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# **Virtual Reallıq texnologiyasının təhsildə tətbiqi**

1. Virtual reality (VR) is an advanced, human-computer interface that simulates a realistic environment. The participants can move around in the virtual world. They can see it from different angles, reach into it, grab it and reshape it. Cyberspace is thought of as the ultimate virtual reality environment. It is an alternative computer universe where data exists like cities of light. Information workers use a special virtual reality system to enter cyberspace and to travel its data highways. The paper discusses the latest developments in virtual reality. It considers applications in engineering and medical fields.
2. Virtual Reality or VR allows a user to interact with a computer generated three-dimensional model or virtual environment. This environment may be realistic, in the sense that it is familiar to us at a macroscopic scale, it may be realistic in the sense that it depicts the physical world as known to science but which is not usually observable, or it may be used to visualize a world that is entirely imaginary. As such, VR is broadly applicable, and has been applied to, many different areas of education including the sciences, archeology, history and architecture. The advantage of VR over conventional methods of description is that the student is given the opportunity to experience subject matter that would be difficult, if not impossible, to illustrate or describe with conventional methods. We argue here that this experiential nature of VR together with its other key feature, interactivity, provides a valuable aid to conventional learning paradigms. In this chapter we give a brief description of common VR setups to give a feel for how a VR experience is provided. We also consider, from cognitive and sensory psychology points of view why learning may be facilitated by interactive multi-sensory systems and we provide some examples of the use of VR in educational contexts.
3. Modern education often requires a student to comprehend complex or abstract concepts or appreciate scenarios and situations that no longer exist. To this end, common mechanisms for teaching abstract concepts are the use of metaphor and analogy, especially within the sciences. By using an analogy we describe an event or abstract concept in terms of commonly observable reality. That is, we relate concepts to experience. The experience provides the material for the construction of a mental model of the concept, which in turn leads to the foundation of knowledge (Duffy & Jonassen, 1992). Humans learn by having experiences, by interacting with their environment and using their senses to derive information from the world. Virtual reality is a technology that replaces sensory input derived from the real world with sensory input created by computer simulation. It provides interactivity by responding to movements and the natural behaviors and actions of humans. In this respect VR may prove to be a powerful resource that can help in teaching by providing an environment that allows the student to experience scenarios and situations rather than imagining them. The experiential nature of VR systems derives from three sources: immersion, interactivity and multi-sensory feedback. Immersion means being enveloped or surrounded by the environment. The benefit of immersion is that it ensures a sense of presence or the feeling that one is really in the depicted world (Schuemie et al., 2001). Interactivity is the ability to control events in the simulation by using ones body movements which in turn initiates responses in the simulation as a result of these movements. The multi-sensory nature of VR means that information can be derived from more than one sense and adds to the experience by making it more believable, engaging (adding to the sense of presence) and providing redundancy of information which reduces the potential for ambiguity and confusion. Sensory combination reinforces information from two or more sensory sources. The aim of VR is therefore to replace the real world with a virtual world and to allow the user to behave as if they were in the real world.
4. The experiential nature of VR supports a constructivist approach to learning (see Winn, 1993). Constructivism is a theory of knowledge acquisition that states that humans construct knowledge by learning from their experiences. As popularized by Jean Piaget the theory states that the learner attempts to assimilate new experiences within their already established world model. If the learner cannot successfully assimilate new detail they change their world view to accommodate the new experience. When we act on the expectation that the world operates according to our world model and it does not then we must accommodate the new experience by reframing our model of the way the world works; we learn from the experience. This implies that learning is a form of active hypothesis testing. This should be contrasted with the view that learning is a passive accumulation or acceptance of facts. VR provides an environment for this active hypothesis testing and thus provides a powerful medium for learning. In general, and as suggested by Bruner (1961), students who actively engage with new material are more likely to retain this material and recall it at a later stage.
5. Virtual reality has existed in the realm of education for over half a century. However, its widespread adoption is still yet to occur. This is a result of a myriad of limitations to both the technologies themselves, and the costs and logistics required to deploy them. In order to gain a better understanding of what these issues are, and what it is that educators hope to gain by using these technologies in the first place, we have performed both a systematic review of the use of virtual reality in education, as well as two distinct thematic analyses. The first analysis investigated the applications and reported motivations provided by educators in academic literature for developing virtual reality educational systems, while the second investigated the reported problems associated with doing so. These analyses indicate that the majority of researchers use virtual reality to increase the intrinsic motivation of students, and refer to a narrow range of factors such as constructivist pedagogy, collaboration, and gamification in the design of their experiences. Similarly, a small number of educational areas account for the vast majority of educational virtual reality implementations identified in our analyses. Next, we introduced and compared a multitude of recent virtual reality technologies, discussing their potential to overcome several of the problems identified in our analyses, including cost, user experience and interactivity. However, these technologies are not without their own issues, thus we conclude this paper by providing several novel techniques to potentially address them, as well as potential directions for future researchers wishing to apply these emerging technologies to education.
6. Before diving into the details of how VR in education will help improve the learning process, it’s important to understand why we need to improve the quality of education in the first place. Historically, most technologies designed to aid learning have been aimed at enabling access to information — facts and observations about the world. Before computers, we had a powerful tool that helped us retain facts: books.
7. In the era of digital technologies, books are being turned into eBooks. Modern search engines make fact-finding really easy — with just a few clicks you can discover answers to many questions.
8. While knowledge has become more easily available for more people, the current approach to education has two significant problems:
9. It’s based on the same old format — fact retention. Teaching methods are focused on providing facts; however, having access to and consuming a lot of information isn’t learning. Being informed isn’t the same as being educated.
10. A lot of people have difficulties comprehending information. Too much information received in a short period of time can easily overwhelm students. As a result, they become bored, disengaged, and usually not sure why they are learning about a topic in the first place.
11. Virtual reality can be used to enhance student learning and engagement. VR education can transform the way educational content is delivered; it works on the premise of creating a virtual world — real or imagined — and allows users not only see it but also interact with it. Being immersed in what you’re learning motivates you to fully understand it. It’ll require less cognitive load to process the information.
12. Here are just a few properties that makes virtual reality in education so powerful.
13. When students read about something, they often want to experience it. With VR, they aren’t limited to word descriptions or book illustrations; they can explore the topic and see how things are put together.
14. Thanks to the feeling of presence VR provides, students can learn about a subject by living it. It’s easy to forget that VR experiences aren’t real — a body actually believes it’s in a new place. This feeling engages the mind in a way that is remarkable.
15. Technologies such as science labs are amazing — they allow students to understand how things work based on practical experience.
16. But such technologies are expensive and almost impossible to scale. They are also limited in the number of things they can do.
17. It’s a well-known fact that people learn best by doing; however, if you inspect modern education, you’ll see how little learning actually happens by doing. Students are focused on reading instructions rather than using them in practice.
18. VR in education provides an experience anchor to the instruction. With VR education, learners are inspired to discover for themselves. Students have an opportunity to learn by doing rather than passively reading.
19. Where can we apply virtual reality in education? The answer is almost everywhere. VR creates an infinite set of possibilities that people can experience. Here are few types of experiences you can create with VR.

## Virtual fields trips

1. VR technology can be used to engage students in topics related to geography, history, or literature by offering a deeply immersive senses of place and time. Simply imagine geography lessons where you can visit any place on the globe — this type of experience is much more enriching than just reading about it.
2. Google Expeditions is one good example of an app designed to provide such an experience. Expedition is a library of field trips available for regular smartphone users. Each trip is comprised of VR panoramas, and trips vary from the Great Wall of China to Mars. People all over the world can visit places that are virtually impossible to visit in person.
3. Google piloted this app in hundreds of schools all over the world. The project was extremely successful, with Google taking more than 1 million students in 11 countries on expeditions.

## Exploring Conceptual Subjects

1. Understanding theory-based conceptual subjects can be extremely challenging for students. With most learning coming from textbooks and diagrams, how can students properly grasp an abstract concept if they can’t even truly visualise it?
2. However, with virtual and augmented reality at their disposal, teachers can genuinely bring conceptual subjects to life! By allowing students to experience, examine and explore more abstract subjects, they can visualise and engage with the topic in ways that just aren’t possible with traditional learning.
3. Imagine you’re a student learning about cells, a topic that’s typically difficult for children to grasp. Would you find the concept easier to understand with a) a diagram of an animal cell in a textbook or b) a detailed, interactive 3D model of a cell that you can hold and investigate in the palm of your hands?
4. We're putting our bets of the fact your chose B! Using immersive 3D models, students can hold a cell, examine it from all angles and investigate its structure. There are some great examples of this in schools, with educators using 3D models of cells and 360-degree photos and videos to help students understand complex Chemistry concepts.

## Developing Computing and Technology Skills

1. In today’s world, technology is everywhere. That’s why computing is now an crucial part of a student’s education. From maximising learning efficiency to preparing for future jobs and careers, there are many reasons why students need to learn these skills at school... and virtual reality can help!
2. Virtual reality offers a perfect opportunity for students to develop technology skills in an exciting and engaging environment. Students can practice and hone computing skills by building amazing virtual creations, and then experiencing it all in virtual reality.
3. For instance, with software like CoSpaces, students can set their imaginations free by creating their own 3D virtual worlds. It’s the perfect introduction to coding! Alongside developing computing and coding abilities, CoSpaces boosts creativity in the classroom and is a perfect tool to use alongside VR. Likewise, ThingLink lets students create and augment images, videos and 3D tours – giving them the opportunity to integrate real-life situations into their learning.
4. That’s not all... From integration with Paint 3D to Tinkercad, SketchUp to Sketchfab, there are SO many examples of how virtual reality in education can enhance computing skills.

## Immersive Group Learning

1. It may come as a surprise, but virtual reality is actually a great way to practice group learning and teamwork! In schools around the world, there are so many brilliant examples of group learning with virtual reality in education. For one, working in pairs with virtual reality headsets can be a great way to improve vocabulary and descriptive writing skills. While one student explores in VR and describes what they can see, the other student can write it down, creating opportunities for discussion. Beatrix Potter School in London used this lesson format to venture on an under the sea exploration, with students working in pairs to verbally illustrate marine life before ultimately writing a descriptive paragraph.
2. The group learning possibilities don’t stop there! With tools like Avantis World – the world’s first educational virtual reality theme park – students can collaborate together in the educational metaverse. Whether they’re wearing a VR headset, using a laptop or even learning from home, students can safely explore and communicate in VR scenes together. Anywhere, anytime - you could even have students from different sides of the world walking and talking with dinosaurs together!

## Blending Virtual Reality with Traditional Learning

1. Last but definitely not least, blended learning is our final example of virtual reality in education. VR is an incredible learning tool within smart classrooms that we’re confident is the future of education. However, it’s important to remember that VR shouldn’t ever be used to replace a lesson. It's not an alternative to teaching, it’s a powerful educational tool that teachers can use to enhance their pedagogy. Educators can take their teaching to the next level by integrating immersive, educational experiences into lessons.
2. In Scotland, Mearns Primary School are a great example of how schools can use VR technology alongside traditional learning. After drawing wraparound landscapes in a lesson, their students used 360-degree cameras to capture the creations, annotated them in ThingLink and explored them using VR headsets! By blending traditional teaching with technology, the students could let their imaginations run free while creating their landscapes, then had the opportunity to experience them as if they were real with virtual reality!

