

# Applying Multimedia in Education: A Case of Science Education

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Received 3 September 2024; Acceptance 22 November 2024; Published 26 November 2024.

## Abstract

*The application of multimedia in science education is timely as it provides teaching aid that spurs learning in this fast developing world. This review examined the application of multimedia: a case of science education. Different procedures in the application of multimedia in education were shown to boost assimilation rate in students thereby developing their domains of learning and increasing effectiveness. Findings also reveal that in the use of multimedia, progress in learning is made in the presentations of facts and observation, the premise upon which science is based. Based on these findings, the study recommends the use of multimedia in science education so as to check the benefits associated with multimedia usage in comparison with its demerits thereby, allowing adequate information necessary for individuals, governments and the society at large to determine the way forward as regards multimedia integration in education.*

**Keywords:** Application, Multimedia, Science, Education.

## Introduction

Multimedia is defined by Turkish Language Society (TLS) as “the platform where a material is combined with text, graphs, audio and simulation” [1]. According to in [2], multimedia is the multiple introductions of a material with picture or text. The author [3], on the other hand, defines multimedia as the synthesis of digital platforms such as text, audio, graph, animation, visual and video. In another explanation, multimedia sources created by using audio, video, visual, graph, text, animation to explain a subject is expressed as the use of different data types to explain an idea, an event or a subject [4]. Also, it is introduced as a tool combining different platforms such as written, audio, numeric graphs and animation. In parallel with these, multimedia is defined as the use of more than one platform bodily to increase the effectiveness of instruction. However, it is generally used to refer to computer-based multimedia today. In summary, it could be stated that multimedia is composed of computer platforms where written media is presented with audio visual and animation media, and high definition and graphs are set [5].

Multimedia is effective in education as it provides easiness and facilities in education. Thanks to multimedia practices, students can learn brand new information. The author in [6] states that students can gain the knowledge and information that would be impossible to get in traditional ways; besides they could find the opportunity to prepare their own products with multimedia technique. As a result, it could be asserted that the use of multimedia possesses the aim of helping students with different skills and learning styles. Also,

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How to Cite: Onah et al. (2024). Applying Multimedia in Education: A Case of Science Education. *Education Annals*, **1(11)**.

DOI: 10.5281/zenodo.14220626

[7] points out that multimedia provide the opportunity for every student to work individually. In other words, a student can work on the subject(s) she/he believes she/he needs to in the way she/he desires.

Also, it can be observed that multimedia gains authenticity and variety in learning and instruction. Message via multimedia reaches the receivers in various ways and thus, it provides a richer learning environment. The subjects being taught could be transmitted to the students with web-based audio, visuals, video and animations in a way that could not be taught in classrooms authentically with other techniques. This way, closeness to reality could be provided and complete learning could be achieved. Also, multimedia eases education in terms of data used, storage, share and transportation of the visual and non visual written material, graphs, audios and other materials. Moreover, multimedia creates a familiar, various, economic and practical environment in education [8]. Another contribution multimedia makes into education is the increase in academic achievement of the students. When compared to traditional instruction, multimedia use increases the academic achievement of the students. The use of multimedia affects education positively when designed properly compared to traditional instruction, in terms of academic achievement [9]. It can be asserted that multimedia use eases and objectifies learning as it presents more than one technological factor to the learner and it addresses more than one emotion of the receiver.

Multimedia applications can be defined as an application that uses a combination of many media sources such as texts, graphics, audios, videos and animations. It is often use to deliver information which is more powerful than printed learning resources such as printed text book. It also allows users to interact with the information quickly and accurately. Educational multimedia applications enable students to get information in various formats. Examples of multimedia applications are World Wide Web, courseware, interactive TV, computer games, and virtual reality.

According to [1], "Multimedia applications are moving from a single PC environment to either a multi-user environment or to a personalized user environment." The rapid innovation and development in information and communication technologies has been increased the used of multimedia applications in our daily life and brought the changes to computing, entertainment and education. However, educational multimedia applications are not going to replace the roles of teachers or lecturers, it will only allow students to learn more when compared with traditional teaching methods.

Multimedia applications for educational purposes are similar like the printed text books and other teaching materials, but they can become in a wider range of sources. The potential of multimedia applications for educational purposes is well-recognized by the universities, school, government and private organization. Educational multimedia applications can be more focused on specific objectives or in more comprehensive ways [10]. In the light of this, this review seeks to examine the application of multimedia in education: a case of science education.

