

# Self-Paced Interactive Multimedia Courseware: A Learning Support Resource for Enhancing Electronic Theses and Dissertations Development

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## Abstract

Submission of Electronic Theses and Dissertations (ETDs) by postgraduate students has become a common phenomenon in learning environments globally. The purpose of ETDs is to train postgraduate students as knowledge workers in online publishing and also extend their skills beyond word processing. The challenge however, is that many postgraduate students are not adequately equipped to design, develop and submit their theses and dissertations electronically. This article reports on a project based on the design and development of a self-paced Interactive Multimedia Application (IMA). The courseware is based on the ADDIE (Analysis, Design, Development, Implementation and Evaluation) instructional system design model to guide postgraduate students to learn to publish their theses and dissertations electronically. Qualitative research design with descriptive approach was employed for the study. Testing of this self-paced computer-based learning material revealed that postgraduate students could work through the IMA with minimal assistance, to become proficient in electronic publishing. The IMA revealed that the Application could be learned with little or no assistance from a facilitator or instructor; it also supports direct transfer and retention of knowledge and skills in ETDs preparation and submission.

**Keywords:** Self-paced courseware; Interactive Multimedia Application; ADDIE model; Online publishing; Postgraduate theses

## INTRODUCTION

Technology has changed the way we work, communicate, and learn (Wein-Pin, 2004). As broadband access becomes ubiquitous, higher education institutions are rethinking a movement to preserve and share research by creating and archiving Electronic Theses and Dissertations (ETDs, Essel, 2009). In lieu of heightening global awareness of key research, expanding capabilities in creating theses and protecting the future value of technology investments, there is the need for academic institutions to develop a global standard for establishing long-term archives of ETDs. Adobe Acrobat application supports this vision by creating opportunity for publishing document from different applications in a secure and reliable portable document format (PDF), which can be accessed by anyone, anywhere. According to the Adobe ETD initiative (2004), PDF is the preferred format for publishing and archiving ETDs, with Acrobat as the ideal application for creating ETDs in PDF.

Much effort has been made towards developing ETDs at the Kwame Nkrumah University of Science and Technology (KNUST) but the major challenge has been training postgraduate students to create and publish ETDs directly into the KNUST institutional repository without mediation. However, graduate students are unable to do this so theses and dissertation submission is mediated by Information and Communication Technology experts (Essel, 2009) of the E-Resources Unit of the KNUST Library, implying that graduate students in this University are not yet able to extend their knowledge and skills beyond word processing. Institutions which have adopted the ETD inventiveness usually spend huge sums of money organizing clinics, workshops, lectures and/or dole out handbooks to graduate students who are due to submit their ETDs. The underlying purpose of ETD activities is to prepare the next generation of scholars to function effectively as knowledge workers in the Information Age (Fox, 2001). This suggests that postgraduate students should be able to self-create and publish their ETDs on the KNUST repository to enhance their expertise as knowledge workers in online publishing and digital library technology.

Adding an extra course to the range of courses offered to postgraduate students in KNUST could increase the students' course load as well as the University's financial burden for recruiting the required staff with specialist skills and competences to teach the course to ensure that the students learn to use the relevant knowledge. These challenges could be resolved with a self-paced computer-based learning material that postgraduate students could work through to become proficient in electronic publishing with minimal assistance if necessary. An example of such a resource is the Interactive Multimedia Application which can facilitate up-to-date training of both academic staff and postgraduate students to enable them create and publish documents, theses and dissertations online at their convenience without bloating their teaching or course load.

## Multimedia

In the broadest sense, Multimedia can be defined as the simultaneous presentation of words and pictures to a learner in a variety of ways; this could be in written or spoken format with or without emphasis on phonology or semantics (Da Costa, 2008). Multimedia has also been defined by Vaughan (2011) as the combination of text, art, sound, animation, and video which is delivered to the end user by computer or other electronic or digitally manipulated means. Multimedia can simply be explained as an electronic means of presenting information to an audience.

The strength of multimedia lies in its propensity to combine sensual elements and digital media types to present rich and dynamic sensations to a target audience. Weaving sensual elements of multimedia such as dazzling pictures and animations, engaging sounds, compelling video clips, and raw textual information together with digital media can electrify the thoughts and action centers of people's minds (Vaughan, 2011). Unlike humans who process and communicate information via verbal and visual means, multimedia takes advantage of both channels to process and present visual and verbal information at once (Mayer, 2003). Combining multiple media is more useful to learners because it calls on the capabilities of both auditory and visual systems; Multimedia therefore appeals to diverse learning preferences (Shank, 2005). Learning in multimedia environments also come with a plethora of benefits (Mayer, 2003).

According to Shank (2005) and Shephard (n.d.) as cited in Khalid and Nuhfer-Halten (2012; 2011), synthesized studies show the potential benefits of well-designed multimedia as providing alternate perspectives, accelerated learning, active participation, problem-solving and decision making skills; retention and application of knowledge, system understanding, high-order thinking, autonomy and focus, control over pacing and sequencing of information, and access to support information.