# **Artırılmış Reallıq texnologiyasının təhsildə tətbiqi**

1. The AR experience is thriving as a significant trend, and it is estimated that by 2023 there will be 2.4 billion Augmented Reality mobile users worldwide. However, there were only 200 million users in 2015. It is an excellent influx in numbers that can't be ignored. However, my interest in this article is looming around the usage of Augmented Reality in education and eLearning applications. Many of us are only aware of Augmented Reality being used in mobile games like Pokémon Go and social media platforms like Snapchat. However, education is another significant space where this technology can blow up the candles.
2. As I referred to earlier, AR has its own magic. It can change the way we interact with mobile apps and other visual graphic experiences. Actually, Augmented Reality is capable of augmenting computer-generated graphics into the real environment on screen.
3. It means if you move your mobile camera to space, AR enables you to see a computer-generated object on your screen. Altogether, it happens in real time while you view it from your camera. This technique can enable students to learn in a more interactive environment.
4. Another aspect of the AR experience is that it includes 25% digital reality and 75% existing reality. It means it doesn't replace the complete environment with the virtual; rather, it integrates virtual objects into the real world. Now you may be wondering how this can help in eLearning.
5. Well, here are some pointers that explain how AR can transform the learning experience. Moreover, if you want to develop an AR education application, you can seek eLearning software development from expert developers.
6. With AR, classroom education can be extraordinary and more interactive, as AR can enable teachers to show virtual examples of concepts and add gaming elements to provide textbook material support. This will enable students to learn faster and memorize information.
7. Human memory doesn't forget visuals easily. Here are some examples of Augmented Reality in education:
8. An AR app, called "Dinosaur 4D+," with a set of flashcards enables users to view 3D dinosaurs, scanning through the card. With this, students can see the actions of dinosaurs and use app features to rotate, zoom, and more. Besides, the application also provides some information about each dinosaur.
9. The "Element 4D" AR app is another promising example of Augmented Reality in education, which makes learning chemistry fun. The application enables users to find the atomic weight, chemical elements, the reaction between two chemicals, and their names by simply putting two paper cubes for a special element block. Isn't it amazing?
10. Another admired example of AR/VR in education is [Google Expeditions](https://support.google.com/edu/expeditions/answer/6335093?hl=en), which enables users to see 3D objects in the classroom, such as volcanoes, storms, and even DNA. This application provides more than 100 AR expeditions that include the history of technology, the moon landing, and more.
11. From the above examples, it is clear that AR in education can turn out to be a very exciting and useful intervention that will change the education system for at least the upcoming 100 years. And, this isn't just about elementary education, rather it will also transform higher education and training systems. Let's take a look at them.
12. Industries like aerospace, aviation, hospitality, military, and others have to invest a huge amount of money and equipment in military training. With AR, the expenses can be reduced and can make training interactive.
13. Here are the ways we can achieve this:
14. The concept of MR (virtual + existing reality) led by AR can enable astronauts to get real-life training and do tasks, like maintaining a space station. Sidekick is a NASA project that is testing Hololens to provide virtual illustrations and instructions to use in crew training. Altogether, its usage in military training is the main attraction, as it can help train soldiers to use equipment in a virtual environment. This is to refrain soldiers from putting themselves in danger and get trained with ease.
15. By now you should have understood how effective and prominent AR usage in education can be. Rather, I would say it will be a game-changing technology. Do not believe me? Let's see how its adoption is picking up the pace in eLearning applications in 2020-21.
16. Now that students are having to learn from home, keeping students engaged in lectures has become very difficult. Thus, eLearning app owners are enthusiastically adopting AR technology. Altogether, Augmented Reality development is also boosting its prominence in the market.
17. AR-enabled eLearning applications render the augmented object on the screen and play 3D examples of concepts that allow students to learn and engage. Altogether, computer graphics are also being used extensively, which enable an object to be captured and show up in the augmented environment and render searches about the object. It means the application can capture the image of objects from the real environment and provide a detailed description of the object. You can also create your own eLearning application enabled with AR with a unique concept.
18. Leaving everything aside, AR applications in education enable a wide range of benefits. Here are some advantages of using AR in education:
19. AR in education allows students to gain knowledge through rich visuals and immersion into the subject matter. Moreover, speech technology also engages students by providing comprehensive details about the topic in a voice format. In short, the concept of eLearning with AR targets a major information-gathering sense in humans.
20. Augmented Reality can replace textbooks, physical forms, posters, and printed brochures. This mode of mobile learning also reduces the cost of learning materials and makes it easy for everyone to access.
21. It can also help in professional training. Imagine being able to cook food or operate a space shuttle without putting others in danger or spending millions of dollars.
22. The gamification of AR and the education system can make students' attitudes more positive. It makes learning interesting, fun, and effortless and improves collaboration and capabilities. Moreover, it provides vast opportunities to make classes less tiring by infusing unmatched interactivity through a computer-generated environment. eLearning involves students in an enhanced environment where they can see how concepts happen. For creating such applications, companies hire developers deft in AR development.
23. Augmented Reality can bring a breakthrough to the traditional education system by transforming the complete learning experience. Altogether, it will also impact the interest of students and make them efficient. Also, this will help students in comprehending concepts in an immersive environment, which will simplify concepts and make learning easy. Moreover, education institutions will also gain colossal attention by offering an excellent learning experience through technology.
24. Augmented Reality is the best way to engage the students. Technology is the most attractive concept for kids, why not using it for the good? We all know that we remember better what we saw than what we listen. With AR apps you can teach complex concepts to the students easily.
25. Wondering why your students are inattentive in your class? The answer may be that they are bored with your traditional ways of teaching. As per the recent report by Harvard GSE, [the student's engagement is dropping each year](https://www.gse.harvard.edu/news/ed/17/01/bored-out-their-minds) because institutes focus on standardized modes of teaching.
26. Ever noticed how easily kids get distracted by smartphones and tablets? Imagine what if we can leverage these devices for the good?
27. We all know that we remember better what we see instead of what we listen or mug up. Augmented Reality is proving this fact. With AR apps a 3D view is helping the students to understand better. Still, there are educators who believe that technology is ruining our generation. We can’t stop kids from using smartphones but we can make sure they are not wasting their lives because of technology.
28. 5 Reasons Why AR Apps Are 'A Must' For This Generation's Students
29. **A Better Explanation Of Complex And Abstract Concepts**
30. There is no doubt that your students will understand the concept better when they will visualize it in reality. Especially for the difficult topics, students will get to learn quickly with 3-dimensional model representations.
31. **Elevated Student Engagement**
32. AR learning provides a gamified approach towards learning; which makes the lessons fun. As a result, it serves a positive impact on the students and keeps them engaged.
33. **No Extra Tools Required**
34. Today, [95% of teens own a smartphone](https://www.geekwire.com/2018/new-research-finds-95-teens-access-smartphone-45-online-almost-constantly/). This can be used for constructive results as well. Parents and teachers don’t have to spend extra on buying tools for interactive learning and teaching.
35. **Practical Knowledge**
36. Students can perform practical without any physical need for lab equipment. This is mainly helpful for professional courses like medical and engineering. Students don’t have to operate a patient practically and still can learn the process.
37. **Accessible Learning**
38. With AR apps the users can learn anytime and anywhere from their smartphones. It is the best way to replace paper books, posters, huge physical models etc.
39. Educators around the globe have already adopted Augmented Reality in their teaching process. App store and Play store are flooding with AR apps for education. Students are responding to these apps in an optimistic manner. Here are the [best Augmented Reality education apps](https://www.excellentwebworld.com/augmented-reality-learning-apps/); categorized for kids, students and self-learning.

## AR Apps For Kids

### AR Flash Cards

1. Students just have to scan the flashcards from their smartphones and the alphabets, and its explanations come to life.

### Bugs 3D

1. Kids can learn more about insects and bugs; the app will illustrate descriptions and images to play for the kids.

### Mathalive

1. The app helps the kids in grasping counting and number identification skills.

## AR Apps For Teens

### Anatomy 4D

1. Students can see 3D models of the human body when scanned through the camera of the smart device.

### AugThat

1. The app explains the core topics from subjects like Geography, Maths, and Science in 3 dimensions. The app also has a dedicated course for students with special needs.

### Arloon Plants

1. The best app to learn practically about various species of flora around the world. The app allows the students to learn about the structure and parts of a plant as well as they can witness the growth and movements.

## AR Apps For Self Learning

### Google Translate

1. The most practical way to learn a foreign language. Google Translate allows users to scan any written text via their smart device, and it will translate it in real time.

### Starwalk

1. Anyone can learn about the stars and the constellations in the sky. By pointing the camera towards the sky the app will show all the details.

### Aurasma

1. This app allows students to build their own AR experiences. Students just have to create their own triggers on the web version with Aurasma Studio.

## The Scope Of Developing Education Apps

1. There is no doubt that education apps should be free for the users/students but that can’t stop you from earning. You can still opt for monetization methods like premium versions, advertisements etc. Education industry still has scope for more interactive Augmented Reality apps. If you are an educator, then you can think of something which your students need or they are bored to study the most. Then, you can build an app for that problem.
2. The education sector needs technology adaptation in order to keep the engagement levels high. Augmented Reality is the best way to do this. Αll you have to do is implement BYOD in your classroom and print AR worksheets or lessons. You will see the difference in the interest of the students towards learning. If you are already using AR in your teaching methods, then I would love to know about your experience. Comment below the results you have achieved after implementing Augmented Ρeality apps or any latest technology in your teaching.
3. Today, animation has replaced the traditional PowerPoint presentation. A lot of eLearning platforms offer classes where a teacher teaches with the help of live animation and not a static PPT. The concept of interactive learning rather than one-way learning is prevailing.

## Exploring The Roles Of Augmented And Virtual Reality In Education

1. Schools and colleges are changing their traditional methodologies of teaching. Virtual and [Augmented Reality in student Learning and Development](https://www.credencys.com/blog/how-augmented-reality-enriches-the-roots-of-education-process/) will completely revolutionize the way teachers teach and students learn. We have seen a lot of change in the education industry over the years. However, the trend hasn’t changed for a long time. Still, the staple tool used in the education industry is PowerPoint.
2. With the help of AR and VR, students will learn interactively like never before. These new technologies are not limited to any specific age group of students. Today, it might not be present in every school or college, but in the upcoming years it will be there. According to New Jersey Institute of Technology reports, the Augmented Reality app development market is going to reach $660 million by the end of 2018.

# **Augmented Reality**

1. One of the most significant questions of the millennial is which technology is better: AR or VR? Which has better capability to shape our future? The answer to such a question is that both of them have their advantages. Augmented Reality uses the environment around it and overlays the animation or any form of information on it. Technically, it adds more to the reality. One of the biggest benefits of Augmented Reality application development is that it doesn't need any dedicated device for display. Due to these benefits, [the technology becomes mainstream of the fourth industrial revolution](https://www.credencys.com/blog/augmented-reality-becomes-integral-technology-of-fourth-industrial-revolution/).

