research is to find a way to improve on classroom activities for the coming year.

One question, which arose, was how to improve in class activities to get the most out of the technology so that students learn more successfully and improve their understanding of the lesson content?

The methodology employed was action research, where the researcher was also an actor. The method featured three existing models: the SAMR Model, the EdTech Quintet Model and Bloom's taxonomy, which were used to analyse classroom activities during 2014 and 2015 and redesign/improve those activities for 2016. The SAMR Model for integrating technology into teaching, developed by Dr. Ruben Puentedura in the late 1980’s (Puentedura, 2009), was used to transform the classroom and help “kick it up a notch”. The model represents four levels of activities that instructors can use to climb the “SAMR ladder”: Substitution, Augmentation, Modification, and Redefinition.
1.3. MICRO-UTOPIA OF INFORMATION

In response to the conference theme, it is useful to consider an aspect of a complex system such as a classroom in terms of information. The history of art and architecture classroom is conceivable without a textbook or a single lecture because it is based on the premise that, currently, resources related to the course are readily available in the cloud. In this micro-utopia of information, an instructor who acquires knowledge then shares that knowledge with a class becomes obsolete because students can bypass the instructor to get information directly; they can also recheck the accuracy of the instructor’s knowledge quickly. Wood (2007) stated, “designers should become the facilitators of flow, rather than the originators of maintainable ‘things’ such as discrete products or images”. This means, within the context of the classroom, “Teachers should become the facilitators of the flow of information, rather than the originators of maintainable ‘knowledge’, such as discrete textbooks or lectures”. It is necessary for students to develop skills that allow them to look for a specific piece of information, judge its reliability, know how to organise it and how to reuse it in an ethical way. With this new set of skills, learning can truly become sustainable.

2. Theoretical models for mobile learning

Several theoretical models have been developed within the context of mobile learning, i.e. Koole’s Frame Model (Koole, 2009) and the TPACK (Technological Pedagogical Content Knowledge) Model (Mishra & Koehler, 2006). These models allow the instructor to understand and describe the kinds of knowledge needed for effective pedagogical practice in a technology enhanced instructional environment. The learning theory of Connectivism, which has been described as “a learning theory for the digital age” (Siemens, 2015) has also been used in the creation of instructional environments. However, one model, which was predominantly more interesting than the others, was the SAMR Model.

2.1. THE SAMR MODEL

Figure 1. The SAMR Model (left), the SAMR Model coupled with Bloom’s taxonomy (middle), and the EdTech Quintet Model (right) - Images created by Dr. Ruben Puentedura, Ph.D.
The SAMR Model is like a lens, which allows instructors to look at how they use technology in the classroom. The name of the model is derived from the initials of each of its four levels. Starting from the bottom (cf. Figure 1–left (Puentedura, 2013)):

- **Substitution** is the direct replacement of existing tools or methods used in traditional classrooms, such as students using word processors instead of pens and paper to write reports,
- **Augmentation** is when substitution provides more functionality, such as when students who write on a word processor also annotate it or share the document with instructors on Google Docs,
- **Modification** is when parts of the tasks are redesigned, such as undertaking collaborative writing using Google Docs and using highlighting and chat functionality to give instant feedback to peers,
- **Redefinition** is the highest level, which allows students to do tasks that were previously inconceivable in traditional classrooms, such as recording videos to submit as homework and then posting them on social media to ask for feedback from the audience.

The first two levels are referred to as Enhancement, where technology assists in the accomplishment of traditional tasks. However, sometimes these levels may not be needed when looking at all the possibilities technology offers. The other two levels are referred to as Transformation, this is where the real metamorphosis of the classroom takes place and technology allows creative tasks, which are very different to those found in traditional classrooms.

The SAMR model offers instructors “a continual re-examination of practice to make the best possible use of technology” (Hogan, 2009). Four ways to integrate technology with learning are provided; it takes the technology into the students’ world and instils lifelong learning habits (Harris, 2014).