## MATERIALS AND METHODS

The qualitative research methodology with questionnaire administration, personal interview and observation was employed for collection, analysis and interpretation of data on the design, utilization and adoption of Interactive Multimedia Application (IMA) for creating and publishing documents online. Convenience sample of 149 Master's and Doctoral students in Faculty of Art, KNUST was used (Table 1). The questionnaire administration solicited data on the students' ability to engage and interact with computers as tools for learning and research, and learner characteristics such as learning styles and preferences. The 149 copies of questionnaire that were administered had a return rate of 68.5%, giving a sample size of 102. Data treatment involved comparing and correlating responses with respondents' literacy and proficiency in Information and Communication Technology (ICT), including Adobe Acrobat, the preferred format for developing ETDs, and how that translates into comprehension and usage of Interactive Multimedia Application. Personal interview was adopted to solicit data from staff of the School of Graduate Studies, the E-Resources unit of KNUST Library, and postgraduate students in the Faculty of Art, KNUST, to inform the design and development of the Interactive Multimedia Application. Other data sought via interview focused on formative experiences and perceptions about Interactive Multimedia Application and the factors that have shaped personal decisions.

Table 1: Affiliate Departments of Study Respondents

Selected Departments in the Faculty of Art	Sample Size	Favourable responses
General Art Studies	77	42
Publishing Studies	7	7
Communication Design	3	3
Industrial Art	11	11
Painting and Sculpture	51	39
<b>Total</b>	<b>149</b>	<b>102</b>

## DESIGN AND DEVELOPMENT OF INTERACTIVE MULTIMEDIA APPLICATION

Designing and programming projects require unique procedures, timing and techniques (Essel, 2009). The Interactive Multimedia Application (IMA), which is the subject of this paper, was guided by the ADDIE (Analysis, Design, Development, Implementation, and Evaluation) instructional system design model (Instructional Design Central, 2012). It gives structure and meaning to an instructional design problem. The researchers adopted this to negotiate design task with a semblance of conscious understanding and visualize the problem, to break it down into discrete, manageable units (Ryder, 2012). The process is defined in Table 2.

Table 2. Segmentation of design and development process

<b>Segment One</b> Analysis	<ul style="list-style-type: none"> <li>• Development of course content guideline (content of application)</li> </ul>
<b>Segment Two</b> Design Development	<ul style="list-style-type: none"> <li>• Screen cast recording of Microsoft word and Adobe Acrobat Graphic User Interfaces; Editing of recorded screen cast</li> <li>• Narration or Voiceover recording to supplement screen cast</li> <li>• Editing of recorded narrations for effective synchronization with screen cast</li> <li>• Incorporating edited narrations into edited screen cast, text, animations and graphics</li> </ul>
<b>Segment Three</b> Implementation Evaluation	<ul style="list-style-type: none"> <li>• Graphic User Interface (GUI) or artwork development</li> <li>• Compiling and publishing of multimedia application as executed file</li> </ul>

### Hardware and application software

Structuring the multimedia application employed several technological devices and applications. The hardware devices employed for design and development procedures were devices that have physical manifestation or substance (Webopedia, 2013). The project employed these devices:

- Dell Vostro 200 and Dell Dimension 4600 desktop computers
- Somic SM-908 multipurpose headset
- HP Photosmart D7560 printer
- Light scribble DVDROM.

The application software packages employed were:

- Adobe Acrobat 10 Professional
- Adobe Captivate 6
- Adobe Soundbooth
- Adobe Photoshop
- Adobe Director
- Nero
- Windows 8
- Mac Intel OS Tiger Operating systems.

Except for the operating systems and Nero, all applications used were trial versions or “students’ editions” obtained from Adobe.com website.

## THE PROJECT

### Segment One: Analysing basic features of theses and dissertations

To enable training of postgraduate students as effective knowledge workers, the project had to identify an innovative technology that would facilitate the teaching and learning of ETDs development. The preferred technology would develop a multi-sensory interactive multimedia application which is self-paced and simulates the teaching and learning process of ETDs to enable the students develop a mental map of online publishing. At the onset, Adobe Acrobat Professional 8.0 was selected as a medium for generating the ETDs as Portable Document Format (PDF) was considered an open standard for document exchange published by the International Organization for Standardization as ISO 32000-1:2008 (Orion, 2007; Adobe Systems Incorporated, 2008). As noted by Adobe Incorporated (2004), standardising on PDF for publishing ETDs allows students to leverage archiving systems maintained by universities, institutions and commercial repositories.

In structuring the content for the multimedia application, the content structure of bound copies of the Theses and Dissertations (TDs) were critically assessed to identify common features that could be replicated in digital format. Features such as table of content, inserted images, figures and tables which gave visual or contextual explanation to the content of TDs; and page numbering styles from the preliminary pages to the end matter were documented. The analysis realised that basic elements such as Table of Content made reference to individual pages within the TDs; Images were referred to in pages besides the original page where they resided; Page numbering showed two distinct styles in the TDs: Roman numerals for preliminary pages while the body and oddments were in a numerical system that starts from one (1) to the number of the last available page. Some References had web links (hyperlinks) which referenced audio and video recordings (mainly not attached) that were used to substantiate arguments.