## The Role Of Augmented Reality In Education

1. ‘A picture is worth a thousand words.’ Augmented Reality helps you in achieving this. Rather than reading a chapter, it will be more effective to visualize the subject. It helps students get a better understanding and insights about the topic. Also, offering interactive experiences, the Augmented Reality keeps students excited and interested in new learning.
2. One of the most significant benefits of Augmented Reality in Learning and Development is that it does not require any investment regarding hardware. We can experience Augmented Reality using our smartphones or tablets. For example, Augmented Reality application development allows to place the smartphone camera in front of a textbook and see a 2D image turning into a 3D animation.

## Virtual Reality

1. On the other hand, Virtual Reality exists in an entirely artificial environment. So, to develop a VR app, we first need to establish an environment and then build animation around it. Opposite to its name, Virtual Reality seems much more real compared to Augmented Reality, but a downside of it is that it needs a dedicated VR headset to run any application.

## How Does Virtual Reality Change The Education Industry?

1. Virtual Reality can entirely change the world of education. VR is going to be used in education starting from the first grade to college. Using VR headsets, students can see the immersive content of any subject.
2. Moreover, a 360-degree view of any content gives a more realistic feel to the students as they find themselves, as a part of the virtual environment. Also, interaction with VR content helps them explore the subject with profound detail. When students are too involved in the virtual world, they cannot be distracted by the real world. It also improves their concentration power.
3. VR provides students with a complete sensory experience through which they can virtually touch, see, and hear the content at the same time with help sensors.

## Verdict

1. As I was writing in a [previous article](https://elearningindustry.com/augmented-reality-and-virtual-reality-transform-industry-education-5-ways), the time has come that we say goodbye to the traditional way of teaching and learning. Augmented Reality app development is one of the latest trends that is followed by the education industry. Augmented Reality in student learning and development can be beneficial for sure, though the cost can be higher sometimes. Augmented Reality is mainly developed to guide students at various stages, whereas Virtual Reality is used to provide a completely different experience to the students as well as teachers.
2. Teachers get to catch the attention of students and motivate them better, while [students get new tools](https://thinkmobiles.com/blog/augmented-reality-education/) to visualize their subjects and complex concepts, as well as obtain practical skills. We believe that Augmented Reality can bring that change faster in the education sector than anyone could imagine.
3. This article describes how virtual reality and augmented reality are already being used to implement primary and secondary education.
4. Let's Explore How AR Is Changing eLearning
5. Amidst the rise of the global pandemic [1], the educational sector has been massively impacted. Not only have educational institutions been temporarily closed and shut down for a long period, there was much uncertainty looming surrounding the course of action to be taken. As a result of the pandemic, education has changed dramatically, with a distinctive and natural rise in eLearning. Undoubtedly, the internet and eLearning resources saved the day during the pandemic along with the [eLearning smart thinking apps](https://elearningindustry.com/subjects/free-elearning-resources/elearning-apps) that came to the rescue.
6. Research has suggested that the adoption and implementation of eLearning during the pandemic has proved successful and has shown a positive increase in information retention. If the changes in eLearning are confidently identifying the positivity of information retention, the changes COVID-19 has forcefully made may just be here to stay.
7. Prior to the pandemic, there were already high levels of growth and adoption of technology and eLearning resources in the education sector. For this reason, the future of post-COVID eLearning will certainly not only include resources that are already in play but will also include the adoption of more sophisticated pieces of technology to help advance the sector further and provide a better, more enriched level of learning. So what does this mean for the future of learning?

## The Future Of eLearning

1. The future of eLearning has received ambivalent perspectives across the world. Some believe that the rapid push and unplanned move into the space with little preparation, insufficient levels of supportive [technology,](https://elearningindustry.com/2021-elearning-trends-what-to-expect) such as internet bandwidth, and no real training will result in poor education levels, poor user experiences, and lower levels of personal and institutional sustained growth.
2. However, the notion of eLearning has been well received by others who believe the new hybrid model of education between technology and personal development will, over the years, emerge with significant benefits. The integration of information technology will help to further accelerate education and take it to places that it has never been before. Doing so will make it accessible to all and make it an integral component of the education sector as a whole.
3. Currently, there is a range of technologies available that can alter and help revolutionize education. Many have seen the positive effects of technologies such as Virtual Reality (VR) and Artificial Intelligence (AI) [2].
4. However, one of the biggest technological advances that has great prospects in radically changing the sector is [Augmented Reality (AR)](https://elearningindustry.com/ar-in-elearning-immerse-augmented-reality-environment). In an effort to improve and protect the education system, making it resilient to future changes, like another pandemic, AR technology shows promising signs.

## How AR Is Set To Revolutionize eLearning

1. Before we can understand how effective AR can be in the education sector, it is important to understand what AR is and how it works. AR technology is already being implemented in a range of everyday items such as smartphones and is a technology that creates interactive virtual experiences in a real-world environment.
2. Objects that reside in the real world are enhanced by computer-generated superimposed digital content and information. Over the years AR has become increasingly popular with big tech organizations.
3. AR can help to revolutionize online learning in three significant ways. This first by helping to create an inclusive and immersive atmosphere that will help the learner feel immersed and which will also help them retain information. The second its ability to help a range of information and knowledge to be shared in a creative way that is dynamic and engaging. Thirdly, it helps to create a sense of physical engagement in a period of self-isolation. Here's a look at some of the implementations of AR in eLearning.

### Practical Training For Medicine

1. Imitation in medical training has always been a prime focus, and AR can help provide medical students an incredible way of training by helping to develop various medical skills including surgical skills through training [3] and observation. AR glasses could be a great way to help eLearning in this way.
2. Big tech giants like Apple are working on smart AR glasses that will help to provide an overlay of virtual information in a real-world setting. Tech, such as AR smart glasses, is promising, as statistics have shown that by 2025 the eyewear market, including smart glasses, will be worth an astonishing [210.8 billion US dollars](https://blog.eyeglasses.com/vision-magazine/glasses-statistics/). The level of training smart glasses can bring means the future of eLearning may go beyond tablets and smartphones.

### Working In Engineering

1. AR training [4] simulators can help students identify complex structures and parts, offering a deeper more contextual understanding of how mechanics work. AR simulations can be used for learning prototypes, reducing costs across the industry in building physical prototypes, and offering untapped training opportunities to create a safer working and learning environment.
2. AR will, across a wide range of industries, aid them in working more safely through procedures and give learners the chance to perform actions similar to those they would do after studying or learning.

### Teaching With AR

1. AR eLearning will help teachers and tutors explain abstract concepts and random entities with the help of 3D objects in real work with AR overlays of information. With the help of AR, teachers can attach AR learning experiences to real-world objects that come to life when viewed through smartphones. Students will then be able to learn about the object by hovering over it.
2. The natural curiosity of children means that this is a great way to incorporate eLearning into today's work without having to be in a classroom setting. Children can carry out these tasks at home using an AR app, which will give them an enriched education with needing to be in school.
3. The future of eLearning is undoubtedly in the hands of AR. The opportunities and possibilities it can offer the education sector make it not only versatile but sought after. Many industries have and will be altered by AR and of course, future technologies to come. Industries have found a way of adapting and progressing far beyond their own realms with homage to technologies such as AR.
4. For this reason, AR in education will not only revolutionize the industry, but will captivate it taking it far beyond the classroom and schools, colleges, and universities.
5. Augmented Reality in education can transform the way teachers deliver lectures. The technology will not only help teachers in making lessons more interactive but it will also benefit students by making it easier for them to understand tough subject matters and topics.

## 5 Ways Teachers Can Use AR In Education

1. Augmented Reality (AR) in education can empower teachers by providing highly stimulating digital content and features that can engage learners in no time. The technology gives you an enhanced experience by adding digital elements to real-view ecosystems. All you have to do is scan a figure in a textbook and you will be proffered with a 3D interactive model. That is how enticing Augmented Reality technology is!
2. Augmented Reality in education can help teachers by making lectures more interesting, interactive, and fruitful than ever. What cannot be achieved with the traditional pedagogies can be done with the help of Augmented Reality technology. Below are 5 ways teachers can use Augmented Reality in classrooms.

### Making Classes More Interactive

1. The whole point of using technology in classrooms is to make learning more interactive and engaging. This is what Augmented Reality technology does. It helps teachers get the attention of students in no time and it increases engagement levels as well. It brings to life abstract topics, such as set theory and logical reasoning, and makes learning more effective than ever. Let students scan images from their textbooks and learn with 3D models. You can make classes even more interactive with the help of 3D simulations that let you perform physical experiments in a virtual world. This way students can learn through experiential learning by trying several iterations to find out the best and the most suitable combinations.

### Being A Guide

1. Unlike other technologies, Augmented Reality lets teachers and trainers act as a guide in the classroom. It is not just a video solution that minimizes the involvement of teachers in the classroom, rather it lets you guide the whole session. Take charge of the classroom by mentoring the session, and don't just give orders and instructions. Make students familiar with the technology. You can also begin by making them aware of the benefits of Augmented Reality in education and how they can use the same for better outcomes. Be someone who they can count on for support and not someone they fear conversing with.

### Teaming Up With Students

1. When teachers become mentors, classes become fun and interactive. Modern students are more engaged in learning when technology is used in some form or the other. Augmented Reality in education has been proven to improve teacher-student collaboration in classrooms. This is because it makes use of game-based digital elements that have the power to intrigue students.
2. Explore the marvels of the world together with your class and help them use the technology. Teachers can begin with simpler topics and gradually focus on more complex ones. You can also ask which topics your students find the most challenging and plan lectures accordingly. Also, doubt clearing sessions will no longer be ordinary when Augmented Reality technology is put to use.

### Making The Most Of Technology

1. The education sector has always been the last domain to adopt newer technologies. Now is the time for teachers to make the most of Augmented Reality in education and deliver lessons in a better way. Being rigid and not becoming familiar with novel evolutions and advancements is not the solution. Rather, teachers and educators should learn how to operate and use gizmos and gadgets to suffice the likes of modern students.
2. Use the power of the new-fangled technology to leave students awestruck. It takes a few seconds to scan 2D images in a textbook and convert them into 3D interactive models. Use this feature to grab the attention of learners. Keep them engaged with the help of simulations and let them practice until they become fully versed. The idea is to make the most of technology.

### Using Technology For Evaluation

1. Evaluation can be fun. Why do examinations have to be dreadful? Why can’t tests be designed so that students find it fun to participate? Well, Augmented Reality in education can do that as well! Most learning management software and apps that come equipped with Augmented Reality technology have the feature of fun quizzes and tests. Instead of taking a test in a notebook or on paper, students can make use of these applications to lock in their answers.
2. Another interesting way to make the process of assessment exciting is by using puzzles and quizzes. While this might not work for every topic, it can do wonders for subjects like history, biology, or for learning mathematic formulas. The idea is to make learning a fun affair and not something students perceive as a burden.

