Designing Multimedia Instructional Materials using Gagne's Framework in Promoting Adult Learners' Asynchronous Learning Experiences

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ABSTRACT

This research addresses the challenges faced in Distance Education (DE) by investigating the impact of carefully designed multimedia instructional materials in creating a conducive asynchronous learning experience for adult learners. With the increasing integration of digital technologies in higher education, especially in DE, it becomes imperative to assess and optimize the various teaching tools available to ensure effective educational delivery. The unique challenge in DE is that adult learners often study in isolation, with limited instruction, and at a distance from traditional classroom activities. To mitigate these challenges, multimedia instructional materials are recognized for their potential to enhance the learning experience. This study delves into how the design of instructional materials, supported by technology, contributes to improving the asynchronous learning experience digitally and subsequently the learning outcomes. Well-designed instructional materials have been identified as crucial determinants of success, emphasizing the need for a learner-supported approach employing carefully selected instructional design. It is suggested that institutions offering DE prioritize the creation of high-quality multimedia instructional materials rooted in suitable learning theories, in supporting adult learners in DE to enhance learner satisfaction, improve academic performance, and reduce attrition rates. Further exploration and evaluation of this instructional design framework are certainly called recommended for a testament enhanced credibility for the said framework.

Keywords: Gagne Events of Instructions, Multimedia Instructional Materials, Asynchronous Learning Experience, Adult Learners, Distance Education.

INTRODUCTION

The rapid advancement in technology and the need for lifelong learning as well as the growth of non-traditional students have encouraged the use of the computer as a means of instructional delivery for learning. Adult learners often engage in distance education (DE) for career advancement, personal development, or acquiring new skills, making it crucial to align instructional materials with their unique cognitive needs. Unlike traditional students, adults bring a wealth of prior knowledge and experiences, which significantly influence their learning process. Thus, instructional materials must be thoughtfully crafted to stimulate their cognitive engagement, foster critical thinking, and facilitate meaningful learning experiences. The importance of designing proper instructional materials for adult learners cannot be overstated, particularly in the realm of DE. Adult learners, unlike their younger counterparts, bring a wealth of experience and knowledge to the learning environment. However, this prior knowledge can also lead to cognitive biases and fixed mental models that can hinder the learning process. Properly designed instructional materials can help mitigate these biases by presenting information in a clear, concise, and

visually appealing manner. This is especially crucial in DE, where learners may not have the benefit of face-to-face interaction with instructors and must rely on instructional materials to guide their learning.

In the DE environment, student centered learning is central and pivotal to the learning content acquisition. With limited interaction with the course instructors, facilitators and among friends, these adult learners must rely more on themselves as well as focus on the learner-content interaction. Thus, the digital learning environment and experiences of the learners, the expected active learning tasks and outcomes, as well as the content design and framework for presenting instructional material in a conducive learning environment should be significant in the overall student-centered learning environments (Jaiswal, 2019).

LITERATURE REVIEW

One central factor that separates traditional learners and adult learners in DE is the time factor. Due to various life commitments, the latter have less time to dedicate to their studies. Thus, it is imperative for the "course materials to be set up efficiently" (Jeffery, 2018). In the modern era of e-learning, the successful implementation of programs hinges on the use of sound instructional design strategies that enhance the learning experience (Karthik et al., 2019). Self-instructional materials are designed to support independent study for distance learners, necessitating that they be intuitive, user-friendly, instructionally clear, and cost-effective. The rise of online education has generated a strong demand for an effective instructional design framework to guide the creation, development, and delivery of online learning experiences (Castro & Tumibay, 2021).

For this study, Gagne's instructional design has been selected to be the framework for the design and development of the multimedia instructional materials catered for the adult learners in the DE program. Gagné's nine events of instruction, an established instructional design model, is intended to create engaging and meaningful learning experiences. Instructors face several challenges, including the need to mentally prepare for teaching, identify appropriate instructional technologies, understand students' capabilities, balance classroom management with facilitation, and assess student performance while providing constructive feedback (Stephens et al., 2022). The Gagne framework is also widely recognized for its systematic approach to teaching and learning, which effectively promotes learner engagement, facilitates clear information presentation, provides practice opportunities, incorporates feedback, evaluates performance, and reinforces essential concepts (Daleon, 2023).