### Segment Two: Design and Development of Courseware for Submitting Theses and Dissertations

A comprehensive documentation was developed based on the synthesis of ideas from the analysis of the basic features of sampled theses and dissertations for designing the interactive courseware. The documentation

generated 29 lessons which were categorized as five course modules, each addressing specific needs of learners (Table 3).

Table 3: Modules and Lessons for the Interactive Multimedia Courseware

Modules	Lessons
1. Transfiguring Word processed document into ETDs	Creating a PDF file using PDF Maker in Microsoft Office; Creating a PDF using print command (Windows and Mac OS); Creating PDF from web pages; Combining Multiple Files
2. Modifying an ETD	Specifying document properties; Changing Page Numbering; Moving Page within a PDF document; Inserting New Pages; Deleting Pages; Rotating Pages
3. Adding navigational nodes to ETD	Adding bookmarks; Making nested bookmarks; Moving a bookmark from a nested position; Adding actions to bookmarks; Changing appearance of bookmarks; Adding links to pages; Adding a destination link; Changing the appearance of a link; Deleting a link; Editing the size of multiple links
4. Introducing multimedia elements (audio and video)	Adding movie clip; Adding sound clip
5. Security implementation for ETDs	Adding Password Encryption; Applying security policies to document; Viewing security policies of a document; Editing security policies; Deleting a security policy

### Rapid Prototyping of the Interactive Multimedia Application

The interactive multimedia application (IMA) was developed on the idea of modularizing course content. Adobe Captivate was used to prototype the content of the application to offer enhanced support for HTML5-based e-Learning content, to create courses that meet accessibility standards, and add more interactivity to courses with drag-and-drop modules, YouTube video streaming, in-course web browsing, and a record system audio along with narration (Adobe.com, 2014). A concept map was then developed to summarise the workflow of the IMA. In order to make the content more engaging and dynamic, four basic application modules were structured for quick tour, demonstration, training and assessment. Experience has shown that the best way to develop and maintain a large program is to construct it from small, simple pieces, or modules, a technique that (Deitel & Deitel, 2010) calls ‘divide and conquer’. Figure 1 exhibits the concept mapping and modularization of the workflow for the IMA.

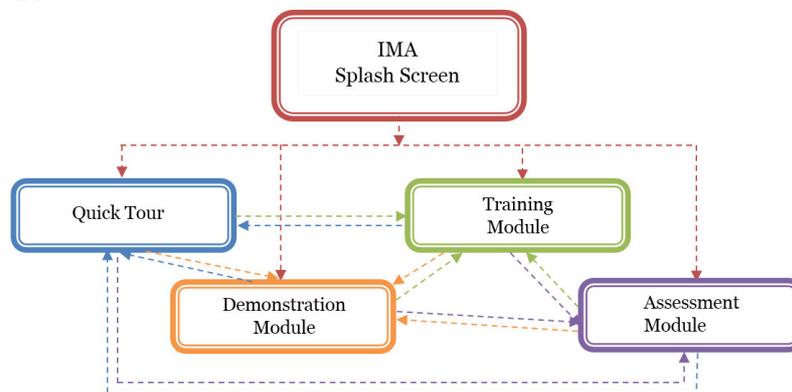


Fig. 1: Concept map for the Application Modularization

### Setting up Art board within Adobe Captivate for Shooting

Choosing the right resolution for capturing the slides is the first critical decision to make. It has to be right because the size of the captured slides plays a critical role in the quality of the final movie (Bruyndonckx, 2012). Adobe Captivate with Microsoft Word and Adobe Acrobat were used for the shooting of the rushes for the IMA. The three applications were launched concurrently. A display screen resolution of 1024px by 720px (widescreen resolution) was chosen for the entire shots. Adobe Captivate was launched as the first active window and depending on the course module to be simulated, Microsoft Word or Acrobat was made active through the window of Adobe Captivate. For instance, the first topic demonstrated how to create a PDF file from the Microsoft Office suite using the PDF maker; hence, Microsoft Word was activated through Captivate for the screen shots. The closed caption capability of Captivate was activated for each screen shot to make provision for clients who have hearing problems or prefer to read the instructions on screen (Adobe.com, 2013).

As Clarke (2001) points out, “many learners access computers through technology such as screen

readers, speech input devices and specialized interfaces which allow them to overcome the barriers of being unable to see the display or use input devices such as the mouse”. For an effective design, Clarke (2001) suggests that the design should “always provide a text equivalent to the different media, since a number of devices make the material accessible to disabled learners through the use of text”. The scenario branching capabilities of Adobe Captivate was used to prototype a quick tour of the Graphical User Interface (GUI) of the IMA. The quick tour provides insight into the navigational structure of the IMA including the GUI of Adobe Acrobat Professional, the basic toolsets and the dropdown menus. Figure 2 demonstrates the GUI of the IMA. (If you make photocopies of this figure it will not be clear at all. Same applies to the other figure).