## **Elements of Multimedia Applications in Education**

Although the definition of multimedia as it applies to education is simple, making it work can be complicated. It is necessary to understand how to make each multimedia element come together using educational multimedia computer tools. The elements used in multimedia applications have all existed before. Educational multimedia applications combine those elements into a powerful new tool, especially in the hands of teachers or lecturers and students. Multimedia applications can be used in many areas, for example like educations, businesses, homes and public places. For educational purposes, students can explore variety of information for further understanding by using multimedia applications. Educational multimedia applications are used to improve learning effectiveness. A multimedia learning environment involves numbers of elements in order to enable learning process taking places. There are six main elements in multimedia applications for educational purposes which are:

- i. Texts

- ii. Images
- iii. Audio
- iv. Video
- v. Animations and
- vi. User control.

Firstly, text is an important element in multimedia applications; it can be used to provide information and emphasize specific point by using different styles, fonts, and colours. Secondly, image is an object that has more significant impact than merely reading about text in an educational session. Image can be added to multimedia applications by using colour scanner or digital camera. Examples of images are photographs, artworks, drawings. Thirdly, audio can be used to emphasize certain points and enables teachers to presents a lot of information at once rather than use printed learning resources. Audio allows students to use their imagination without being biased, so it will greatly increase the learning outcome. Fourthly, video can be used to present the information beyond the scope of the ordinary lecture room such as medical operations. The use of video to deliver information can be very powerful and immediately, it allows teachers or lecturers to highlight certain key points or tell the students what they are going to do next and understand the real life situation. Fifthly, animation is used to demonstrate an idea or illustrate a concept; an object that appears blurry in video can be presented clearly in animation because it can view the changes of the object over time. Lastly, user control uses it to provide students with the option to skip particular parts of the multimedia application and allow them to navigate other areas of that program. All of the elements are combined to provide a platform for students to maximize the effectiveness of educational purposes [11].

## Multimedia in Teaching

A teacher should be aware of the fact that technology has no value in itself independent of the content that needs to be presented. Use of technology for the sake of technology and assuming the use of different mediums in itself as a goal doesn't promote teaching [7]. The teacher also needs to evaluate a medium to see how it adds to the content and if the medium enhances presentation of the content. Therefore, the following steps by [12], acts as a guide that may help in creating a successful multimedia presentation.

### Step One: Make a plan

One of the biggest mistakes that presenters make while creating a presentation is focusing on technology more than content. As mentioned earlier, you are going to present content and not exhibiting features of the presentation tool. In general, you need to clarify your purpose of presenting, which is effective delivery of information relevant for a course, a business meeting or a seminar; in this case science education.

The process of preparing a presentation involves making careful decisions at different steps. Although these steps may follow a sequence, because of their interdependencies, the presenter may sometimes need to go back to a previous step and make some changes. In making a plan, the following steps are essential:

**Identify a particular content based on the topic:** The first prerequisite for presenting anything is to have enough knowledge about it. If you do not know sufficiently about your subject, you cannot make a good presentation on it, no matter how interesting is your presentation. However, it does not mean you should present all your knowledge about a topic in your presentation. You must choose a few important points for the presentation according to the context such as objective of presentation, knowledge level of audience etc. For this purpose, you need to prepare an outline to clarify what concepts you are going to present. Having an outline helps you in several ways.

**Be aware of your audience:** Attention to audience's age, gender, prior knowledge, interests, skills, abilities and experience is necessary to make any decision in relation to pedagogical goals and selection of presentation techniques. The authors in [13] state that the presenter needs to understand the audience's

“perceptual, cognitive, and emotional capabilities, expectations, and habits” and to explore the relationships between the audience and “visual technology” and “manipulations of that technology” in a better fashion. In general, the nature of the audience may influence selection of the level of details of content, pedagogical method to be adopted in presenting it and the type of technical features of the presentation tool used to prepare the presentation.

**Assume the role of a teacher rather than a transmitter of information:** Identify objective goals of the content based on the audience’s characteristics. The objective goals define the expectations about the changes (in knowledge, thinking, skills, etc.) in the audience resulting from presentation of each concept. In order to identify the objective goals, you need to determine the level of knowledge and skills which are required to learn the particular concept being presented. These objective goals should preferably be precise and particular.

**Determine a suitable learning experience:** It is very crucial to select a suitable learning experience in order to ensure that the presentation helps you to bring about a pedagogical change that you expect.

More generally, there may be different pedagogical changes that the presenter may wish to bring in the audience as a result of the presentation. These include remembering, understanding, applying, analyzing, evaluating and creating as defined in the Bloom’s taxonomy. According to the kind of learning objective determined by the presenter, a suitable learning experience should be selected. In order to provide the suitable learning experience, appropriate technology tools or technical features present in the presentation tool may be utilized.