### 2.2. SAMR Model and Bloom’s Taxonomy

Dr. Benjamin Bloom first created Bloom’s Taxonomy in 1956 to “promote higher forms of thinking in education, such as analysing and evaluation rather than remembering facts” (Bloom, 1956). In the context of mobile learning, a revised version of Bloom’s taxonomy, the Padagagy Wheel (Carrington, 2013) is useful for lesson development because it incorporates numerous examples of online tools and apps that allow instructors to integrate each part of Bloom’s taxonomy into the classroom. However, when the SAMR Model is coupled with Bloom’s taxonomy, initially, instructors may feel daunted because, when the models are combined they appear more complex.
The goal for the instructor, when designing a classroom, is to construct a simple SAMR ladder that is coupled to Bloom’s Revised Taxonomy (Anderson et al., 2001). As the task moves from the lower to the upper levels of the taxonomy, it also moves from the lower to the upper levels of the SAMR ladder. Figure 1 - middle illustrates the correlation between the two and it shows the steps required to integrate technology into the classroom (Puente, 2014).

2.3. THE EDTECH QUINTET MODEL

Apart from Bloom’s Revised Taxonomy, when assigning tasks to students who use technology in the classroom, the SAMR Model is often coupled with the EdTech Quintet Model (Puente, 2012) to give another perspective.

The EdTech Quintet model proposes another way of looking at technology to get the most out of it in an educational environment. This can be attained when we start thinking about which technologies relate most closely to what makes us profoundly human. The model depicts prehistoric artefacts (cf. figure 1 - right) that represent the concepts behind each category of technology. For example, the human skull discovered 200,000 years ago has modern features; it is from an era when human language expanded because, at that time, there was a complex society and the human race had become socialised. Therefore, it represents technology such as social media, the virtual world, and collaborative webs. Furthermore, the Lascaux cave painting tells the story of a Palaeolithic hero, which represents a storytelling technique that began around 17,000 years ago.

<table>
<thead>
<tr>
<th>Technology</th>
<th>Associated practice</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social</td>
<td>Communication, Collaboration, Sharing</td>
<td>social media, discussion boards, the virtual world, file sharing</td>
</tr>
<tr>
<td>Mobility</td>
<td>Anytime, Anyplace Learning and Creation</td>
<td>mobile apps, cloud computing, tablet computing</td>
</tr>
<tr>
<td>Visualization</td>
<td>Making Abstract Concepts Tangible</td>
<td>augmented reality, visual data analysis, mind mapping apps</td>
</tr>
<tr>
<td>Storytelling</td>
<td>Knowledge Integration and Transmission</td>
<td>Storytelling: electronic books, video editors, video sharing websites</td>
</tr>
<tr>
<td>Gaming</td>
<td>Feedback Loops and Formative Assessment</td>
<td>Educational games, game-based learning such as quizzes and role-playing games</td>
</tr>
</tbody>
</table>
3. Analysis of activities

The following three activities were analysed using the SAMR Model coupled with the Bloom’s Revised Taxonomy and the EdTech Quintet Model (Puenteđura, 2012): (1) Great artists, (2) Great designers, and (3) The History of Art and Architecture Quiz. Table 2 summarises all three activities and provides an analysis of the three different patterns that were found.

- For ‘Great artists’, the activities during 2014 and 2015 stayed at the same SAMR level (Augmentation), using Mobility technology. However, assignments achieved a higher Bloom level (from Understanding/Analysis, Evaluation to Understanding/Analysis, Creation),
- For ‘Great Designers’, a higher SAMR level was achieved (from Augmentation to Modification) by changing from Mobility technology to Storytelling. The assignments also achieved a higher Bloom level (from Understanding/Analysis to Understanding/Analysis, Creation),
- For the ‘History of Art and Architecture Quiz’, a higher level of SAMR was achieved (from Augmentation to Redefinition) by changing from Social to Gaming. However, it stayed at the same level according to Bloom (Remember/Understand).

