

Action Research Progress on Incorporating Augmented Reality into Courses: Taking Digital Publishing as an Example

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Abstract

This paper is based on the reflexivity approach towards teaching and learning the action research process of a Digital Publishing subject. The initial motivation was developing a new teaching format, to guide students in the integration of Augmented Reality in a print book because the current digital trajectory allows prospective designers to showcase their uniqueness. Action research was engaged to explore factors that affected the planning and professional growth of the researcher, as the process underwent a constant adjustment which promote educational innovation in line with the accumulation of experiences which aimed to narrow the gap between academic aspirations and market reality. During the course of this study, professional growth was shown after introspection as when the researcher was encouraged from students evaluation and then to explore the cross-disciplinary collaboration with colleague from communication department and understand the marketplace and consumer needs which in turn provided the required momentum to go further by identify the next cross-discipline potential collaborator in Music and Audio technology department, to further fine tune the teaching format and development for next cohort, as instructors can rely on each other's expertise to solve problems and provide support. And, researcher also suggested that should publicly disseminate their knowledge of action research through research reports.

Keywords - Action Research, Augmented Reality, curriculum development, Digitalised book

1. Introduction

Digital books gained popularity due to their convenience and eco-friendliness. Large collections of books can be stored in a single digital device, thus reducing deforestation and pollution by reducing the use of paper. However, physical printed books have their own unique sensory appeal. Avid book collectors and readers enjoy the various sizes, thicknesses, papers, weights, typesetting styles, binding methods, as well as the calming motion of flipping pages, or the smell of ink. Readers still prefer physical books, although ebooks are more affordable and convenient. Thus, the researchers were inspired to conduct an action research process with a group of students from the newest generation – Generation Z – as participants who grew up in the digital world. The teaching innovation is to enhance the ability of students to create and design layouts of books in addition to using the traditional method of desktop publishing, and typesetting software applications, then further improve the quality of operations by emphasizing the integration of video, audio, and animation into digital books with Augmented Reality (AR) – a technology that enriches the real world with digital information and media. Action research was applied during the process of design visualization to test the practicality of the proposed concept.

Action research and cognitive structures share a common goal in generating, communicating, and fostering understanding of human ideas and experiences. It may be an exciting venture for students as it allows them to showcase their individuality in creativity through publication design. However, uncertainty exists in whether upstream parties (publishers) will accept their creations, as traditional publishers may have perspectives that differ from the new generation (Mohr, 2017). At the same time, it is also a challenge for instructor to explore between market reality and students works and undergo adjustments.

2. Literature Review

This study explored the processes and methods that could improve professional knowledge for instructors, and the factors that affect action research. The literature review is divided into two sections: the first explains the relationship between the curriculums; the second discusses the origin, characteristics, models of action research, and how action research can promote professional growth.

2.1 Curriculum

A curriculum is a plan created to help students gain experience and grow with specific learning outcomes in mind. It helps to build the social competence of students, especially undergraduate students (Uya & Yesilpinar, 2017). The program standard for Art & Design under the Malaysia Quality Agency (MQA) emphasized that design focuses on aesthetics, concept, function, creativity and innovation (MQA, 2018). Students are expected to be able to synthesize and apply relevant knowledge practically and effectively (MQA, 2018, pp 8), thus allowing them to fulfil their societal responsibilities (Malaysian Qualifications Agency, 2018). In the past ten years or more, developments in science and technology have rapidly changed the value of the international community. Education cannot withstand the rate of change, though many advanced countries have joined the ranks of reform.

The 2015-2025 Education Blueprint of Malaysia's 11th plan and Malaysia Higher Education 4.0 indicated that higher education can cultivate capable, creative talents in the new economy. In 2018, the MQA revised their Code of Practice for Program Accreditation (COPPA) based on feedback from higher education providers, evaluators, quality assurance experts, regulatory agencies, and certification standards in the region and surrounding areas to further improve higher education in Malaysia (Malaysia Quality Agency, 2018). Of all the stakeholders in higher education, this study only refers to two essential parties – instructors and students. Instructors are expected to have relevant work experience or have participated in community engagement in addition to having the relevant education (MQA, pp 19). Programmes have to become dynamic – regularly monitoring, reviewing, and evaluating students' progress, employability, and performance – to accommodate the constantly changing environment.