### Step Two: Make a Scenario

**Make a map:** First decide about the content that needs to be imparted to the students. The author in [14] advocated using PowerPoint to present concept maps. Concept mapping is a teaching method which is a part of constructivism. Concept mapping is a simple graph that presents knowledge concepts in the form of nodes and the relationship between concepts as the branches of a tree. “Mind Mapping” is a simple form of concept mapping that is advised in many learning theories. If the instructor is successful in implementing level two of the second round, the mind map exercise will cover all six levels of learning as presented in Bloom’s taxonomy [14].

**Create a logical sequence of presenting concepts:** The teacher needs to make a logical sequence in which the concepts would be presented according to the concept map and objective goals of the presentation. Make a reasonable set of concepts of the content both horizontally and vertically. Further, it is important to realize the prerequisite concepts.

**Organize the Content:** In order to properly organize the content in different slides, considering the characteristics of the audience and also the complexity of the content is important. Decide what you are offering in each slide. For this purpose, making a table can be useful. The main concepts may be placed in every cell of table and each slide should be made in a logical manner.

### Step Three: Select the Techniques

A successful multimedia presentation includes good use of audio-visual characteristics.

**Decide about using the characteristics:** Each multimedia presentation may employ different audio-visual characteristics such as designs, colours, animations and sounds in presenting information. You need to select appropriate characteristics according to the learning objectives or requirements of the content. Applying characteristics (animations, colours, fonts, images, graphics, design etc.) merely for the sake of using them while they may not really be required may distract the audience.

**Keep a coordinated style:** Start making slides and select presentation techniques according to the style of your multimedia presentation. A particular style is characterized by the type of layout, design, fonts, images and sounds used in it. All these items should be selected according to the characteristics of the students, nature of content to be presented and the type of learning experience that the presenter wants to provide to the audience. Keep the slides simple and easy to understand so you do not have to apply another technique for emphasizing the main point. It is important that all elements of the multimedia presentation (animations, colours, fonts, graphics, etc.) should revolve consistently around the theme of the presentation.

**Engage the mind of the audience:** Some researchers have indicated that the audience remains passive when a presenter is delivering a talk using presentation slides [13]. To counter this, [15] have suggested combining the use of content-based questions (CBQs) with traditional presentation slides in order to enhance involvement of audience and thus learning.

**Make your slides interesting:** A good presentation should not include long texts. Try to use some tables, charts and graphs to summarize the words. However, charts and graphs can be difficult to understand if they include too much information. Some studies have acknowledged that audiences disliked some slides that contained too much material, complicated diagrams or seemingly irrelevant images [16]. Also, using unrelated graphics in a presentation has been found to have a negative effect on the enjoyment and the learning of the material [17].

**Utilize the most suitable option from the different options available in the presentation tool:** For example, in PowerPoint, you may select font, design of background, bullet points, transition and animation. You must select each element with awareness and reasonable justification for its selection. These include;

1. **Font:** Select the proper font size, colors and style. Choose the font size according to the area of presentation. Select the size such that it is readable by the entire audience. Also, select the font colors such that it strongly contrasts with the background color. It is suggested that in a room with good lighting, you should select dark colors for fonts on light backgrounds. When the classroom is dark, you can select light color fonts on dark color backgrounds. This combination makes your presentation more attractive and readable. Use the style of font that is usually installed in every computer such as Arial or Times New Roman. Also, avoid selecting fancy fonts. The most important factor in the case of font is "make it easy to read".
2. **Design of background:** The background design may make your slides more attractive but be sure that this design is not complicating the slide or making it messy. Also, the background should not be distracting to the audience. As mentioned above, the color of background depends on the color of fonts and other materials in the screen.
3. **Bullet points:** Utilize bullet points when you need to show some subcategories and keep only one idea for each bullet [13]. Use bullet points rather than numbers when you do not intend to convey any particular sequence or priority among the points. In providing content in the form of bullet points, follow the 6 x 6 rule. "There should be no more than 6 bulleted items per page. Each bullet should have no more than 6 words in the statement."
4. **Transition and animation:** Usually transition and animation effects are applied to make a presentation more attractive. Therefore, the teacher must be aware not to make the audience tired by too many unnecessary motions.

#### Step Four: Practice the Presentation

The way in which the multimedia presentation is delivered is as much important as the way in which it is created. Therefore, practicing delivery of the multimedia presentation is crucial. During this practice, you may observe some factors (e.g. time taken for presenting) that you may have ignored or some common mistakes. Sometimes, you may find some conceptual gaps between content in subsequent presentation

slides. By practicing the presentation, you would get a chance to correct, add or edit your slides before presenting it to the audience.

The following should be considered while practicing for a multimedia integrated lesson

**Start your presentation interestingly:** You can start your presentation with an interesting question or image. Also, start the presentation when you are sure that the audience is ready to listen to you. You may prepare a short introduction before you start presenting, to get the audiences' attention.