Studies by Daleon (2023), Delita et al. (2019), Gogineni et al. (2019), Jaiswal (2019) and Jeffery (2018), demonstrated that instructional materials designed using Gagné's nine events of instruction framework significantly enhanced students' knowledge and skills, creating a more effective learning environment that successfully supported their educational objectives. The framework contains nine instructional events that align with learners' cognitive processes, facilitating a systematic approach to achieving optimal learning outcomes and promoting retention and transfer of knowledge. These events effectively connect external instructional activities with internal cognitive processes, adhering to the information processing model of mental events that occur during learning as indicated in Table 1.

Table 1 Instructional events and corresponding internal cognitive processes (Gogineni et al. 2019)

Instructional events	Cognitive processes
1. Gain attention.	Reception
2. Inform learners of objectives.	Expectancy
3. Stimulate recall of prior learning.	Retrieval to working memory
4. Present the content.	Selective perception
5. Provide "learning guidance."	Semantic encoding
6. Elicit performance (practice).	Responding

7. Provide feedback.	Reinforcement
8. Assess performance.	Retrieval and reinforcement
9. Enhance retention and transfer to the job.	Retrieval and generalization

The success of effective E-learning implementation ultimately depends not only on the availability of high-quality content and reliable technology but also on the careful design and structure of that content. Karthik et al. (2019) also opined that instructional designers are increasingly demonstrating their expertise in developing design strategies, responding to learners' growing demands for features that enhance effective learning transfer. They further mentioned that the primary responsibility of instructional designers is to facilitate the seamless transfer of content from subject matter experts to learners, which is achieved by organizing and presenting the material in a manner that ensures ease of understanding and accessibility. Therefore, this study intends to discover the effect of a carefully designed multimedia instructional materials based on a learning framework that could help the adult learners in their study in the DE environment.

METHODOLOGY: GAGNE FRAMEWORK IN EDUCATIONAL ACTIVITY AND SETTING

The first-year undergraduate students of a non-computing DE public administration program utilized and completed the multimedia instructional materials on a selected chapter from a computing subject. Various previous research has reported some promising success and achievement on the use of Gagne framework with instructional materials and lesson plan at various levels (Jaiswal, 2019; Gonineni et al. 2019; Ramadhina et al. 2019; Pandey, 2020; Iqbal et al. 2021).

Event-1 Gain Attention of the Learners

It is imperative to get the learner's attention before they start learning. To aid the learners' readiness to learn, they must realize and understand that the lesson is important. There must be a "stimuli to gain their attention and arouse their curiosity for the lesson" (Jaiswal, 2019). In relation to the course Interactive Multimedia for the DE adult learners, it is worthwhile to provide some examples of the application of multimedia in the real world. Figure 1 shows the instructional material, a video containing three different sections and related to multimedia. The receptiveness to learning can be significantly increased by incorporating elements such as humor, storytelling, intriguing quotes or facts, cartoons, and multimedia, including audio or video clips (Davies et al., 2018).

Figure 1 Event-1 Gain attention of the learners

Event-2 Inform Learners of the Objectives.

To ensure that adult learners have a clear understanding of the learning expectations, the three objectives for the course section were explicitly communicated. Figure 2 shows the slide containing the objectives to be informed to the learners. Well-crafted objectives provide learners with a framework that shapes their expectations regarding learning outcomes (Gogineni et al. 2019).

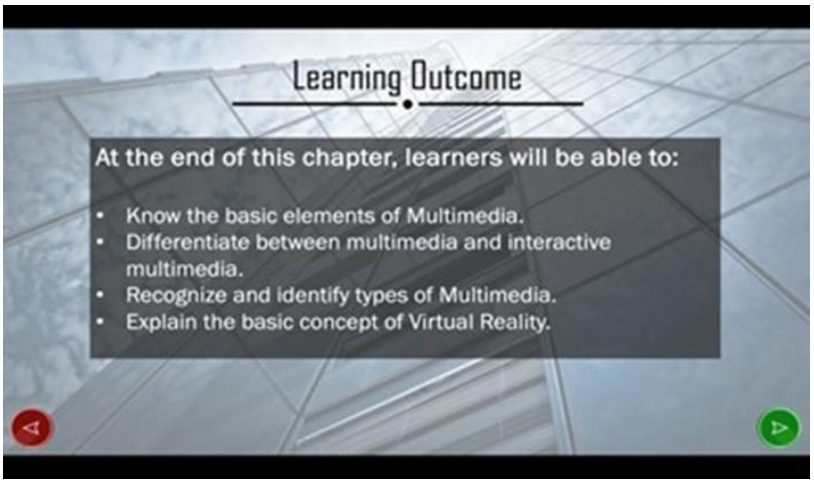

Figure 2 Event-2 Inform learners of the objectives

Event-3 Stimulate recall of prior learning.