# ClassVR - Virtual Reality designed just for Education

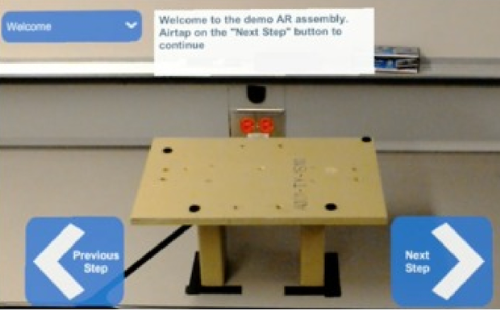
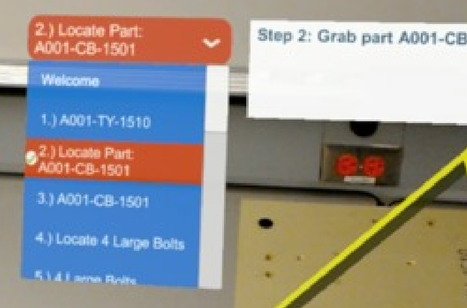
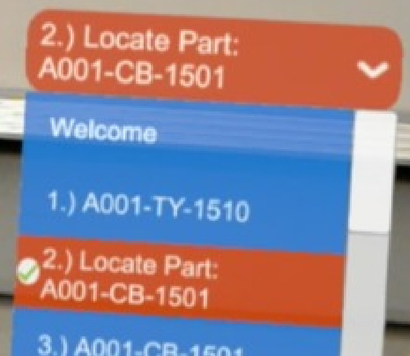
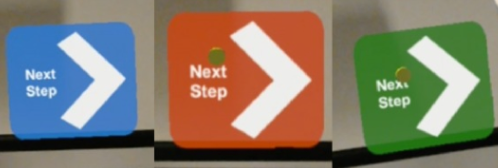
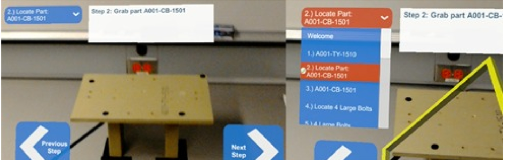
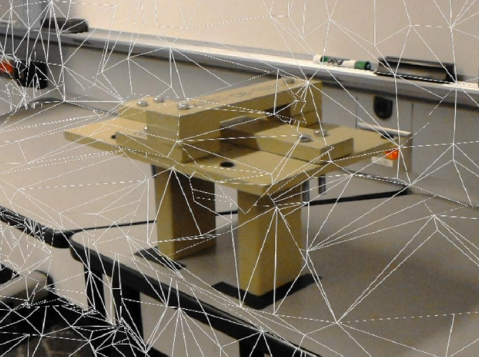
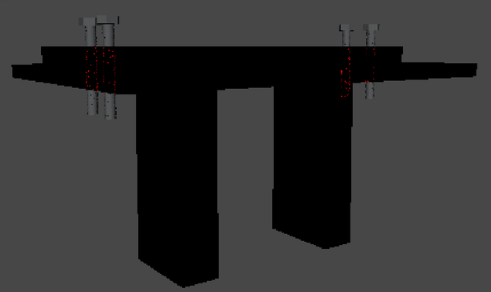
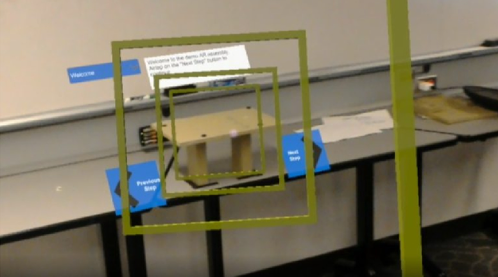


1. ClassVR brings affordable, innovative Virtual Reality lessons and experiences to students of all ages. It comes complete with hardware, software, curriculum-linked activities and lesson plans, equipping teachers with everything they need to introduce this cutting edge technology straight into the classroom.
2. ClassVR comes complete with a [toughened VR storage case](http://www.classvr.com/school-virtual-reality/classroom-case-vr-headset-8/) to keep your headsets charged and safe when they are not in use. The portable case allows you to easily and safely move devices between classrooms, sharing the engaging experience with all students.
3. Classroom Sets include eight [all-in-one virtual reality headsets](http://www.classvr.com/school-virtual-reality/student-vr-standalone-headset/), a storage and charging case, curriculum aligned VR lesson plans and access to the [ClassVR Portal](http://www.classvr.com/school-curriculum-content-subjects/) for VR content and classroom controls.
4. Pedagogically sound virtual reality content together with curriculum aligned lesson plans
5. The engaging [content available with ClassVR](http://www.classvr.com/school-curriculum-content-subjects/) is aligned directly to the curriculum. This works in combination with the structured lesson plans, designed to encourage the imagination of students from all ages.
6. Each lessons will leave pupils with memories and experiences which help to visualise and understand even the most complex of school subjects.
7. The ClassVR Portal is a simple way to discover and deliver engaging Virtual Reality content and lessons within the classroom.
8. It also provides full control and management of multiple headsets in the classroom all from a simple web page.

# Google Cardboard

1. Google Cardboard is a simple and economical way for users to dive in and explore the immersive experience of virtual reality using their smartphone. Virtual reality is gaining mainstream interest, and the accessibility and affordability of Cardboard will play a significant role in VR continuing to reach new audiences and new markets.
2. Google Cardboard is an inexpensive handheld device that powers a virtual reality (VR) experience using almost any smartphone running Cardboard-enabled apps.
3. You need only 3 things to use Google Cardboard:
4. Cardboard viewer: The “hardware” that is used to view VR content with a smartphone
5. Smartphone: Typically supplied by the consumer
6. Android app: Created by third-party developers
7. The Cardboard viewer itself features:
8. Holder/enclosure for smartphones with screens up to 6 inches that assembles (and disassembles) in just 3 steps
9. A button for performing actions with Cardboard-enabled apps, designed to work with most smartphone
10. High-quality lenses made of durable material