**Present instead of reading out from the slides:** Reading out from the slides would make your class boring. When the audience is bored, they may distract you easily by talking to each other or engaging in some other activities. Instead, let the content in the slides supplement your talk. Further, talk interestingly, but not without relevance to your slides. Invite the audience to watch what you have already prepared in the slides.

**Keep eye contact with individual:** Not only inexperienced speakers but sometimes even experienced speakers may not be comfortable when they are in front of a large audience. Although the use of the multimedia presentation implies that the audience is not going to be looking at you all the time, eye contact with the audience is still required. Many people in the audience prefer to look at the speaker when they are listening. So it is important to look towards the audience while periodically shifting eye-contact among different individuals of the audience.

**Consider the situation:** Many factors such as room lighting, room size, the direction of light in the room, time of your presentation, number of participants and so on may affect the effectiveness of your presentation. Review your presentation slides and correct them according to these factors.

**End the presentation impressively:** It would be good to end your slides by giving a brief summary, or by reiterating the key-points presented or by leaving them with a question as food for thought. Do not abruptly finish your presentation with a "Thank you" slide. Provide a smooth transition towards the end.

In order to prepare and present a multimedia presentation effectively, it is important to realize the complex relationship among content to be presented, type of learning experience intended and kind of presentation techniques used in preparing the presentation. A multimedia presentation can be successful only when an appropriate learning experience is created based on characteristics of the audience by using suitable presentation techniques that are matched to both the content and the intended learning experience.

## Science Education and Multimedia Application

The multimedia applications play an undeniable role in science education. Multimedia applications have many advantages that allow science teachers and lecturers to provide other advice which tailored to particular group of learners' needs [18]. Science teachers discover the ways to boost student's interest and motivate them by using educational multimedia applications. Students can also be actively involved in the learning scientific processes by using multimedia applications such as CD-ROM based textbook, tutorials and laboratory experiments [11]. Multimedia applications increase the learning effectiveness and are more attractive than traditional-based learning methods. This new learning environment definitely influences the way teachers teach and the way students learn.

As opined by [19], science teachers continually search for more effective ways to attract their students during learning as well as to increase student learning outcomes. People learn better from words and pictures than from words alone. Therefore, educational multimedia applications use a combination of multimedia elements to present and emphasize science concepts only, thus it is more effective because the students are easier to put attention on it rather than on static printed learning materials. Students often

split their attention when they are forced to focus information that is far apart, or it is presented at two separate points at the same time. Therefore, when the related content is presented in words and picture at the same time, the learning outcome is more effective. Research found that students will participate in science lesson more actively when teachers or lecturers integrates multimedia element in learning process because they will pay more attention as the lesson becomes more interesting [20]. For example, when the animation and narration are presented simultaneously, students are easier to understand and that information can be quickly be integrated into long term memory. A multimedia presentation is an example of multimedia application, it can highlight certain information that teachers want to deliver.

Multimedia applications are used to grab student's attention and generate interest during learning process. It can improve the student's attitude toward content and learning. Multimedia applications enable students increase their memory of content and foster deeper learning when compared to traditional teaching ways that use by teachers [19]. Multimedia applications for educational purposes also can make the learning fun and decrease the anxiety and tension toward certain scary subjects.

There is no doubt about the important role of multimedia applications for educational purposes particularly in science education because it can influence the way teachers teach and the way students learn. Multimedia applications are easy to use by the students or teachers. Students are able to navigate and retrieve the information quickly because they have the ability to interact with the multimedia applications. Students can learn more when they can control pace of the presentation such as slow down, start and stop at certain information as they want.

Multimedia applications are tailored the information need to the individual because it can be presented in different ways to engage students with different learning styles and strengths [19]. Every student may have different preferences and modes to learn about something. As an example, a student prefers to read certain learning materials from prints, while another student may prefer a visual presentation. Evidently, multimedia applications for educational purposes are effective to all particular students and lecturers because it is tailored to their needs.

## Conclusion

Applying multimedia in education: a case of science education is presented. The review examines different procedures to the application of multimedia in science education. This is most necessary in science education that requires demonstration of concepts which are mostly vague to the students when explained without any form of multimedia aid. Assimilation rate for most students is increased when they are taught using multimedia gadgets which helps to develop all their domains of learning thereby increasing effectiveness. It therefore becomes necessary that multimedia application in teaching be encouraged so as to ensure that progress is made in presentations of facts and observation, the basis upon which science is based. Based on these observations, this review recommends the use of multimedia in science education so as to check the benefits associated with multimedia usage in comparison with its demerits. This will allow for adequate information necessary for individuals, governments and the society at large to determine the way forward as regards multimedia integration in education.

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