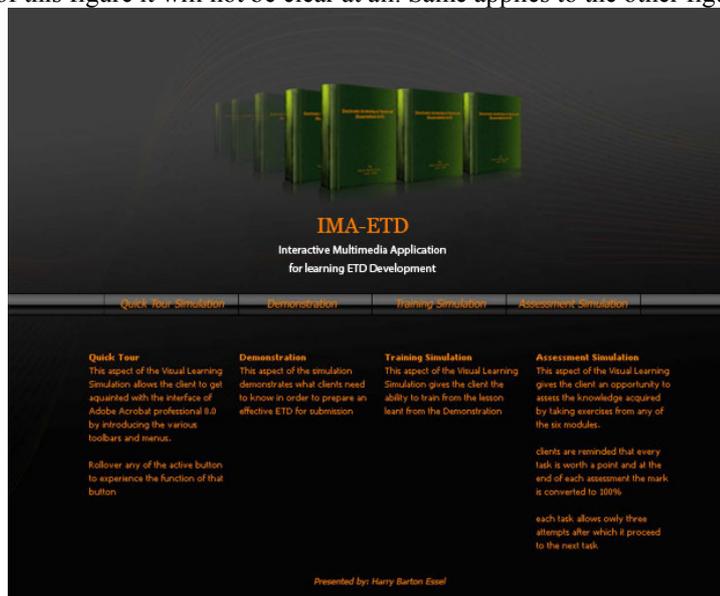


Fig. 2: Splash screen GUI of the IMA

The look-and-feel factor was built on the interface development concepts of ‘unfamiliar territory’ (Nicol, 1990) and ‘way finding’ (Jones, 1989) cited in Jones and Okey (1995), as the Quick Tour must assist new clients and help them find their way around the look and feel of the application. The demonstration, training and assessment modules were also prototyped sequentially based on the five courseware modules.

The rushes for the demonstration module were loaded one after the other and edited sequentially by adding appropriate graphics created in Adobe Photoshop and imported into Captivate using the image button controls. Redundant slides were removed as demanded. New slides, where required, were subsequently generated by using full motion recording or activating the F10 function key to generate a screen print view.

The training and the assessment modules were prototyped using in-built controls of Adobe Captivate such as the rollover caption for adding rollover events; highlight box for emphasising hotspots; text entry box, which allows the client to add inputs where necessary; the click box and the buttons, which allow the client to advance or retreat based on the options provided; and the rollover image, which allows the client to display large views of specific elements within the simulation.

The training module provides a closed caption view to orient clients through the tasks. Unlike the demonstration, the training and the assessment modules are not time bound, implying that clients are required to complete a task within trainings or assessments to advance to other tasks. Failure and success hint captions were provided in both modules to give the client feedback on whether a particular task was performed successfully or not. Feedbacks are as important as the question (tasks) itself. Effective feedback should motivate the learners and help them understand what they did wrong in order to get it right next time (Clarke, 2001). Though the training and the assessment modules provide failure and success hint captions, the training module provides infinite attempts within a task whereas the assessment module provides three attempts only. The client is programmatically advanced to the next task if all the three attempts fail. The assessment module is also structured in a way that each task within an assessment scores a point upon success. The points are accumulated and displayed at the end of each completed assessment as illustrated in Fig. 3.

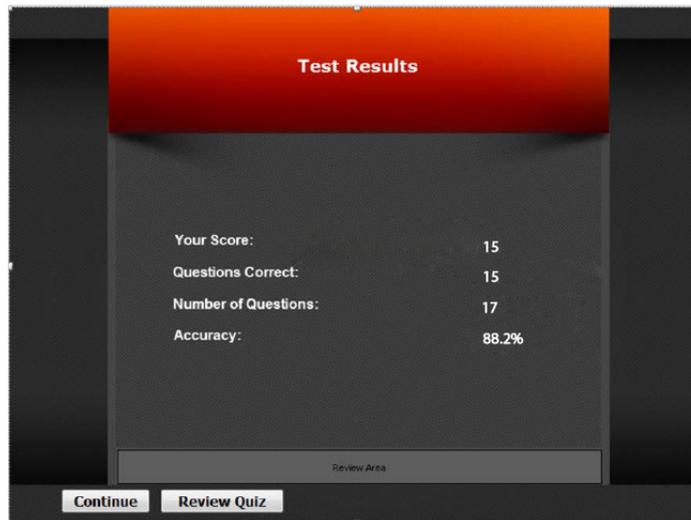
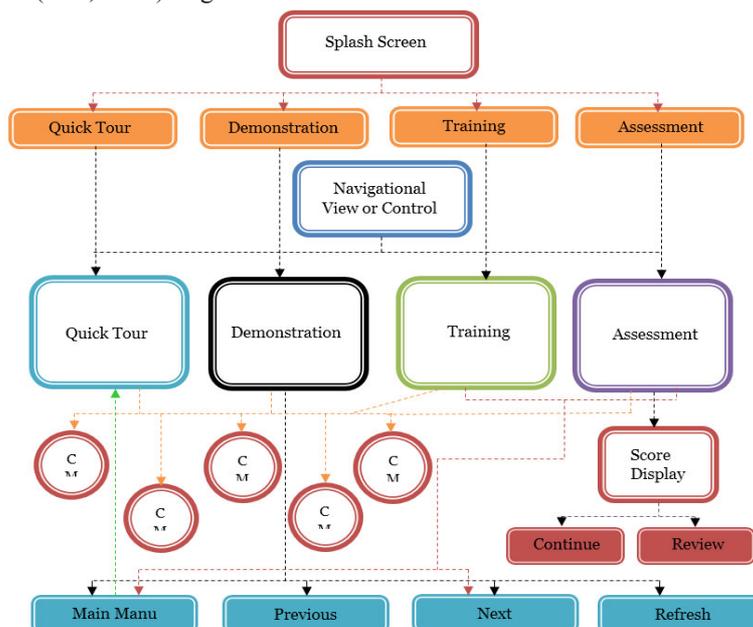