<table>
<thead>
<tr>
<th>Lesson</th>
<th>Activity in 2014</th>
<th>Activity in 2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Great artists</td>
<td>Students use apps (like PowerPoint or Keynote) to create presentations on iPads. They gather information about a famous artist of their choice, their peers can vote on the quality of the presentation.</td>
<td>Students use apps to create presentations on iPads. They gather information about a famous artist of their choice then create artwork inspired by that artist. Their peers can vote on the quality of the presentation.</td>
</tr>
<tr>
<td>SAMR</td>
<td>Augmentation</td>
<td>Augmentation</td>
</tr>
<tr>
<td>EdTech Quintet</td>
<td>Mobility</td>
<td>Mobility</td>
</tr>
<tr>
<td>Bloom’s</td>
<td>Understanding/Analysis, Evaluation</td>
<td>Understanding/Analysis, Creation</td>
</tr>
<tr>
<td>Great designers</td>
<td>Students use apps to create presentations on iPads. They gather information about designers and artists of their choice.</td>
<td>Students create a video about a famous designer of their choice using iMovie.</td>
</tr>
<tr>
<td>SAMR</td>
<td>Augmentation</td>
<td>Modification</td>
</tr>
</tbody>
</table>

TABLE 2. An analysis of classroom activities using the SAMR Model coupled with the EdTech Quintet Model and Bloom’s revised taxonomy
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<table>
<thead>
<tr>
<th>EdTech Quintet</th>
<th>Mobility</th>
<th>Digital Storytelling</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bloom</td>
<td>Understanding/Analysis</td>
<td>Understanding/Analysis, Creativity</td>
</tr>
</tbody>
</table>

**History of Art and Architecture Quiz**

- **Description**: Students participate in a quiz related to the architectural styles of a building on a Google Spreadsheet by searching for answers or asking their peers.
- **SAMR**: Augmentation
- **EdTech Quintet**: Social
- **Bloom**: Remember/Understand

**History of Art and Architecture Quiz**

- **Description**: Students participate in an online quiz (Kahoot), to test their knowledge of the history of art and architecture while competing with their peers. The scoring system incorporates self-evaluation and real-time feedback.
- **SAMR**: Redefinition
- **EdTech Quintet**: Gaming
- **Bloom**: Remember/Understand

### 4. Transforming the classroom

#### 4.1 THE SAMR LADDER

For each of the activities the SAMR model was used to discover how the classroom could be transformed. The following SAMR ladder exercise (Table 3) was created to find ways of integrating technology into the classroom.

<table>
<thead>
<tr>
<th>Lesson</th>
<th>SAMR ladder</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Great artists: Students work in groups to present a famous artist of their choice</td>
<td>Substitution</td>
<td>Students use apps (like PowerPoint or Keynote) to create presentations on iPads. They gather information about a famous artist of their choice.</td>
</tr>
<tr>
<td></td>
<td>Augmentation</td>
<td>Students use apps to create presentations on iPads. They gather information about famous artists of their choice then create art inspired by that artist. Their peers can vote on the quality of presentation.</td>
</tr>
<tr>
<td></td>
<td>Modification</td>
<td>Students use apps to create presentations. They gather information about a famous artist of their choice then they create artwork together using a collaborative online whiteboard.</td>
</tr>
<tr>
<td></td>
<td>Redefinition</td>
<td>Students use apps to create presentations by gathering information about a famous artist of their choice then they create artwork using new visualisation technology i.e. augmented reality (Layar).</td>
</tr>
</tbody>
</table>
Great designers: Students work in groups to present a famous designer of their choice

| Substitution | Students use apps to create presentations by gathering information about an artist of their choice.
| Augmentation | Students use apps to create presentations by gathering information about an artist of their choice. They also incorporate Interactive media such as audio, video, and hyperlinks.
| Modification | Students create a video about a famous designer of their choice using a video editing app (iMovie).
| Redefinition | Students create a video about a famous designer of their choice using a video editing app (iMovie), then share the video on social media and ask for feedback from the community.