2.1.1 Contents for Project Brief

The effects of unrestricted social media content on the younger generation is a growing concern in the age of globalization. When planning a project brief, it is important to consider if the younger generation has the appropriate societal values and norms, local cultural identity (Anwar, Vermol, & Jalil, 2016; David & Govindasamy, 2015; Rahim & Pawanteh, 2010), and national identity to complete the project brief. In this study, Malaysian folklore was chosen as the main content for the project brief.

Folklore is an expressive body of culture shared through oral and symbolic forms, passed down from generation to generation (Mohd Bakhir, Bidin, & Abdul Aziz, 2018). The purpose of oral traditions is to preserve the values enconced in folklore and legends, and pass on the customs and traditions that comprise the identities of Malaysian communities (Goh 2015). It is an intangible cultural heritage that embodies the Malaysian identity: a multicultural and multilingual community living side-by-side in peace and harmony while maintaining their separate identities (Chew & Ishak, 2010). In the digital age, folklore and customs are treasured inheritances that have to be preserved. This can be done through globalisation, commercial entertainment, and cyberspace activities. By popularising them among young Netizens, it is possible to spread knowledge of Malaysian own local folklore through the Internet (Harun & Jamaludin, 2016). Using folklore as teaching material of

educational entertainment had proven in enhanced student interest and focus in the classroom (Dikul & Kiting, 2019).

2.1.2 Augmented Reality (AR)

Dr Siti Hajar Halili reported that technological advancement in teaching and learning can bolster learner interest (Halili, 2019) and revamp the Malaysian Higher Education system. Augmented Reality (AR) technology uses computer technology to superimpose virtual information onto the real world by displaying it on electronic devices. The implementation of AR in print books would add life and motion to print books, thus allaying boredom. The content exists on its own plane, providing information by displaying its corresponding pictures, audio and video (Lee, 2012). It refers to the real-time perception and calculation of the real environment through the computing device, superimposing text, pictures, video and other 3D content and information in the real world, with three major features of virtual reality fusion, real-time interaction, and three-dimensional registration. As technological giants such as Google and Apple invest in AR and more application examples emerge, it will become more popular among students. In any AR-based system, the following three components are essential: hardware, software, and remote servers. The key hardware components in AR-based devices are processors, displays, input devices, and sensors. The display refers to the common display device, the input device can be the camera of a smartphone connected to the Internet; the sensor is a gyroscope or accelerometer of a mobile device, or an infrared sensor.

First, the camera or sensor collects the objects of the real scene, and then passes them into the background processor unit and analyzes and reconstructs them to achieve the alignment between the coordinate system and the fusion of the virtual scene. After the fusion, the information is displayed on a screen in real time. Today, almost all smartphones fulfill the hardware requirements for AR technology. Web or cloud servers play an important role in storing virtual image data. Based on the request received from the AR application, virtual objects from the Web or cloud server are collected and sent back to the application. The most mature technology and widely used of AR is the recognition-based, which through the camera perceives the corresponding mark of a two-dimensional code to activate AR visualization (Gao & Wong, 2015).

2.2 Action Research

Action research is also a process of construction and deconstruction. It discovers the dialectical relationship between research and reality (Xu, et al., 2016), teacher's perception in classroom research (Hathorn and Dillon, 2018) and executed with undergraduates who had experience in STEM fields (Science, Technology, Engineering, and Mathematics) (Guy, Feldman, Cain, Leesman, & Hood, 2020)

Action research and cognitive structures share a common goal in generating, communicating, and fostering understanding human ideas and experiences. Both are forms of educative enquiry and analytical techniques. The four key components of action research are: planning, acting, observing, and reflecting. This process was developed by Lewin in 1952, then further refined by Kolb in 1984. It was used to identify a focus area, collect data, carry out research, analyze and validate results, and evaluate actions. This project aimed to further extend Lonergan's insights and theory (Roscoe, 2004). A natural, real, and dynamic environment is necessary so that instructional decisions can be based on the best possible outcome, and the actions can be justified as valid and reliable. McNiff considers action research a type of practice research that enables the researcher to enter their own practical work unit and complete their research. Sell & Lynch (2014) defines action research as a teacher's inquiry – an inquiry to explain and promote teaching practices (McNiff, 2013). Instructors are bound to pursue professional growth. For that, active research should play an important role.