# Microsoft HoloLens

1. AR’s forecasted market revenue of $80+ billion by 2021 has not gone unnoticed by entrepreneurs and investors. Many companies such as Microsoft, Google, Apple, and DAQRI are taking an interest in this technology. Consequently, AR’s user and consumer community could potentially increase well into the millions.1-3 This potentially revolutionizing technology is characterized as any display that overlays spatially registered 3D content, including computer-generated models, onto a user’s view of the environment in real time.4 This technology has experienced acceptance, and popularity in domains from consumer gaming to industrial applications. Specifically, technological development for AR in manufacturing and assembly is fueled by its proven benefits such as improved first time quality and reduced training times.5-8 AR assembly studies have shown that one advantage of superimposing digitally rendered objects in the real world is that they help guide the positioning of different assembly parts to their respective location. AR, also, eliminates the need to read long and detailed instructions by replacing that information with 3D models, signifiers, animations, and visual feedback. This allows a user to focus on the assembly task at hand.7,9-12
2. Although AR has shown great potential in assembly-based applications, previous delivery methods have restricted the technology from reaching its full potential. Many systems referenced in literature were built for research purposes rather than for commercial use, meaning that these devices are not commercially available for purchase and are not stable enough to distribute to consumers.13-15 Also, until recently, AR has been developed for use on tablets, mobile phones, and bulky HMDs due to technological constraints. As a result, many AR content delivery devices do not allow for hands free operation, constraining the user’s movements and ability to interact with the physical world. This impedes the user’s process by diverting their hands and focus away from the assembly, forcing them to alternate between the assembly tasks and the instructions. However, with recent advances in computing power and display technologies, new devices that offer hands free see-through Head Mounted Displays (HMDs), like the Microsoft HoloLens and the DAQRI Smart Helmet, are becoming commercially available.16,17 By implementing an assembly-based application on a hands-free device, the user would then be able to reduce their unnecessary movements, no longer having to switch their attention between the instruction delivery device and the assembly task.18,19
3. While the benefits of HMDs are clear, moving away from handheld devices to hands free HMDs introduces another problem: 3D user interfaces. Unlike in past AR delivery devices, HMDs do not rely on the use of touch screens or a mouse and keyboard to navigate the application. This suggests that HMD devices for AR will likely focus on implementing gesture interactions. Unfortunately, there is a shortage of User Interface (UI) guidelines for AR HMDs. Most of these guidelines are found through experimental reports as developers or content creators have tested their product during the development process. This suggests that many guidelines are not necessarily reinforced by scholarly articles. Even with the limited research-based UI guidelines for AR applications, it’s uncertain how they translate to new commercially available HMD devices. Fortunately, using research from the field of Virtual Reality (VR) can help guide the creation of a user-friendly AR assembly instruction interfaces.
4. Virtual Reality (VR) is a similar type of technology that uses computer generated content to create a virtual world that users can interact with. In contrast to AR, VR environments are isolated from the real world as all content is computer generated and the user’s view is completely occluded form the physical world. VR technology is often implemented and used in fully occluded HMD devices, such as the Oculus Rift. As a result of VR’s consistent implementation in HMD devices, 3D UI and interaction guidelines have been developed and explored over the years. This is in contrast with AR, where the implementation of its content on HMD devices is less developed. Due to the similarities in content and now delivery devices, drawing on VR’s previous knowledge can help develop more user friendly AR interfaces. This can ultimately lead to an enhanced user experience, increasing the likelihood of AR adoption. Specifically, VR principles like affordances, visibility, feedback, usability, 3D user interfaces, and interactions can help guide AR interface creation.20,21 In addition to VR guidelines and design principles, it’s possible to glean information from current AR UI guidelines for tablet and mobile devices.8,22 Additionally, Microsoft has also provided some guidelines for the HoloLens, gathered through their own internal testing and user studies.23-26 However, Microsoft’s guidelines only provide case studies and general guidelines for developers. By fusing available research on user interfaces for HMDs with a prototype HoloLens AR assembly application, valuable insight can be gained on the feasibility of creating a user-friendly hands free interface.
5. Even with the proven benefits of AR, many opportunities still exist to increase its effectives. One such area of opportunity is to explore the development of an AR application on a commercial HMD and to investigate creating a user-friendly interface for such an application. This paper focuses on the design and development of a manufacturing-based assembly application. The chosen AR device was the Microsoft HoloLens because of the system’s commercial availability and numerous unique features such as a high-resolution display, ability to spatially map objects, gesture interface, gaze, and voice recognition control mechanism. The HoloLens is the only commercially available AR HMD capable of spatially mapping its environment that is currently on the market. That commercial availability allows researchers and developers to experiment and discover the capabilities the system provides. Unfortunately, because of the recent and rapid development of HMDs, only a minimal amount of academic research has pointed out how to build an assembly application for AR HMDs. For that reason, there is a limited amount of information about possible issues that might come up during the development process. To investigate those issues, this application is intended to be a proof of concept design, focused on implementing a user-friendly interface, supported through established guidelines and research. The developed application includes AR instructions for a tabletop assembly built using the Unity3D game engine and deployed onto the HoloLens.27 The proof of concept application intends to demonstrate the use of a simple and intuitive user interface, use and integration of 3D models, and spatially registered object positioning.
6. 2.BACKGROUND
7. Academic research on users performing assembly tasks illustrated the first-time quality improvements and time savings benefits that Augmented Reality (AR) work instructions provided over their traditional 2D manual counterparts. A vast majority of that research highlighted the advantages of AR for training individuals on a tablet or digital 2D interface, but lacked an evaluation of AR instructions on a wireless, commodity, HMD. The lack of research covering AR instructions on HMDs is largely due to ergonomic and technical constraints that have traditionally made research on that specific topic infeasible. Those roadblocks include bulky or tethered HMDs, low-resolution displays, short battery life, and inadequate computing power on mobile platforms. However, recently there have been many advances in high fidelity displays and computing capabilities on mobile platforms. These advances have led to a commodity see-through HMD which may have the ability to deliver AR instructions on a hands-free device. Unfortunately, due to the aforementioned roadblocks, past AR work doesn’t provide adequate guidance on the design of 3D User Interfaces and the corresponding 3D user interactions. Understanding how to develop a UI for AR instructions on a HMD is extremely important because the interface, and the corresponding 3D user interactions, drastically differs from the traditional 2D Windows Icons Menus Pointer (WIMP) system. Fortunately, research in VR emphasizes the key components of an effective 3D UI while also alluding to the challenges associated with 3D user interactions. Implementing a 3D interface on a commodity HMD in order to ultimately display AR instructions would provide many added benefits to the user. With the aforementioned technological advances, the development community may now be able to break through the barriers that have restricted such research in the past. The following section will discuss previous work on AR in manufacturing, challenges with previous technologies, and the design requirements for a gesture based 3D UI that would be necessary to support AR assembly instructions on an HMD.
8. 2.1Augmented reality for manufacturing and assembly
9. Augmented Reality affords a user many benefits when compared to traditional 2D work instructions. In a manufacturing or training environment this technology allows the user to dynamically see exactly where a part, fastener, or tool must go.4 An analysis of the system’s effectiveness and proposed benefits must be tested in a controlled academic study before that system can be implemented in industry. To analyze the benefits of tablet based AR, Richardson et al. conducted a between-subjects experiment. Quantitative and qualitative data were gathered, measuring the effectiveness of three modes of instruction delivery for an AR assembly training application. The modes included traditional model based instructions (MBI) on a stationary desktop, the same MBI on a moveable tablet, and finally AR work instructions on a tablet. The AR instructions guided the user to assemble the product with eight times greater first time quality when compared to the traditional desktop MBI. In addition, the users completed the assembly in 33% less time while using the AR work instructions.8 Richardson also collected user location data by tracking the head position of the user during the study. The results of that data showed that participants using desktop and tablet MBI spent more time traveling about the work cell than the participants using tablet AR instructions. The reduction in travel for those using AR instructions granted them more time to spend focusing on the assembly itself.8 Baird and Barfield studied 4 modes of manual assembly instructions and determined that the two AR methods were superior to the two traditional delivery methods in terms of completion time.19 Additionally, Chryssolouris evaluated the use of AR assembly instructions in manufacturing and found that they contributed to reduced product development times and cost savings while simultaneously improving first time quality and market response times.28 In addition to the sources mentioned above, numerous other studies point to the effectiveness of AR work instruction delivery.19,29,30,12
10. While the benefits of AR are proven, certain ergonomic and usability restrictions impede them from reaching wide adoption. Baird and Barfield’s evaluation of AR instructions in manufacturing, which showed substantial time savings, also noted that the AR methods faced usability issues due to ergonomic factors. These ergonomic considerations include, but are not limited to, heavy headsets, laptop powered displays, and wired devices which cause tripping hazards. Furthermore, work by Starner and Mann, and Wagner, revealed that traditional AR work instructions have been limited to using a tablet or a bulky, tethered, HMD as the display device due to technical and ergonomic constraints.31,32 Additional work by Dunleavy et al. showed that the HMDs used for AR work instructions have had relatively low graphical fidelity, hindering the effectiveness of such devices.33 While tablets mounted on an arm or movable stand are effective at displaying the AR work instructions, they often lack the mobility required for an assembly task at a workstation. Mounted tablets used for AR work instructions restrict the number of accessible vantage points due to tablet holder constraints. Through a user study Aromaa et al. found that when a participant performed an assembly task while using AR work instructions on a tablet without a holder they had to put the tablet down, momentarily disconnecting them form the spatially registered instructions.34 Although AR work instructions are highly beneficial, the aforementioned restrictions imposed by the previously utilized delivery devices have prevented wide adoption of AR technology in manufacturing.
11. Many of the limitations associated with tablet AR work instructions can be addressed by delivering the AR instructions on a wireless optical see through HMD. Caudell and Mizell demonstrated how this type of device’s hands free capability allows the user to perform assembly operations while simultaneously changing their vantage point and the position of the dynamic AR instructions.35 Research from the late 1990s showed the potential for AR instruction delivery through an HMD but at the time many crucial elements had yet to be addressed. Azuma found that in order for such a device to be feasible in assembly operations it must be lightweight, computationally powerful, able to display high fidelity graphics, and finally be able to interpret specific user input and the environment.36 Unfortunately, due to insufficient technology, at least one of those criteria was compromised in one way or another during previous studies.4 However, Reed and Dongarra found that, over the past two decades, computing power has grown substantially.37 In addition, high-resolution displays now provide levels of graphical fidelity that were unfathomable in the late 1990s. Those advances address two of the important criteria that Azuma noted would be necessary for the widespread adoption of AR technology.36 Finally, the development community and researchers alike are beginning to see commodity HMD devices that may capable of providing the functionality necessary to successfully display AR assembly instructions. Using previous research as a guide, the authors developed an AR assembly instructions application to explore a commodity HMD’s ability to deliver AR work instructions.
12. 2.2Designing User Interfaces in Virtual Environments
13. Traditional work on AR instructions delivered via HMDs is limited due to previous technological shortcomings, however, the vast research covering 3D UIs and user interactions in Virtual Environments (VEs) can afford insight into potential solutions. While technology has hindered HMD development in the past, a 2015 article by Reed and Dongarra attests to the recent advances in computing power and high-resolution displays. [11] 36 With this progress, it is conceivable that HMDs will be both ergonomically friendly and technically capable in the next 5 years. Consequently, the development community must address the challenges associated with designing user friendly UIs and physical button free 3D user interactions in order for a complete system to be feasible. The main issue regarding 3D UIs is the necessary transition from a 2D WIMP system to 3D menus and interactions without a customary mouse. All user interactions must be intuitive and for optimal functionality they should be accessible by hand gestures, not a wand, controller, or another physical device. Harnessing the plethora of research covering UI design in VEs provided guidelines for the development of a research based 3D UI for this application.