Fig. 3: Screenshot of results page for the assessment module

The narrations (sound bites) were recorded based on the topics in the courseware modules and the closed caption text generated by Captivate. Adobe Soundbooth was used for recording the narration at a sample rate of 44100Hz in the Stereo channel. The length of the unedited narrations was 3 hours, 2 minutes and 57 seconds. Sound editing effects such as noise reduction, fade in/out and EQ graphic effect were applied to the narrations to audibly enhance it. The sound clips were saved in MP3 file format at a compression level of 128kb/s in folders that reflected the topics outlined in the modules. In incorporating the narrations into the demonstrations, each slide received sound clips depending on the closed caption text it generated but the timeline was used to synchronize the sound clips with the other elements on the slides such as the graphics and the closed captions.

The look and feel of the IMA was designed with Adobe Photoshop and developed in two parts: Splash Screen and “Control Dock”. The splash screen and the control dock were designed with navigational controls which give the client easy access to all aspects of the interactive application. However, the controls on the splash screen and the control docks are different. The controls on splash screen grants privileges to clients to navigate to the individual application modules while the controls on the control dock grants privileges to the application modules as well as the course modules. The control dock also provides a breadcrumbs navigational structure which gives clients an alternative method of navigation, allowing them to see where they stand in the hierarchy of a website, and reduce the number of steps needed to navigate to a higher-level within the interactive multimedia application (Lim, 2013). Figure 4 illustrates the flowchart of the IMA.



CM = Courseware Module

Fig. 4: Flowchart of the IMA

### Segment Three: Implementation and Evaluation of the IMA

The assembled elements were compiled as an Adobe Director Projector file, which is a standalone file. The projector files were generated in two standard operating system (OS) modes: as Microsoft Windows projector executable and as Apple Macintosh projector executable; a standard projector can contain the uncompressed playback libraries along with a movie and possibly additional movies, casts and "extras" (help.adobe.com, 2008). Within the publish settings, a 128px by 128px icon designed with Photoshop was designated to the IMA for ease of identification on the clients' desktop. The final output of the published VLS generated a total file size of 182Mb. The projector file was transferred as an "autorun" executable file (.exe) on to a light scribble DVD-ROM by using the Nero burning application software.

Pre-tests were carried out to certify the IMA's performance and to also determine whether it can withstand adverse technological conditions and circumstances during usage. The navigational controls such as the dropdown menus, the next and the previous buttons, and the refresh button were effectively tested to avoid navigational exceptions during runtime. The simulation was tested on different operating systems, including Windows OS and Macintosh OS, to establish its capacity to run on different platforms. Different monitors with varying display resolutions were also used to check the display setting of the IMA to sidestep errors with screen displays. Evaluation in Segment Three is catered for in the following sections.

## RESULTS AND DISCUSSION

The variables for testing the Interactive Multimedia Application were analysed as follows:

### Knowledge or familiarity with Computer Usage

The Interactive Multimedia Application was designed as a computer-based teaching and learning material, hence the need to evaluate Graduate Students' knowledge with respect to computer usage and the effect it had on the learning material. The rating for assessing the respondent students' *savoir faire* with computers ranged from excellent to poor; to put a clear line between the two extremes, highly skilled respondents in computer hardware and software were considered 'excellent users' while those with no such knowledge were considered 'poor users'.

The responses received proved that postgraduate students' fine-tuning with computer usage is substantial. The statistics in Fig. 5 demonstrates that only four (3.9%) respondents had excellent knowledge in computer usage while 22 (21.6%) had very good knowledge, 40 (39.2%) had good knowledge and 36 (35.5%) had average knowledge of computer usage. No respondent was a 'poor user'.