Studies explored how action research can train and develop professional capability and promote educational innovation to bridge the gap between theory and practice (Chevalier & Buckles, 2019). Action research is regarded as an effective way to improve professional competence while maintaining autonomy and practical education reform.

Action research is a means of improving curriculum, teaching, and realizing educational innovation. Since knowledge of action research is democratic, instructors can produce their own educational knowledge. This

knowledge determines the theme and process of research, making the research process transparent and allowing everyone to contribute. Action research is cooperative. It pays attention to personal practices and can break the barriers of individualism and isolation through studying one's own practice, then using personal knowledge as the object of analysis.

3. Research Methodology

A qualitative method of research was applied in this study. The research methods explain the research situation and implementation process, the research object, the role of the researcher, the collection and analysis of resources, and the methods of dealing with the research issues involved.

The beginning of the research was as follows:

1. Course description and Learning Outcomes- Select and identify the research topics for students.
2. Prepared the project brief, conduct the research plan and Evaluation
3. Observe and collect related resources: Outcomes were collected for literature research, and the market response was discussed with industry players.
4. Reflect: Evaluate the contents and implement improvements.

3.1 Course Description and Learning Outcomes (research topic for students)

To fulfill the requirements of the study and meet the appropriate programme standards, students (participants) were introduced to design through various publication layouts, organizing documents, various printing methods, and the usage of special papers. Each participant was expected to do literature review research based on given topics then experiment with adding animations, videos, and audio to a physical printed book. This allowed unprecedented interactivity, providing new real-time experience to readers. Upon completion of this subject, students would gain the necessary skills to achieve professional looking results with ease. With both knowledge and digital skills, students can manipulate ideas and concepts into various forms of visual communications.

3.2 Project Brief, Research Process Planning and Evaluation

To preserve local folklore, the researcher decided to work on Malaysian folktales, such as superstitions, taboos, and ethnic beliefs. A total of 64 story ideas (daily-life, rituals, and festival taboos) were prepared. Each participant was given four story ideas, to be presented on two pages each (open page). Participants were expected to do research based on given story ideas without word limits, using grids, columns, layout & design, animations, and illustrations, then integrated audio (free music online), video, motion graphics, or animations with Augmented Reality (AR) (minimum 15 seconds/story). Participants were also expected to design the book jacket, end page, foreword, content page, and credit page. As these pages followed the typical and traditional graphic design and layout, they will not be discussed further.

Observations were made on site, and main points were listed. Focus was placed on the instruction process, where instructor interacted with participants based on changes in beliefs, cognition, and ability. The analysis was carried out based on professional growth with regards to trust, competence, and cognition; and factors affecting research progress. In order to ensure the focus was relevant, the perspectives of evaluation of participants, experts and scholars should be considered. Furthermore, publishers were consulted to confirm the focus of resources.

3.3 The roles of Researcher, Collaborators and Participants

The research period was two semesters – March to December 2019. The researcher carried out the first semester (March to August) with collaborator A and 16 participants. In September 2019, one more collaborator was added to improve the action research. There were a total of 29 participants in design creation, and 20 participants in copy writing. The roles of researchers and collaborators are described below:

- 1) Researcher:
 Researchers play the following roles in a collaborative action research project.
 - a. Constructive criticism and feedback: Researchers provide specific suggestions and feedback during weekly discussions and practical teaching.
 - b. Assisting supporters: Researchers can seek support from other instructors on technical issues.
 - c. Archivists: Researchers record discussions, meetings, classroom observations, and art works for research purposes.
 - d. Recognition: Researchers want to gain recognition and a sense of accomplishment, thus giving them drive to complete the study.
 - e. Facilitator: Pay full attention to active research and assist the students in achieving the objective and outcome.
 - f. Observer: Observe changes in learning attitude and skills during the study.