14. While the processing power, resolution, battery life, and ergonomics of a device are extremely important, an appropriately designed user interface and realistic looking models are also necessary for a robust and user-friendly AR system. Sherman and Craig discovered the necessity of carefully designing the elements in a 3D UI in order to achieve the highest levels of presence and immersion in a VE.38 AR and Virtual Reality (VR) simulations are designed to trick the user into believing that the models and animations are almost identical to what they would experience in real life.[12] Without adequate presence and immersion, the VE a user will be able to distinguish the stark contrast between the simulation and reality, ultimately diminishing the user experience. Pausch et al. conducted research to quantify those required levels of immersion based on the type of visual and auditory feedback users received while interacting with their environment.39 In addition to providing natural feedback, Crison et al. found that utilizing high fidelity models, which accurately represent their real life counterparts, was crucial for an immersive VE.40 To further elevate the level of immersion for a user, Argelaguet found that in VR training simulations the specific menu types, input options, and user interactions must be carefully chosen to fit the use case at hand.41 Leveraging this, and a plethora of other knowledge gained from VR research, provides insight into what can be done to address the challenges associated with displaying AR instructions on an HMD. McMahan backed up Argelaguet’s statement that selection techniques must be tailored to specific applications in addition to mentioning that the Field of View (FoV) must be adequate for the designated use case.41,42 Bowman et al. conducted various user studies in order to determine what content a proper 3D UI should contain as well as how the user should interact with it in various scenarios.20 His work lays out guidelines for the design and development of 3D UIs in addition to covering 3D interaction techniques such as selection and object manipulation. Finally, he covers the evaluation of 3D interfaces based on their defining characteristics and specific metrics.20 [13]
15. In light of the rapid advances in computing capabilities and high-resolution displays that were noted by Reed and Dongarra, it is proposed that the development community has reached a time at which it is beneficial to evaluate AR instructions on an HMD.37 An innovative design and the aforementioned technological advances have yielded an ergonomic and highly capable optical see-through HMD in the form of the Microsoft HoloLens. It will be necessary to utilize the 3D design guidelines dictated by Bowman et al. and the plethora of other authors who laid the groundwork for 3D user interfaces on such a device. Melding that knowledge into an AR assembly instructions application deployed on the HoloLens will allow for feasibility testing of such as system. This paper aims to evaluate the effectiveness of a cutting edge wireless HMD’s ability to display AR instructions. The HMD application will ultimately be compared to the research-based benefits of tablet based AR instructions.
16. 3.METHODOLOGY
17. The methodology section discusses the hardware selection, UI development, and application development processes. The hardware section describes why the Microsoft HoloLens was chosen over its competitors and the key features that allow it to be a suitable device for an assembly application. The UI development section describes the design of the UI and the choices made based on prior academic research. Finally, the application development section describes the tools used to develop this application and the challenges that had to be overcome.
18. 3.1Hardware
19. While AR HMD’s have been used in the past, they are often expensive and custom made for research. The Microsoft HoloLens is the first commercially available AR HMD to reach the market. The HoloLens was first released as a development edition in 2016 and is now available as a consumer version. Since this device is so new, and the HoloLens is first to market in this area, there are little to no competitors for consumer grade wireless AR HMDs. The Google Glass was marketed as an AR device, however it is merely a transparent display lacking many necessary features, such as spatial mapping and a usable display, to interact with the real world and provide true AR capabilities. Another AR HMD, the Daqri Smart Helmet, is designed for industrial use but is currently still in development. Since the Smart Helmet is being designed for manufacturing use cases, it may be beneficial to explore AR assembly applications on this device in the future. Since the Google Glass is not capable of running AR assembly applications and the Daqri Smart Helmet is not yet released, the Microsoft HoloLens is the ideal choice for investigating an AR assembly application on a commercially available device.
20. The decision to use the HoloLens to investigate an AR assembly application on a HMD is strengthened by its’ state of the art capabilities. Unlike AR HMDs in the past, the Microsoft HoloLens is a completely self-contained HMD, i.e, it does not require the HMD to be tethered to a separate computing device. The HoloLens features four Intel Atom x5-Z8100 1.04 GHz Intel Airmont Logical Processors, a HPU/GPU Holographic Processing Unit, 64 GB Flash, 2 GB RAM and 2-3 hours of active battery life that allows standalone operation of this device. All of this processing power is used to run 2 HD 16:9 light engines that project light through holographic lenses leading to a total resolution of 2.3 million light points. High resolution spatially located 3D content is generated by this system. The HoloLens also includes an Inertial Measurement Unit (IMU), 4 environment-processing cameras, a RGB camera, and 1 depth camera to map its surroundings and allow interaction between the real and virtual world while tracking the device’s position. Other features include 4 microphones, gaze tracking, gesture input, spatial sound and voice support. The HoloLens is shown in Figure 1 below.
21. 
22. 3.2UI Development and Development Principles
23. When considering the implementation of the HoloLens in a factory environment, specifically when developing the UI, the following aspects need to be kept in mind: the expected user, the use case, intended interactions, and the user’s surroundings. By catering the application’s interface design to the intended user and implementing design standards, potential user harm or desired task complications can be avoided. Hence, with the help of aforementioned guidelines from similar technologies, developers can start building an assembly application with a user friendly UI. This section provides an overview of different established guidelines in AR user interfaces and VR best practices. The established guidelines helped develop a better understanding of what the proof of concept application implements, along with a set of suggestions for developing an AR assembly application for the HoloLens.
24. The expected user, factory workers or assembly technicians, are constantly surrounded by busy and noisy spaces, therefore, the different UI components should be accessible, simple, and visible for the user to employ, regardless of the environment. If the UI fails to be simple and clear, the worker could potentially be harmed or cause an incident, raising uncertainty about the application’s usability and safety. Hence, poor UIs hinder the user’s work or progress, which is the opposite of what a UI should do. However, there are very few specific protocols that help guide the design of AR interfaces on HMDs. Fortunately, there is work that can be drawn on to guide a friendly UI. These guidelines provided their insights on user considerations, 3D graphical UIs and graphical design standards, gestural interface UI interactions, and VR implementations on 3D elements in order to build a foundation. The exploration of those sources led to a list of necessary requirements for creating the UI. Microsoft’s Senior Holographic Designer acknowledged that there aren’t any strict best practices for 3D UI and interaction design pertinent to the HoloLens, and much of their discoveries and suggestions are based off on their own internal testing.16 Furthermore, the HoloLens applications’ interfaces are considered to be a mixture between 2D and 3D, mainly due the lack of AR UI design principles or standardization. However, this hybrid combination of 3D interfaces and 2D GUIs can help facilitate navigational structures as it provides a softer transition to a new technology (AR HMDs) with familiar UI elements in order to avoiding frustrating or scaring the user away.43 There are some basic design principles that every new user-based technology should follow: visibility (or affordances), feedback, consistency, non-destructive operations (e.g., undo), discoverability, scalability, and reliability.44 Even as AR enters a more interactive and gestured based phase, developers can always rely on these principles in order to help create a successful interface.
25. Due to the expected type of environment the application will be used on, the application designers opted not to use voice commands. By not using the voice command, the application minimized the user’s need to remember commands, reducing their cognitive load. Hence, the application only focused on the HoloLens gaze and gesture actions, which allows users to navigate and interact with the UI. To aid in the application’s simplicity, any unnecessary information was stripped out and only the essential elements to guide an assembly task were implemented. The application focused on the following elements: next and previous step, description of the current step, guided animation of current step, and the ability to verify the list of steps and jump to any on those.8 These elements indicate their functionality through the incorporation of basic graphic design principles, such as distinguishing something that is a button versus something that it’s not, allowing the UI to maintain cohesiveness throughout the application. Additionally, the UI elements incorporated visual guidelines such as color, form, size and the implementation of icons. The combination of all of the presented guiding principles can influence the application’s interface design.
26. 3.3UI Implementation
27. With the guidance of the previous suggestions the following section presents the different UI elements in the prototype system. These sections include the reasoning behind element placement, text, color choices, feedback, element shape and form, buttons, icons, and the steps menu, all of which affect a user’s experience and interaction with the application.
28. Element Placement – All elements, including buttons, descriptions, arrows, etcetera, are placed at a comfortable distance (anything between 1m -10meters) from the user. These distances are derived from VR HMDs that have initial screens (optional first screen that allows the user to enter or edit data/options before moving on) and interactive elements; such research concluded that anything less than 0.5 meters is considered the “no-no zone” or an uncomfortable placement area.25,26,45,46 By placing the elements in an accessible and away from possible intrusive zones, the user can comfortably use the UI, reducing eye-strain and intrusiveness. Additionally, one tradeoff was aligning the elements within the factory worker’s field of view, defined by the HoloLens. An overview of the elements in the UI is shown in Figure 2 below.
29. 
30. Text – Font size was decided to be 20pt in order to provide legibility within the application.47 Also shown in Figure 3 below, the application uses a popular and widely available sans serif font, Arial. A sans serif font was chosen because serif fonts do not render well on screens and users seem to prefer sans serif fonts when reading computer generated text since it can help minimize confusion and eye-strain.48,49,51 With the aid of a bigger text size and screen-friendly text, the assembly technician can easily read and understand the information that the text presents to them, avoiding possible confusion, eye-strain, and system render issues. These guidelines transferred well in to the HoloLens application, due to the font’s wide standardization and usage in digital or non-print media content.
31. 
32. Color Choices – Taking into account the different environments the application could be used in, the integrated colors manage to keep a high contrast between each other for legibility. It should also be noted to avoid using black, as it is perceived as “transparent” in AR and avoid using pure white, as it appears as too “bright”.23,47 The selected colors reflected the choice of providing a combination of both bright and calming colors. The brighter or lighter colors are implemented to stand out from the environment and calming colors are meant to not distract the user while providing a sense of presence. No major issues were encountered when transferring from a computer screen to an HMD; brightness, hue, and saturation were relatively true. Since pure black and white have proven to be at a disadvantage in AR, the designers avoided using pure RGB colors, and provide a more harmonious combination of colors. The following colors were selected from Microsoft’s color palette and other AR application color schemes: RGB blue 0,120,215 (used for buttons and backgrounds; shown in Figure 2), RGB dark blue 0,77,11 (for descriptive text on white backgrounds; shown in Figure 2 and Figure 4), RGB green 16,124,16 (feedback change when button is pressed; shown in Figure 3), Bright green RGB 0, 255,44 (for object location; shown in Figure 4), RGB white 242,242,242 (used for icon, text, and background; shown in Figure 2 and Figure 4), RGB yellow 255, 255, 0 (used to indicate direction and gazing cursor; shown in Figure 5 and Figure 6), and RGB orange 216, 59, 1 (for hover button state, the eye is focused but item has not been selected; shown in Figure 6).23,47,51,52 As a result, providing different colors to specific behaviors and elements, along with other UI aspects, the user is able to frame, identify, and distinguish different UI elements in the real world. When applied to the HoloLens, these colors did not present any brightness or saturation issues and were able to be captured well in the applications UI.
33. 
34. 
35. Feedback – Feedback is a way of assuring the user, in this case through visual cues, that a performed action has been executed. By ensuring that different elements provide feedback to the user, the elements become visible and provide a good conceptual model to the user.21 The application focuses on the implementation of color change or highlight (user focuses or selects an element; shown in Figure 3 and Figure 6), animation and movement (open and close of the menu; shown in Figure 2 and Figure 6), and appending (checkmark to indicate completeness; shown in Figure 7). Through feedback, the factory worker is assured that some sort of action has been performed, avoiding possible feelings of confusion and frustration. The different types of behaviors or feedback had to be simplified or generalized in order to execute them in the HoloLens, due to the restrictions within the provided HoloLens coding. This means that manipulating various elements within a specific area proved to be too complicated due to the scarcity of specific documentation and development case studies.
36. 
37. Framing and Billboard Styling – Billboard style or “framing” is the surrounding shape in an UI element, allowing any text-based or icon-based UI element to stand out from the background. This style was used for the both the buttons and descriptive-text in order to differentiate from other elements in the environment. Figure 2, 4, and 6 show how the descriptive-text was designed with a white background and blue text with a straight edged billboard. AR text integration research shows that blue and white provides to best combination when there is not a plain environment background.51,52 Figure 2 and 4 demonstrate how the buttons have a blue background and rounded billboard with white text and icon whenever it’s idle, differentiating them from the descriptive-text billboards. By having the buttons look different in both color choices (inverted) and form, visual differences for the assembly technician to pick up on are established, along with helping frame the UI from the real world. Additionally, the development of different forms and billboards proved to be an easy transferable guide for the HoloLens.
38. UI Elements – The UI elements the application focuses on are icons and buttons. The application emphasizes on implementing 2 simple icons, along with appropriate identifiable labels, which minimize user memorization and cognitive overload.22,53 The first icon is an arrow based element (Figure 2 and 8). Arrows are usually associated with directions, similarly, they are heavily used in WIMP applications, allowing the user to quickly familiarize with them. The arrow in the step menu (Figure 2 and 6), provides a static downward arrow to indicate the user that more information can be accessed, and new options appear if the user has selected and opened the menu. Similarly, the arrow in the buttons (Figure 2, 4 and 8) do not move, however, they indicate direction or the cognitive understanding or going to the previous or next step in the assembly (back and forward). The second icon is a checkmark enclosed in a circle (Figure 7), meant to be used in the step menu as additional feedback for the user. The checkmark icon is meant to express an indication of completeness, due to its positive association with good, correct, or success.54 The implementation of icons and labels help the factory worker quickly understand what each element does, reducing the time they take to familiarize with the application. The implementation of different icons within separate elements proved to be an easy task within the HoloLens application development, however, performing an icon movement within the element proved to be a harder task in the HoloLens, which only allows for static icons to populate the UI.