Learners achieve optimal understanding when new knowledge is placed into a familiar context (Jaiswal, 2019). This approach emphasizes on the learners' ability to identify various forms of multimedia content present in their surroundings and classify them according to specific elements or characteristics. Additionally, the instructor engages the learners in discussing their prior experiences and any difficulties they may have encountered in recognizing and selecting multimedia content.

Event-4 Present the content.

Presenting the academic content in an organized and structured manner and with the possible use of multimedia helps to promote effective delivery as well as cater to learners' different learning styles along with small manageable sections of content thus avoiding cognitive overload (Jaiswal, 2019). The multimedia instructional material was presented using examples, non-examples, real situations, and diverse contexts significantly enhances the learning process. By applying Gagné's framework, the content was systematically delivered in a sequence that aligns with the hierarchical structure of the interactive multimedia domain, thereby facilitating the cognitive organization of the material. The instructor offers the learners a comprehensive understanding of the fundamentals of multimedia, including its key features and applications and incorporate pauses and moments for reflection before transitioning to the next subtopics.

Event-5 Provide learning guidance.

This event concerns with providing guidance and support to learners about possible strategies to learn and encode new information (Gogineni et al., 2019; Jaiswal, 2019) that can be found in the instructional material. This section lets the learners examine the examples and forms of multimedia identified in the learners' environment by analysing the distinct features highlighted in Events 2, 3, and 4. Additionally, the learners need to review the presentation covering the specific elements and characteristics of multimedia in detail.

Event-6 Elicit performance (practice).

After the learning guidance, the learners put their newly acquired skills and knowledge into practice to strengthen their understanding and verify the accurate grasp of the instructional concepts (Gagne et al., 1992)

in McNeill and Fitch (2022). In this study, this step lets the learners review the instructional material on multimedia by addressing the questions provided under specific subtopics. It also allows the learners to engage in practice exercises to assess understanding of the various types of multimedia content. Figure 3 illustrates the practice question "Have you ever used this device? How did it feel?" for a subtopic on Virtual Reality.

Figure 3 Event-6 Elicit performance

Event-7 Provide feedback.

Formative assessment serves most beneficial for learning when learners receive high-quality feedback (DiVall et al., 2014). Gagne et al. (1992) in McNeill and Fitch (2022) argue that offering learners immediate and personalized feedback holds greater significance than the actual content of the feedback. Therefore, during the learning activity in this study, relating to this event, constructive feedback in the form of explanation and validation is given to the learners. The focus of the feedback is not on formal scoring but rather informing the learners on the actual information regarding the topic on interactive multimedia.

Event-8 Assess performance.

At this stage, assessing performance, which encompasses assessing learners' knowledge and monitoring their progress, is used throughout the learning process to determine the effectiveness of instructional activities and to ensure that the intended learning outcomes have been achieved (Jasiwal, 2019; Ramadhina et al., 2019). In the learning activity in this study, the instructor can assess the performance of the learners through a quiz at the end of the learning activity. The learning objectives at the beginning of the lesson were assessed using a quiz using multiple choice questions. This is conducted to evaluate the immediate effectiveness of the learners. Figure 4 indicates the outcome of assessing the performance of the learners after the learning activity was completed.

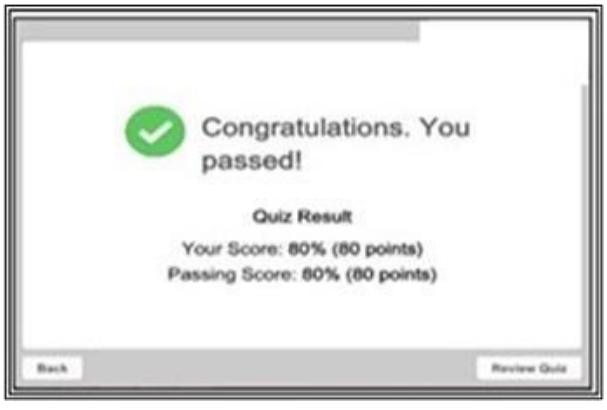

Figure 4 Event-8 Assess performance

Event-9 Enhance retention and transfer to the job.