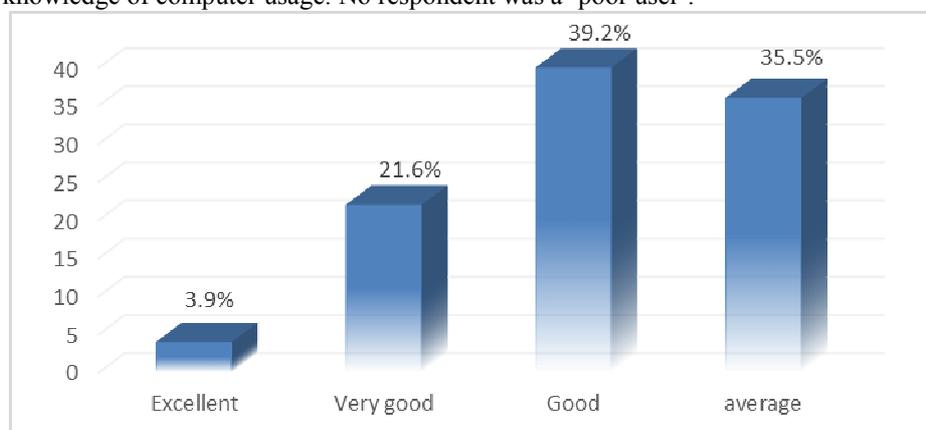


Fig. 5: Respondents' Knowledge in Computer Usage

### Operating systems employed by Graduate Students to run the application

Deployed as a standalone computer-based application, it was imperative to determine whether or not the IMA could run virtually on diverse operating systems (OS). Designed as a cross-platform application to enhance accessibility and usability, it was also critical to ascertain the sort of OS platform the respondents used. The responses suggested that majority (92 representing 90.2%) of the 102 respondents ran the IMA on Microsoft Windows OS while six (5.9%) used Macintosh OS. Four respondents (or 3.9%) failed to respond to the question suggesting non-use of the IMA. The results imply that the IMA runs virtually on the two most common platforms available to the respondents. Figure 6 attests to the IMA accomplishing its accessibility target as a cross-platform application.

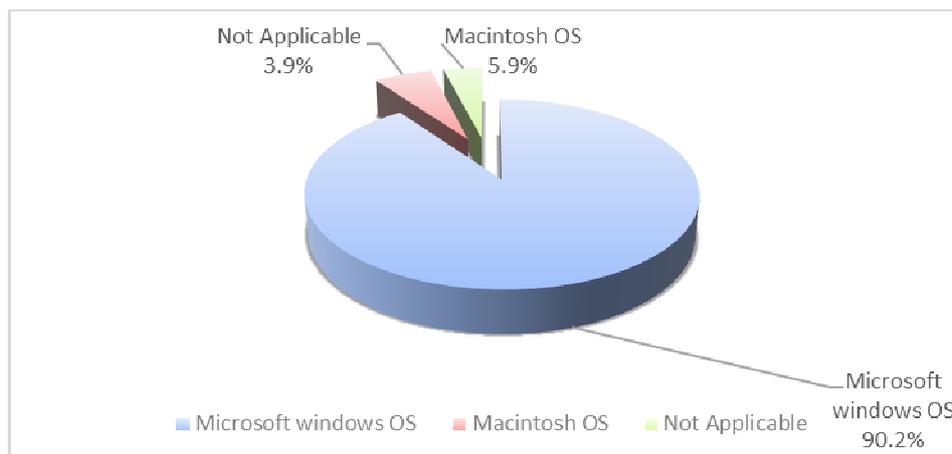


Figure 6: Operating systems used by respondents to access the IMA

### Experience in Adobe Acrobat Professional

This question determined respondents' proficiency level or prior experiences with Adobe Acrobat Professional, that is, whether they had ever used Acrobat and for what purpose. The idea was to discover how new and experienced users of Acrobat would respond to the course modules of the IMA. The question is grounded in Clarke's (2001) statement that identifies knowledge in a subject area as a factor that may influence learners' response. It emerged that 69 or 67.6% of the respondents had prior experience with Acrobat whereas 33 (32.4%) had not used Acrobat before. Having nearly 70% of respondents knowing how to use Acrobat Professional implies the usage popularity of this software among graduate Art students.

The data in Figure 7 reveals that the study respondents who had prior knowledge of Acrobat employed it for diverse purposes: reading and printing, creating and publishing eBooks, and preparing layout for presswork.