39. 
40. Graphical User Interface (GUI) based buttons are the visual representations that symbolize a possible user action in the environment. By implementing clear affordances and signifiers such as color, feedback, and a different shape from other elements, it can help user to understand their intended actions, even in an AR.21 The buttons incorporate both text and the arrow icon; the direction of the icon allows the user to understand direction, (going back/forward) and the text label clarifies the button’s intended action. Similarly, the implemented button actions are represented through their behavior: idle, user is focused/hovering, and user selection, shown in Figure 8 above. The idle state is portrayed as a rounded billboard with a blue background with a white icon and text. The focused/hovering state denotes that the user’s eyes are gazing on top of the button but has not yet been selected. This provides a contrasting color from the idle state (orange background with a white icon and text). The selected state, performed with a hand gesture, has a green background with white text and icon, to indicate a completed action.45 There’s an ongoing debate to as how much WIMP integration should be used in 3D environments, but for now, users don’t seem to favor one side entirely. By keeping the UI simple, and adding the appropriate signifiers and affordances, the implementation within the HoloLens application did not present any issues.
41. The Steps Menu – The steps menu is modeled after collapsible web menus (shown in Figure 9). The steps menu has similar states as the buttons, due to its interactive nature.21,22,45,53 Additionally, the checkmark icons appear as supplementary feedback. If the checkmark is present next to a step, this indicates that the user has completed that step (Figure 7).54 The checkmark icon is a combination of a white circle with a green checkmark. Briefly explained in the icon section, the steps menu also contains an arrow icon, used as a signifier to open and display more of the assembly’s steps.21 The steps menu combines previously discussed elements, creating a uniform and cohesive understanding of what the different elements do even if placed in different zones. The menu is meant to be simple and provide only quick references to the different assembly parts, along with the appropriate behavior and feedback. This allows the assembly technician to quickly refer back to any step and verify which steps have been completed, reducing their cognitive load, while simultaneously providing UI uniformity. The implementation of various steps within a single area transferred well into the HoloLens application development, capturing the idea of organizing matching information in one area.
42. 
43. It is crucial to always keep the user in mind and practice the implementation of founding design guidelines, regardless of any new technology, in addition to understanding how each implemented element might impact the user. Different AR HMD applications might call for other guidelines or specific assembly-related implementations that are not necessarily relatable to this assembly application. Nonetheless, by catering the application’s interface to the environment, content, and user, the developers can implement a user friendly UI, reducing the likelihood of unintentionally harming the user or delivering a cumbersome application. The HoloLens has proved to have many advantageous and transferable UI implementations, but developers still need to consider the development limitations and reserved accessible coding implementations the HoloLens provides to developers outside of Microsoft.
44. 3.4Application Development
45. The application development section explains the concept of the application, what tools were used, and specific challenges that had to be overcome. The developers generated an AR assembly application in order to assess the capabilities of the Microsoft HoloLens. The following sections describe the outcomes of the assembly application which was developed for the Microsoft HoloLens.
46. The AR assembly application was developed using Unity3D, Vuforia and the Microsoft HoloLens. For assembly instructions, AR provides the unique advantage of displaying the assembly information over the physical assembly area. This allows for better visualization of the assembly steps over paper based instructions.
47. In general, this application goes through each step of an assembly process, guiding the user on which parts to pick and how to assemble those parts. For interaction and additional guidance, a UI is included over the assembly and parts area. This UI displays information about the current step along with buttons that allow navigation between steps. Users can also choose a specific step from a dropdown menu. For each step that involves obtaining a part, a green frame is rendered around the correct part to indicate which part is needed. For each assembly step, a virtual object is rendered and may be animated to show the user how the part is to be assembled. The application follows this method of having the user find parts and then assemble them until the assembly is complete.
48. Developing for the Microsoft HoloLens requires the use of the Universal Windows Platform and creating a Universal Windows Application. These applications need tools designed to take advantage of the Windows Holographic Application Program Interface (API). Microsoft highly recommends that Unity3D is used to do this.55 It is also possible for developers to build their own engines using DirectX and other Windows APIs.
49. Unity3D is an excellent development tool for the Microsoft HoloLens. Microsoft provides ample documentation on how to develop for the HoloLens using Unity3D in addition to their guidelines on how to ensure a high quality application. Unity3D removes much of the programmer’s burden; it allows for the rapid development of applications by setting up the framework and tools to allow the developer to focus on the content of the application. Developing this assembly application using Unity3D, instead of building a custom engine, allowed for quick development iterations resulting in a high quality assembly application.
50. The Microsoft HoloLens is able to create a virtual representation of the real world using spatial mapping. Using the depth cameras, the HoloLens is able to map out the surfaces of a room and create a mesh from this data. For many applications this technology may be sufficient for the interaction of holograms with the real world. However, for an assembly application there are intricate steps and the location of the holograms in the real world must be precise. Shown in Figure 10, the spatial mapping mesh is not detailed enough to support an assembly application. The generated mesh is not a complete and accurate representation of the final assembly. To achieve higher precision, a Vuforia plug-in was used to perform marker based tracking. Marker based tracking uses target images recognized by the computer to establish an accurate frame of reference in the real world. This is done though using the RGB camera to detect an image, registered with the application, to deduces the position and orientation of that image. Objects can then be positioned relative to the image with considerable accuracy. The downside of marker based tracking is that images must be placed to define locations in the real world. While spatial mapping does not require markers, limitations in technology do not allow it to be as accurate in defining specific locations with markers. Multiple marker images are used to define the separate locations of the assembly workspace and parts table. This is important because the directional gates guide the user between the assembly workspace and the parts table, which is the location where unassembled parts are stored. After these locations are defined, the HoloLens then takes over control of tracking using its IMU and environment processing cameras.
51. 
52. Despite requiring a plug-in, the HoloLens has the proper tracking capabilities for an AR assembly application. From a hardware perspective, the HoloLens itself is capable of marker based tracking. All that was required was a simple plugin for Unity3D to establish which markers were to be used and how they pass pertinent information to the application. Microsoft does currently suggest that if a developer wants to use marker based tracking, that the Vuforia plug-in for Unity3D should be used.56 After the parts and assembly locations are defined using Vuforia markers, the HoloLens could properly track those positions as the user moves around in the assembly area. That is crucial because without the specific location of each component being tracked, the device cannot achieve true AR capabilities.
53. Occlusion in AR refers to one object in 3D space being blocked by another, virtual or real. Occlusion allows the user to have increased depth perception of virtual objects by showing how they are occluded by other virtual or real objects.57 Kruijff et al. explains that the main issue with occlusion is the incorrect separation of the foreground and background, objects need to be rendered in a particular location occluded by what is in front of it.58 The depth perception cues given by occlusion shows where an object belongs, and if done incorrectly can lead to objects being perceived in the wrong location. Richardson et al. explored a comparison of AR instruction delivery with tradition model based instructions.8 This AR system did not include occlusion and users found it difficult to complete various assembly steps due to the lack of occlusion. If occlusion is not included in an assembly application, then users may not be able to properly locate how parts are to be assembled. A virtual part must be occluded by a real part, and vice versa, to give the user proper depth perception cues.
54. This AR application includes occlusion cues based on prior research done in AR assembly. The holograms of the virtual parts must be occluded by real parts to show a proper representation of how the assembly comes together. While the HoloLens spatial mapping can detect these parts, the mesh is not detailed enough for proper occlusion in an intricate assembly. The mesh may be too big or small leading to the improper occlusion of real and virtual parts. Instead, the authors can use the part locations defined by the image markers using the Vuforia plug-in to determine where parts should be occluded. The location of the assembly station is defined using the Vuforia image markers. Based on that defined position, the location and orientation of every assembled part is defined relative to that position. Therefore, for every real part already assembled, a virtual representation can be placed in that exact location. This representation needs to be completely transparent as it is acting as a virtual placeholder for the real part. To accomplish this, every virtual representation of real parts is rendered matte black, an RGBA value of 0,0,0,0. This is done because the HoloLens uses light engines to render the images on the display. Since matte black is completely void of light, nothing is rendered and the virtual representations are effectively invisible. A shader is then used to display a red mesh outline when one virtual object is occluded by another, shown in Figure 11. The end result is the assembly step holograms being almost perfectly occluded by real parts. Unity3D was able to handle this process without any issues. This workaround is necessary due to the current limits in computer vision technology. Once spatial mapping is accurate enough to define intricate parts, the mesh generated from that mapping will likely be sufficient for proper occlusion.
55. 
56. In an assembly application it may not always be clear where the next assembly step or part is located, part locations and assembly stations may be located in separate areas of an industrial factory. For this reason, it is necessary to include a navigation system for the user. Previous research indicates that a 3D gate system is preferred and more usable than a 3D arrow system or a heads up display.59,60 It was found that participants were faster in finding the target object and had a decrease in mental workload while using a 3D gate system.60 Using a cubic Bezier curve, gates are placed along a path to guide the user to the correct location, shown in Figure 12. This provides an intuitive navigation system that allows the user to find where they need to go without being distracting. These gates also disappear when the user is close to the specific step in order to avoid distractions while picking parts or assembling.
57. 
58. This navigation system was fairly easy to implement using Unity3D. Unity3D had no problem calculating the Bezier curve and the correct orientation of the gates at each frame to ensure a smooth performance. A simple C# script was also included to determine whether the user was within a certain distance and looking at the current part to turn off the gates. Again, Unity3D was able to handle this with ease.
59. 3.5Discussion
60. An AR assembly application on the Microsoft HoloLens proved to be viable using Unity3D. The Microsoft HoloLens has sufficient hardware capabilities for an AR assembly application. Using Unity3D, the authors were able to utilize these capabilities and develop an application that included features necessary for an AR assembly application. The main area of the HoloLens that seemed to be lacking robustness was its’ spatial mapping. This system was not accurate enough to create a mesh of intricate parts and a marker based tracking plug-in by Vuforia had to be used. This plug-in allowed the Unity3D application to detect and handle image targets which allows the HoloLens to interpret a known location in the real world and display models at specified offsets from that location.
61. 4.CONCLUSION AND FUTURE WORK
62. 4.1Conclusion
63. This application shows that the commercially available Microsoft HoloLens is a viable platform to deliver an application that provides AR assembly instructions. The hardware capabilities of the HoloLens allowed for virtual content to be spatially located correctly enough for assembly instructions. The display also allowed for a detailed UI. Previous academic research in UIs for AR and VR was used to create a UI that was user friendly and well suited for a factory. This included colors, text and icons that are intuitive to a user to reduce distractions and increase usability. The one area in which the HoloLens fell short was tracking the location of the parts and assembly station. An intricate assembly requires precise location capabilities. The HoloLens does have spatial mapping capabilities, however the mesh created is not accurate enough for a detailed assembly application. Vuforia was for marker based tracking to provide accurate locations of the parts and assembly stations. Since commercially available AR is so new, it is important to use previous academic research on best practices to create an application that is functional and usable.
64. 4.2Future Work
65. In the future the authors would like to perform a user study to compare this AR HMD assembly application with an AR tablet based assembly application and traditional paper instructions. Previous publications have found many benefits of AR tablet based assembly instructions over traditional paper instructions. It would be beneficial to explore whether or not AR HMD assembly instructions surpass tablet-based AR instructions.
66. Once released, the Daqri Smart Helmet should also be explored to see if there are benefits to using this device over the Microsoft HoloLens. The Daqri Smart Helmet was designed specifically for an industrial environment and an assembly application of this variety would fall well within its intended use. However, as it is not yet released and it is unclear if the capabilities of the Smart Helmet will be able to handle a robust AR assembly application.