In the final stage of the learning process, the learners deepen their expertise by internalizing new knowledge or skills, retaining them, and applying them in different contexts, thereby advancing their learning to a higher level and enhancing their ability to transfer knowledge to others (Ramadhina et al., 2019; Jaiswal, 2019). In this study, the learners are encouraged to apply their knowledge by examining different multimedia content in their environment. The instructor advises them to reach out for clarification if needed and to engage in peer discussions. The session concludes with a set of open-ended questions, followed by a review of key points highlighted in the summary.

Table 2 Learning Activity outline

Event	Aim	Activities
1	Gain Attention	Instructor explains the justification of the learning session. Begins the lesson with an opening video on examples of Multimedia content. Use a multimedia visual stimulus: PowerPoint presentation of the chapter on introduction to Interactive Multimedia
2	Inform learners of the Objectives	The instructor presents the slide containing the learning objectives in the PowerPoint presentation. 1. Point out the basic elements of Multimedia. 2. Differentiate between multimedia and interactive multimedia. 3. Highlight the need to recognize and identify types of Multimedia. 4. Explain the basic concept of Virtual Reality.
3	Stimulate recall of prior learning	As the learners to identify the possible multimedia content seen in the environment. Categorize them based on the elements or features. Ask the learner about any previous experience and challenges in identifying and deciding multimedia content.
4	Present the content	Provide the learners with a thorough insight into the foundation of multimedia and its various features and usage. There are pauses and reflection before moving to the next subtopics.
5	Provide learning guidance	Review the examples and types of multimedia discovered in the learners' environment and surrounding by looking at specific features found in the content in Event 2, 3 and 4. Go through the presentation on each specific elements and characteristics of Multimedia.
6	Elicit performance	Revise the information on Multimedia with the questions provided under certain subtopics. Practice on the questions to check on the different types of Multimedia content.
7	Provide feedback	Observe the responses by the learners and take notes for the instructors' feedback. It is useful to combine similar responses for the feedback. Common feedback can also be done in the slides in the form of explanation. Another form of feedback can be in the form of validation but not a formal scoring.
8	Assess performance	The learners can take a post learning activity quiz in the PowerPoint presentation. After the quiz, the instructor and the learners can discuss on the questions and answers.

9	Enhance retention and transfer to the job.	The learners are advised to practice what they have learned with the surrounding by looking at various multimedia content. The instructor also informs the learners to contact him/her if the learners when questions arise. They could also discuss among themselves. Close the session with a few open questions and answer them. The instructor can also review the key points as included in the summary.

Results and Analysis

The study implemented a quantitative method to evaluate the adult learners' accomplishment in the pre test and post test in relation to the intervention. The said intervention is the structurally designed and developed multimedia instructional material based on the Gagne framework. It was established to evaluate the performance of the adult learners in the experimental group within the asynchronous learning environment where self-directed learning must be present.

Sample

The sample size for this study consisted of 28 (10 males and 18 females) undergraduate adult learners from a non-computing Public Administration program. The They were studying Interactive Multimedia course in a local university. The participants, forming a homogenous group from the same class and selected through purposive sampling, were designated as the experimental group and had no prior knowledge of Gagne's nine events of instruction. There are about 209 adult learners in this study centre from a few study centres scattered all throughout the country. The university, with a student population of more than 160,000, supports undergraduate and postgraduate programs in science and technology, education, business, and natural and social sciences with many branches all over the states in the country.

Instrument

The study was experimental in nature and involved pretest and posttest to collect data about the adult learners' achievement or performance before and after the implementation of the intervention which was the multimedia instructional material based on the Gagne framework. The pre test was administered at a specific date. It consisted of 20 multiple choice questions and 5 subjective questions with different difficulty levels of easy, intermediate and hard based on selected Bloom's Taxonomy level of knowledge, understanding and application. After the pretest the adult learners were given the multimedia instructional material based on Gagne's framework as the academic course material for two weeks and after that the posttest was administered. The post test consisted of the same questions with different arrangement. Table 3 indicated the process flow of the experiment with the experimental group.