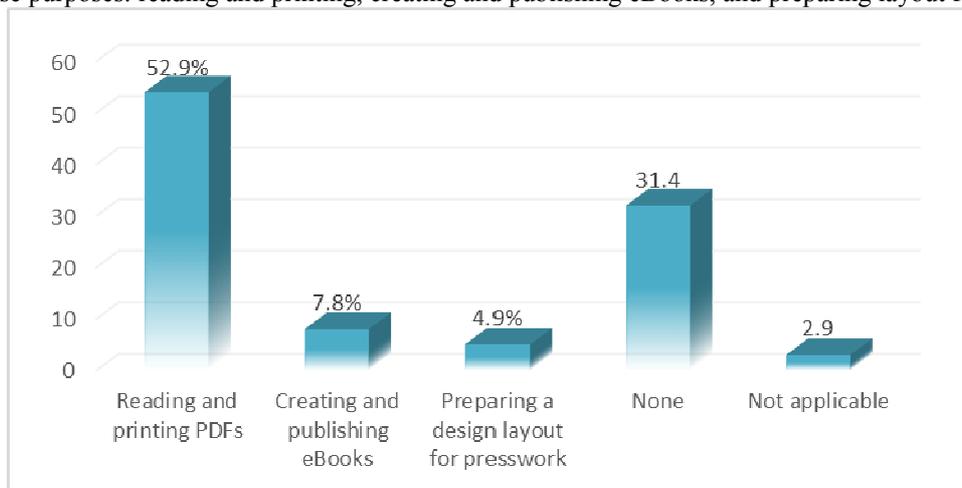


Fig. 7: Respondents' Usage of Acrobat Professional

It can be deduced from Fig. 7 that apart from the eight (7.8%) respondents who reported they had used Acrobat for developing and publishing eBooks, the rest had no idea about eBook development, which is the subject area of the IMA for ETDs.

### Respondents' capacity to experience course modules of IMA without assistance

It is important to emphasize that the IMA was designed to function as a computer-based self-paced learning material that requires minimal or no assistance to users. The respondents' views were critical to establish this characteristic of the IMA. From the responses, 98 (96.1%) of the 102 respondents confirmed that the IMA is adequately comprehensive for users to understand the modules whereas four (3.9%) said it did not meet that expectation. Unfortunately, three of the minority four negative responses cited no reasons for their answers while one attributed this to the mechanics associated with some of the modules. Further analysis established that the four respondents had average knowledge in computer usage and had no proficiency with the Acrobat Professional. Limited knowledge in computer usage and inexperience with Acrobat are the most likely variables that hindered the four respondents' understanding of the IMA. The majority (96.1%) responses indicate the effectiveness of the IMA as a self-paced computer-based learning material; the remaining four respondents,

including the ones who have no proficiency with Acrobat, would successfully use the IMA with assistance from a facilitator, technical person or supplementary tutorials.

#### Appreciation of the IMA's logical workflow

Significantly, the respondents' appreciation of the presentation or organization of the application modules, digital media types, interactivity and feedback within the IMA in learning ETDs development was a vital component of the project. The questionnaire required the respondents to indicate whether or not the application modules, courseware modules, integration of digital media types, interactivity and feedbacks were helpful in assimilating the content of the IMA. On this, 101 (representing 99.0%) of the 102 respondents affirmed that the application was helpful in assisting the learning of ETDs development; the remaining respondent did not answer the question.

The 99.0% affirmative responses confirm that despite the respondents' varied knowledge rating in computer usage, nearly all of them readily understood the logical workflow of the IMA. The respondents appreciated the fact that the presentation of courseware and the integration of the multimedia element and interactive feedbacks provided all the assistance they needed to find their way through the IMA. This finding substantiates the concept of interface design of closure (Jones, 1989) that specifies that organization of program information into manageable segments prevents users from getting overwhelmed by the amount of information contained in the program. The finding also buttresses the statement that adult learners are motivated to learn when they see the immediate relevance of the material to their professional or personal life (Knowles, Holton, & Swanson, 2011).

#### Difficulties respondents encountered with the courseware modules within the IMA

Specific problems the respondents encountered with regards to understanding the modules in order to address them concerned the appropriateness and logical sequence of the courseware modules for ETDs creation. The responses indicated that not all the respondents readily understood the modules; 98 (96.1%) of them reported they understood the logical sequence of the modules without any hitches but four (3.9%) of the 102 respondents reported they encountered setbacks with some of the modules. Of the remaining four respondents who reported they experienced difficulties, two (1.9%) specified challenges with the topics in module two; one encountered difficulties with module five, while one respondent did not specify the module that posed such challenges. Those who were specific about difficulties with the identified modules pointed out they needed technical expertise to understand the issues, implying the need to simplify the topic. It was also established that these minority respondents had average knowledge in computer usage; three respondents had used Acrobat Professional for preparing design layout for presswork while one had no experience with Acrobat. Presswork experience with Acrobat is likely to have influenced their understanding of some of the topics.

#### Respondents' advancement after completing the assessment modules

Respondents who successfully completed the demonstration and the training modules were required to take the assessment module to verify their level of progression and affirm the respondents' ratings after experiencing the learning material. Although the results indicated that not all respondents scored a mark of 100% in all the assessment modules, a mean mark of 100% was recorded in Modules 1, 2 and 5. Modules 3 and 4 had students not scoring 100% in the assessment (Table 4).