2) Collaborators and instrument in research:
 Collaborators enhance cross-disciplinary learning experiences and broaden social skills, responsibilities, team skills, values, attitudes, and professionalism of the students. Working with collaborators answered the basic theory of action research in planning, action, observation, and reflection. It is a practice-oriented process which involves cooperation between a researcher and their collaborators, a process of self-reflection, where instructor autonomy and responsibility has been realized.

This study had two collaborators.

- a. Collaborator A, a motion graphic & AR lecturer; provided guidance on the production of motion graphics in 2D and 3D animation, after effects, stop motion, and AR.
- b. Collaborator B, a communication writing lecturer was invited to assist in copywriting after the review and evaluation of the first semester. B arranged for communication students to work on copywriting with the design students.

Software zapper apps were used to assess student’s augmented reality content after completion of the motion graphics; scanning the image with a zap code generates the AR content. Readers have to download free zapper apps to their device and scan the zap code to view the AR content.

3) Participants (students):
 In March 2019, 16 Visual Communication design students (First cohort) were invited to design and produce a physical book with Augmented Reality (AR); another 29 Visual Communication design students, and 20 Public Relation & Communication students (Second cohort) were in the following semester after the first semester’s evaluation and review (see Table 1).

Table 1. Participants in the study

Cohort	No of Participants/ Students	BA degree/ Major in	Duration given	Tasks	
				Designing	Copy writing
1 st	16	Visual Com	14 weeks	Yes	Yes
2 nd	29	Visual Com	14 weeks	Yes	Provided
	20	PR Com	5 weeks	-	Yes
	65				

3.4 Enhancement on Project Brief (after first round of Action Research)

After the first cohort, based on the official feedback evaluation distributed by University which consists of 15 questions on evaluation of subject (eight questions) and teaching (seven questions) in five point likert scales (Strongly agreed to strongly disagreed) and enable written comments.

8 questions: evaluation of Subject		7 questions: evaluation of Teaching	
1	Aims and goals are clear	1	Teaching was well organised
2	Well-structured	2	The lecturer's explanations helped in understanding
3	Enabled to achieve the learning outcomes	3	Inspired to learn
4	Intellectually stimulating	4	Encouraged to be involved in learning
5	Developed problem solving skills	5	Encouraged to participate
6	Learning resources assisted the learning	6	Assignments were marked and returned within the stipulated time
7	Received helpful feedback on the progress	7	Overall, the lecturer was excellent
8	Quality of this subject is satisfied	-	-

As all 16 students are required to complete the evaluation but only 11 out of 16 wrote their comments. Overall the feedback was good, scored at the average of 83.25% in subject, 85.28% in teaching and there were 36% commented quite heavy in term of assignment.

For the following semester, researcher reduced the workload of students. each student was given two different pieces of story ideas instead of four and free them from writing the storyline but they were expected to work together with students from the Communication department for in-depth research with 300 to 500 words per story; a total of 58 story ideas was prepared for this second cohort, this time it was about Malaysian industry taboos. Students were allowed to form groups and share research outcomes, then present it in different manners. Each story still had to be two pages (open page), with a minimum of a 30 second AR instead of 15 sec compared to first cohort (see Table 2).

Table 2. Project Brief Descriptions for 1st and 2nd cohort

Cohort	Participants (Students)	Stories given	Research	No. of words	Page layout	Motion Graphics /story
1 st	16	4	Yes	No restriction	4 x 2 pages	15 sec
2 nd	29	2	Yes	-	2 x 2 pages	30 sec
	20 (copy writer)	2 to 3	Yes	300 to 500	-	-

4. Research Results and Discussion

Action research has different research orientations. The core skill is introspection, an important source of motivation for the continuous growth of professional ability. This study is based on three propositions:

4.1 Evaluation and Review from the Action Research Process

The first cohort, 13 out of 16 participants completed four stories with AR; 10 of them obtained free music from the internet, and 6 completed the project without audio. There were 10 who generated an AR code in time for submission. It became apparent that 14 weeks (one semester) was insufficient for participants to complete the project. On average, each story was less than 200 words. There was not enough time to fine tune the illustrations, videos, or animations. After the evaluation and review of first round, participants from Communication department were invited to write copy for the stories. The number of stories given was reduced from four to two.