History of art and architecture quiz: Students take a quiz

| Substitution | Students take a quiz related to the history of art and architecture on an electronic document or a web form.
| Augmentation | Students answer questions related to the history of art and architecture on a Google Spreadsheet by searching for answers using iPads or asking their peers.
| Modification | Students answer questions related to the history of art and architecture on a Google Spreadsheet by searching for answers using iPads or asking their peers. The spreadsheet is improved with an add-on (i.e., Doctopus) that allows automatic assessment and emails the result to the students.
| Redefinition | Students play an online quiz game (Kahoot) to test their knowledge of the history of art and architecture while competing with their peers. The system provides instant feedback, ranking, and a summary of the results.

4.2. PROPOSAL TO IMPROVE THE CLASSROOM

Next year, the following improvements to classroom activities are proposed:

- For ‘Great artists’, to achieve the Modification level, let the students create artwork together using a collaborative online whiteboard. For the Redefinition level, let the students create artwork using new visualisation technology such as augmented reality (i.e., Layar).
- For ‘Great designers’, to move from the Modification to the Redefinition level, let the students share video on social media and ask for feedback from the community.
- For the ‘History of Art and Architecture Quiz’, the game represents the SAMR Redefinition level since it allows students to compete with each other in real time and provides instant feedback of the students’ ranking.

Even though the original assignments from the lessons ‘Great artists’ and ‘Great designers’ were the same (students working in groups to present fa-
mous artists and designers of their choice), the activities were different; one incorporated a voting system, while the other let the students create artwork. This is where the SAMR Model is most useful because it allows the instructor to analyse the classroom and ensures that they get the most out of it.

5. Conclusions and discussion

The SAMR Model was found to be an effective tool for instructors who design classrooms in a technology enhanced instructional environment. It provided four ways to integrate technology into the classroom that had a significant impact on the students’ learning outcome. As a result, in 2015, 25% of the students in the class achieved an A grade, and less than 5% were graded F compared to 26% in 2012. However, the model is more effective when coupled with Bloom’s revised taxonomy and the EdTech Quintet model because this combination gives a clearer picture of what is happening in the learning environment in terms of technology use and cognitive learning. Guidelines were framed to improve classroom activities, which resulted in a higher level being accomplished according to Bloom’s taxonomy.

For the quiz game, even though the Redefinition level was achieved using SAMR, the cognitive level stayed the same (remember/understand). However, the quiz was found to be a very useful way of improving students’ general knowledge of history and geography. The key was letting the students take the same quiz twice so that they could reinforce their knowledge. Moreover, it was found that the quiz was the most effective way of engaging the students in the classroom. Apart from the three activities that were held in the classroom for the last two consecutive years, a new activity, the “Ancient civilization war game” was designed in 2015. In the game, students work in groups representing civilizations to ask questions in defensive mode while trying to answer questions about another civilization, which is in attack mode. Since they search for answers on the internet using mobile devices this activity is considered as Modification under the SAMR model, Gaming under the EdTech Quintet model, and Remember/Understand under Bloom’s revised taxonomy. This activity could be developed into an app for collaborative gaming. Therefore, future work will focus on further integrating gaming technology into the history of art and architecture classroom.

However, the classroom has still not been completely transformed according to the SAMR model because some activities remain at the Enhancement level while others are already at the Transformation level. This is as expected because instructors take time to become familiar with using technology in the classroom. They need to be at ease with using technology at the Substitution and Augmentation levels (Enhancement) before they pro-
gress to the Modification and Redefinition levels (Transformation). It is important not to assume that Redefinition must be achieved for all of the activities. For example, it may be impractical to assign first year students to complete artwork using augmented reality within a week. The most significant role of the SAMR model was to raise instructor awareness when technology was incorporated into the classroom.

References