**Table 4: Summary of result for modules 3 and 4**

Modules	Respondents		Mean (%)
	Number (102)	Score (%)	
3	84	82.4%	80.0
	10	9.8%	
	8	7.9%	
4	76	74.5%	76.6
	13	12.8%	
	13	12.8%	

It was realized that respondents who scored an average of 100% in all the five modules were mostly those who had experienced Acrobat for preparing layout for press, creating and publishing eBooks or for reading and printing eBooks, and had earlier rated their experiences with ETDs creation as excellent, very good or good. This high score can be attributed to the respondents' previous knowledge and experience with the software.

Respondents who had never used Acrobat, 28(84.8%) scored a mean score of 100% in all the courseware modules while 5(15.2%) scored less than 100%. When respondents who could not score the 100% mark were interviewed, they confirmed they were first time users of Acrobat; they also found some of the topics outlined in some modules too technical and complex to comprehend. Nonetheless, the cumulative results for the assessment proved that 87 (85.3%) of the 102 respondents scored a mean mark of 100% in all the modules while

15 (14.7%) scored a mean mark of less than 100%. Further analysis of the responses showed that all 102 respondents appreciated the assessment module exercises because it provided real-life experiences for decision making in IMA. This acknowledges the fact that adults want to make decisions on their learning (Knowles, Holton, & Swanson, 2011) yet as Clarke (2001) posits, the materials and activities which support successful adult learning must be relevant and meaningful to the learner as well as provide opportunity for the learner to play an active role in the learning process and thereby share the life experience of adults. From all indications, the IMA provided this service at a level that enabled these adult postgraduate students to tap into their own experiences to deal with the challenges in ETDs development.

### **General comments respondents offered about the IMA**

After completing the learning process successfully, respondents were offered opportunity to share express opinions and reservations about the IMA so that the necessary modifications could be applied to any of its features to ensure quality and ease of use. Of the 102 respondents, 54 (52.9%) of them found the IMA very easy and practical to use as it gives users “hands on” experience while 30 (29.4%) described the IMA as “standard material with comprehensive layout and subject content delivery”. Although 84 (or 82.3%) of the respondents gave a good account of the IMA, six (5.9%) reported that the IMA’s responses to user clicks should be instantaneous; four (3.9%) commented that the demonstrations and quick tour run too fast and make it difficult to grasp some of the topics the first time; one (1.0%) described the IMA as ‘packed’ and called for some topics to be eliminated whereas two (2.0%) requested that the grading system of the Assessment module, which requires the user to score 100% in order to pass a topic within a module, should be made flexible; while one respondent (1.0%) requested that the simulation be made ‘available and downloadable’ online for straightforward access. Interestingly, four respondents offered no comments after testing the IMA.

Inadequate or limited background knowledge and experience with Acrobat Professional is the most plausible reason for the difficulties these 14 (or 13.7%) study respondents encountered with the IMA. With respect to students’ varying learning styles or the way students prefer to learn new materials (Shaffer & Kipp, 2007; Downes, 2010), the findings suggest the need for the participating departments to incorporate advance literacy skills development in their curriculum to empower their students to self-publish their theses and dissertations online. Learning difficulties encountered with the IMA also indicated an apparent mismatch of learning styles between those offering instruction and those receiving it (Gardner, 2006) because the study assumed that postgraduate students in art and design programmes were adept in the relevant computer applications to have the requisite skills to tap into their knowledge bank to manoeuvre their way through the different modules of the IMA.

As significant as the views of the majority of study respondents, the opinion of the minority also highlighted the significant factors that could frustrate users with low ICT aptitude and those who have low tolerance for challenging encounters in the teaching-learning process. Lack or inadequate computer vocabulary to express an opinion probably made four (3.9%) respondents unable to pass any comments about the IMA. Nonetheless, interviews held with the respondents made it clear that they appreciated the User Interface (UI) or artwork of the application, the interactivity, animations and the navigational systems incorporated into the IMA. A few respondents remarked that the IMA mimics teacher-learner interactions and described it as a perfect platform for learning ETDs creation and development. The questionnaire responses and comments showed that the respondents valued the hands-on approach to training through active learning, the assessment modules, graphical representations, interactive quality and feedbacks, the level of simulation, and the layout or logical workflow of the IMA which gave opportunity for these adult learners to play an active role in the teaching-learning process. The E-Resources Unit of KNUST could incorporate this IMA to train more postgraduate students to create and publish their theses and dissertations on the KNUST repository.

### **CONCLUSION**

The design and development of the self-paced Interactive Multimedia Application (IMA) brought to bear the capabilities of application software that could be used to achieve an enhanced look-and-feel and comprehensive client-side interactivity. The multistate controls enhanced the graphical user interfaces and eased navigation through the application. The technologies employed to develop the application enabled compliance with open standard or the ability to execute as a stand-alone application that operates on diverse operating systems. The pre-tests and post-test demonstrated that the IMA is capable of running on different display resolutions, defining its adaptability to self-publishing of postgraduate theses and dissertations on the KNUST Repository with little or no assistance from facilitators or instructors.

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