The second cohort, all 29 participants completed the tasks by collaborating with 20 copywriters. The copywriters wrote 300 to 350 words per story. Research starts from interests, difficulties, or unknown situations. Problems arise with interest or when one encounters difficulties. However, these can be further improved based to the feedback of the learning outcomes.

After two rounds of action research which carried out for two semesters, the researcher approached two publishers to confirm the focus of resources and to figure out market acceptance level by presenting two prototypes (physical full colour books in print, perfect binding, book in A5 size, total of 150 pages, each story having its own AR code) (see Table 3).

Table 3. The learning outcome of two semesters

Sem	students	Stories given	Text copies	Able to meet dateline (within 14 weeks)				Action taken: Evaluate & review
				Page layout	Motion Graphics	Audio	Upload with AR	
1 st	16	4	Less than 300 words	16 (100%)	13 (81%)	10 (62%)	10 (62%)	1. Copywriting need to enhance on stories 2. Inadequate time
	28	2	-	28 (100%)	28 (100%)	28 (100%)	-	1. Market acceptance level 2. Invite more collaborators to work on, such as music composition
2 nd	20	2 to 3	300 to 350 words	-	-	-	-	

4.2.1 The Gap between Academic Aspirations in Designing and Market Reality

Several new dimensions came to light after discussions with the publishers. There was a need to break away from limited thoughts and approach the problem from different angles. The researcher was made aware of the possibility of soliciting articles from others, and possible essential improvements. The comments from publishers are compiled in Table 4.

Table 4. Comments from two different publishers

Comments about design:	Comments about narrative/ stories:
1. Impressed with the quality of the design work	1 each story can be more critical and meaningful rather than just delivering little vignettes
2. In terms of visual and graphic design, the student's work is serviceable	2 making each story longer, deeper, and more rooted in Malaysian folklore
3 AR, can attract young readers	3 more experimental and creative in terms of actually driving a narrative forward
	4 It may be necessary to solicit essays/ articles from a board spectrum of students outside of visual media and communications

4.3 Spur the Researcher into Introspection and Momentum to Go Further

Action research often arouses interest in more research questions. After the first semester's evaluation and review, the researcher decided to extend and collaborate with other faculty members. The enthusiasm of the collaborators rekindled researcher's interest in continuing developing the action research by inviting more collaborators to work on other things, such as music and sound composition.

And, the average scored from second cohort (29 students) of their official evaluation for subject and teaching were 82.4% and 85.1% and 25 of them had wrote their comments with positive feedback, such as build a fine

artistry throughout the progression, achieving good final outcomes, learned real-world application and workflow of the publishing industry well, providing insight and new perspectives. Students befriended those from another faculty, providing more opportunities for brainstorming and peer discussion. Researcher met up with two commercial publishers in knowing the market expectations; it has spur the researcher into introspection and momentum to go another step further in improving and keeping pace with the times and development in curriculum.

5. Conclusion and Suggestions

5.1 This Research has concluded the Existence of Four Key Factors

During the process of action research, the factors affecting the research of action research and professional growth were as such:

- 1) Interest as Motivation: In the absence of external pressure and rewards, the motivation in conducting research is based on interest and the urge to solve existing problems. During the process, the instructor gained familiarity and significant progress with the research methods and steps.
- 2) Self-gratification: Instructors experienced satisfaction after observing students' performance; instructor took the initiative to learn new forms of media.
- 3) Enhancement of reflection: an important skill for action research. The instructors were able to detect problems, formulate new action strategies, and prepare for new research.
- 4) To complement each other: During collaboration, instructors can rely on each other's expertise to solve problems and provide support. Additionally, music faculty students can be conscripted to compose music.

5.2 Suggestions

There are four suggestions for those who are willing to engage in action research.

- 1) Participate in collaborative research to remove the barriers between classrooms and faculty.
- 2) Instructors should publicly disseminate their knowledge through research reports.
- 3) Be involved in action research for professional growth.
- 4) Seek possible collaborators. Differing opinions can catalyze and promote action research.

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