Table 3 Flow of the experiment

Timeline	**Activities**
2-3 weeks	First year Adult Learners in a Public Administration Program taking Interactive Multimedia course (Single Experimental Group)
5 – 10 mins	Introducing adult learners to the experiment and procedure
50 mins	Pre test
5 mins	Downloading Multimedia Instructional Material (MIM)
2 weeks	 Learning activities in MIM
50 mins	Post test

The pre test and post test scores of the adult learners were systematically compiled and entered into SPSS for analysis. The data underwent thorough collection, tabulation, and subsequent analysis. Descriptive statistics, including the calculation of mean and standard deviation, were employed to determine whether a significant difference existed between the adult learners' performance on the pre test and post test following the intervention. Furthermore, the results were elucidated using bar graph to facilitate a clearer comprehension of the findings.

RESULTS AND DISCUSSION

Based on the experimental evaluation conducted, the overall adult learners' performance had improved. Generally, all the adult learners in the experimental group demonstrated better cognitive capabilities through the multimedia instructional material designed based on Gagne's nine events of instruction. Gagne's framework had statistically positive impact on the delivery of the content, and it can be said that the adult learners gained better acquisition of knowledge that improved their overall academic performance. The score means in Table 4 indicate that there is a significant difference between the performance of the adult learners on the pretest (Mean=15.50, SD=3.33) and posttest (Mean=28.14, SD=2.35) in the experimental group. The difference in marks attained in the pre test (Min=9.0, Max=22.0) and post test (Min=24.0, Max=34.0) of the adult learners in the experimental group also attested to the significant improvement in their academic performance. The findings revealed that the Gagne's framework has a positive effect on the adult learners' academic performance which address the need of the adult learners' of course materials to be set up efficiently.

Table 4 Descriptive and Inferential Analysis of Achievement from the Experimental Group

Experimental Group	N	Mean	SD	Min Marks	Max Marks	p-value
Pre test	28	15.50	3.33	9.0	22.0	.00
Post test		28.14	2.35	24.0	34.0	

In Figure 5, the pre test and post test marks bar graph shows a clear difference. Not only the high scorers in the pre test performed better but also the lower bound scorers have also improved. These positive academic performance reflected the benefits of an effective instructional design framework that guided the creation, development, and delivery of online learning experiences as demanded by Castro and Tumibay (2021).

Figure 5 Pretest and Posttest Marks of Adult Learners in the Experimental Group

CONCLUSIONS AND RECOMMENDATIONS

This study elaborated and described the implementation of Gagne framework in the design of multimedia instructional materials. Adult learners in the DE environment had to pursue their studies under various limitations and challenges. They are physically separated from their instructors and institution meaning less instructor-learner interaction, reduced instruction, less learner-learner interaction in the study community and rely mostly on their instructional materials for their academic pursuit in a self-directed manner. As such, it is significant that the instructional materials be designed, structured and developed accordingly to assist and fulfil the expectations and needs of the target learners (Delita et al. 2019). Thus, Gagne framework was selected to be the design structure of the learning activities of the instructional materials for the adult learners in the hope that the adult learners may benefit from the properly designed instructional materials. Based on the results, it clearly indicates that the marks of the adult learners in the experiment have improved in the post test as compared to the pre test and it can be said that the intervention of the multimedia instructional materials have helped the adult learners performed better (Pre test min mark=9, post test min marks=24) (Pre test max marks=22, post test max marks=34). Based on the findings, this study recommends that student centred instructional approach, in this case Gagne's nine events of instruction, is useful for improving the adult learners' academic performance as it provides ample opportunities for students to self-assess their

progress in learning about multimedia. It also allows the instructor to assess students' progress informally and facilitate in the understanding of multimedia, a computing technology course that is different from their study program which is public administration. However, this study is not without limitation. One of the limitations of the study was the comparatively small sample size used in the experimentation. Twenty-eight adult learners from a single class participated in this study. For a better representative distribution of the adult learners' acquisition of knowledge, a larger sample size would have been more appropriate. Besides that, this study only involved a selected computing course. By emulating the same study with a non-computing course, the findings can provide a clear and more significant effect of the Gagne framework within the instructional materials and the academic performance. These considerations in future studies can help to validate the effect of Gagne framework on the overall academic performance of adult learners in the DE realm. Following Gagne's instructional events ensures that learning aligns with students' internal cognitive processes, optimizing retention and transfer to relevant study settings. However, further research on the application of instructional design models in adult learners' DE is needed.

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