# E-Book Platforms

1. Abstract
2. E-book learning platforms are increasingly used as curriculum resources for independent reading at school and home, although benefits for students’ reading motivation and skill are unclear. Using a set of analytic tools, this study describes two e-book learning platforms in terms of platform affordances, digital architecture of e-books, functionality of screen pages and dashboard analytics. Qualitative analyses reveal patterns of strength and weakness along each dimension. Affordances rated highest in content and administration characteristics, but largely unmet in accessibility and communication. Architecture tends to maximize text access, but minimize text/media integration and active reader engagement. Functionality suggests a word-focused pattern that favors word learning over text comprehension. Analytics tend to inform skill building over self-awareness and progress. Analytic tools were designed and/or refined to develop and improve technical adequacy. Findings lay the groundwork for more controlled studies of the effectiveness of e-book platforms as literacy curriculum resources and more active collaboration among publishers, IT developers and educators to improve e-book platform quality.
3. Introduction
4. Recent reports point to a renewed interest in independent reading at school spurred by the surge of e-books into the reading marketplace for children. The 2014 report of the National Literacy Trust, for example [1], cited the positive effects of e-book reading on students’ motivation to read, especially boys, and to some extent on students’ reading comprehension [2]. Relatedly, Scholastic’s Kids and Family Reading survey [3] reported that the percentage of children who have read an e-book has increased steadily since 2010, up by 14%.
5. Access to e-book reading collections creates new opportunities for students to build a personal mobile library and, when coupled with dashboard feedback on reading stats, a new level of self-awareness and control of their own reading experience. Anytime, anywhere, students can make more informed choices, set personal goals, monitor their reading habits, check comprehension and share their book reading.
6. What this access means for the role of independent reading in reading development, however, is still unclear. Early studies of educational apps designed to teach literacy-specific skills in young children, for instance, show that apps range from developmentally appropriate training to incomplete support or none at all. Overall, instructional quality was found to be low, prompting recommendations for designing and choosing educational apps intended to “teach” [4]. Results are similar with respect to e-book quality in early literacy experience [5]. Few studies, however, have critically examined e-book learning platforms as curriculum resources for independent reading practice at school and home. Presently we know relatively little as to their potential impact on students’ reading habits and skills, especially when used routinely.
7. Our study explores this topic, undertaking an analysis of sample e-book learning platforms that serve as supplementary reading programs in elementary grades. Typically such platforms do not serve as core reading programs, but rather as supplemental resources that are integrated into general reading instruction, at teacher discretion. Our aim is to unpack sample platforms as illustrative of the independent e-book reading experience at school and to describe what the respective collections offer developing readers in terms of affordances, architecture, functionality and analytics. Description builds a foundation for more controlled studies of the impact of e-book supplementary programs on students’ reading motivation and skill.
8. The addition of e-books as independent reading resources for students provides them with distinctly new reading experiences. Enriched with multimedia (animation, music, sounds, highlighting), e-books can be engaging and motivational, garnering students’ attention and persistence in reading. The effects of technology-enhanced stories for young children’s literacy development compared to listening to stories in a traditional format, for example, show a small, but significant additional benefit of technology for story comprehension and expressive vocabulary, especially for at risk children [6]. Similarly a research synthesis of the effects of electronic books on students’ literacy and language outcomes suggest that interactive features of e-books (hotspots, popups) congruent with the text support comprehension [2]. Research evidence coupled with an expanding e-book market has led to an increasing number of comprehensive e-book reading platforms that offer a framework of curriculum materials supportive of e-book reading experience.
9. But, there are pitfalls. Often loaded with interactive features, e-books can divert children’s attention from the cognitive work of reading, thus hindering literacy skill development. When students can choose between listening/reading the story and playing with visual and sound effects, they invariably choose the latter and literacy learning opportunity is missed [7]. Extraneous features incongruent with the storyline create a diversion that splits attention, thus creating cognitive overload, which in turn disrupts comprehension processing of the story content [8]. Over time, some argue [9], this pitfall of e-books can lead to superficial, staccato-like reading of texts that may stunt literacy development.
10. To date, a synthesis of the empirical evidence on the pros and cons of e-books indicates that interactive features, such as hotspots and games, although appealing, do not benefit story comprehension. Multimedia features like animation, zooming, music and sound effects closely aligned to the story content, on the other hand, do facilitate understanding of story language and plotline [10].
11. To read well, and become well read, students need time for reading practice at school, although the amount of time allocated to independent reading at school varies considerably. While sustained silent reading time at school with print books has been researched [11], [12], few studies have examined the logistics and impact of independent reading at school with e-books. Using a mixed-methods approach, Barnyak and McNelly [13] compared outcomes of primary graders’ independent reading between e-books and print books on vocabulary, comprehension and motivation in a Title 1 summer reading program. Students expressed a preference for reading e-books, but results indicated that their preference did not significantly impact targeted reading variables when compared to peers reading trade books. The critical role of adult scaffolding in supporting reading practice, whether e-book or trade book, was a key finding of the study.
12. Relatedly, Jones and Brown [14] found a student preference for e-books among third graders who enjoyed the wide selection of titles and freedom to choose their own e-book; they also liked the amenities of e-book reading (e.g., pop-up definitions). Comparing reading engagement between e-books and print books, they found that format was not as critical to engagement as students’ identification with setting, characters, and theme of the book. Some studies, though, indicate that the increased self-control that e-books afford has a strong bearing on reading engagement [15].
13. Still, we know relatively little about the role of e-books in reading practice at school, and it is a fruitful area for further research. As access to e-books widens, there is an increasing need to know what e-books students like to read, how to select quality e-book collections for independent reading, how to manage e-book independent reading for best results, and how to balance e-book and print book reading that guides reading growth and develops lifelong reading habits.
14. At scale, we cannot expect reading educators and teachers to both evaluate and effectively implement e-book reading platforms on a daily basis. The task of reviewing and rating electronic reading materials in a burgeoning digital marketplace is a serious challenge. Yet, for educators and parents, a fundamental question remains: how do I know if these digital reading materials are good?
15. Teachers need reliable and valid tools for evaluating e-book platforms. While early steps have been taken to vet e-books titles by expert groups [16], methodologies for assessing and evaluating the quality of e-book titles, either singly or in collections, lack scientific rigor [17]. An analysis of several research-based tools showed that they predominantly focus on graphic and interface designs, i.e., how e-books sensorily present (e.g., music) and conventions of use (function buttons) [7], [18], [19] and less on how the e-book design structures the reading experience, i.e., the path of attention supporting reading skills [20]. Dashboard analytics are also less scrutinized, perhaps because these are seen as “extras”, and not instrumental in promoting reading skill development.
16. Development of reliable, valid tools for practical use is critical in a rapidly changing e-book marketplace, albeit challenging. A good tool should be theory-driven, iteratively tested, applied in authentic settings and include clear procedures for practical use [21], [22]. This requires the design and testing of prototype tools to name, define and operationalize criteria for assessing quality of e-book platforms followed by replication to ensure the integrity of tools for general use.

## Research questions

1. In this study we analyze the learning platforms of two e-book collections as representative of supplementary e-book reading at school. Drawing on the instructional technology literature [23], we define an e-book learning platform as an integrated framework of interactive online materials that provide teachers, students and parents with curriculum resources to support independent reading. To our purpose, an integrated framework includes: (a) affordances, i.e., the possibilities for action; (b)

## Method

1. We used a descriptive research approach to examine sample e-book platforms using a set of analytic tools. We drew on the e-book quality research literature and qualitative information from prior studies to develop and/or refine a set of analytic tools for review purposes [18], [19], [24], [25]. We applied the analytic tools to the aforementioned dimensions of the sample platforms as enablers of reading development. We used primarily qualitative data analytic techniques focused on content

## Affordances

1. Mean ratings of learning platform characteristics were converted to percentages in categories of functionality, communication, accessibility, content, administration and tools, and as a total PPT score (Fig. 1).
2. As shown in Fig. 1, the profiles for the two platforms are more similar than different. Across both samples, the percentage of affordances present rated highest in content and administration characteristics, but were largely unmet in characteristics of accessibility and communication.

## Affordances

1. Our specific interest is in elementary school e-book platforms that consist of integrated applications that enable students, teachers and parents to access reading content and track performance. To describe platforms geared to this purpose, we developed a tool to descriptively profile platform affordances. Profiles of our samples described the affordances on the platforms, revealing their extent. We observed differences in their distribution across categories with some more prevalent (e.g.,

## Limitations

1. Our research is exploratory, descriptive and interdisciplinary, converging literacy and IT concepts to examine e-book platforms for independent reading. The study is limited by a small sample size and the use of tools that are at different stages of technical adequacy, thus not ready for widespread use, although helpful as guidance for educators knowledgeable of e-book design and build. It uses qualitative analyses that can tell us what the affordances, architecture, functionality and analytics

## Conclusion

1. Online reading programs are fast becoming part of students’ reading experiences at school and beyond. More than time-fillers, their organization, content and activities matter in students’ reading development and motivation to read. Our analysis describes two e-book learning platforms as integrated frameworks, offers analytic tools for researching platforms and lays the groundwork for more controlled studies of the effectiveness of e-book platforms as literacy curriculum resources. As reading

# Kindle/FireTablet

## Abstract

1. This study serves as an update to a previous study by Sam Houston State University librarians about the use and preferences of Internet, communication, and educational technologies among students. Since the previous study was initiated in 2010, the iPad has made its debut and significantly altered the educational technology landscape. In this new landscape, this study investigates student usage of such technologies as instant messaging, cell phones, e-readers, social networking, RSS feeds, podcasts, and tablets. In addition, this study aims to determine which technologies students prefer the library to utilize for a variety of services, such as reference assistance or book renewals, and which technologies may not be worth the investment, such as geosocial networking. The information gained from this survey is intended to provide guidance for libraries looking to provide services utilizing the most popular technologies with the most efficient use of resources. Survey results show an increasing use and dependence on educational technologies and a desire for basic library services to be available on a variety of platforms and technologies.

## Introduction

1. In 2010, Sam Houston State University (SHSU) librarians initiated a study published the following year in Reference & User Services Quarterly titled “Higher education and emerging technologies: Student usage, preferences, and lessons for library services” (Cassidy et al., 2011). Since the time of that study, the iPad has made its thunderous debut, significantly altering the educational technology landscape by becoming a major player in the field and opening the door for other tablet computing technologies. As a result, an updated survey was developed to more closely represent SHSU students' usage of Internet, communication, and educational technologies in this new landscape.
2. In addition to exploring students' interaction with such technologies as instant messaging, cell phones, e-readers, social networking, RSS feeds, podcasts, and tablets, educators and librarians are pressing beyond a surface exploration of digital content in order to capitalize on the idea of continuous instant access and active engagement with learning afforded through the use of mobile devices. This study is intended to provide guidance for such issues by surveying student library users' utilization and preferences of Internet, communication, and educational technologies at SHSU. SHSU is a Carnegie Research Doctoral university located about 1 h north of the Houston metropolitan area, and is made up of a large number of commuter, first-generation, or otherwise “non-traditional” students. With such a diverse student population, this survey set out to acquire as much information about SHSU students' educational technology usage in order to provide the most efficient and highest quality library services where they are most needed and desired.
3. The idea of mobile learning, or m-learning (El-Hussein and Cronje, 2010, Sharples et al., 2007), is not necessarily new—it has been waiting in the wings since e-learning made its first stage appearance—but its pairing with the recent influx of smart technology devices has certainly fueled m-learning's popularity. Early on, the term smart was often paired with devices such as phones and portable tablets that functioned “like a small, networked computer,” enabling users to access Internet browsers and e-mail; more recently the term is paired with phones and portable tablets that provide additional software features or operating systems (OS) which enable the installation of mini-software applications, or apps (Zheng & Ni, 2006). These apps themselves can provide a wealth of educational interaction with the target app's subject content, including games, quizzes, audio, and visual display of malleable content. The mobility of these devices means that students are now engaging with learning content in brief spurts, on-the-go, in the hallway, during lunch, and even the classroom itself. This smart technology is “changing the ways we consume, distribute, and create information” (Little, 2011, p. 267).
4. In the interest of exploring how these new mobile devices are being used by the student population as a whole, several national anchor studies feature prominently in this literature review in order to give a baseline comparison for individual university study projects. The anchor studies for this review include the NMC Horizon Report: 2013 higher education edition, the ECAR study of undergraduate students and information technology, 2012, the Pearson Education Students and Tablets Survey 2012 (Summary of findings and the Topline results), and several Pew Research Center reports, including The rise of e-reading (2012), Teens, smartphones & texting (2012), and Younger Americans' reading and library habits (2013).
5. Individual university studies relating to student technology include results from a 2011 survey at Utah State University (USU) and a 2012 survey at the University of South Carolina Columbiana campus (USC). For comparison purposes, SHSU is classified by the Carnegie Foundation as a public Carnegie Doctoral Research University; it is located in semi-rural Huntsville, Texas, and offers around 136 undergraduate and graduate degrees (Sam Houston State University, 2013). USU is classified by the Carnegie Foundation as a public Research University (high research activity); it is located near mountainous Logan, Utah, and offers around 203 undergraduate and graduate degrees (Utah State University, 2013). USC Columbiana is also a Carnegie-labeled public Research University (high research activity); it is located in Columbia, South Carolina, and offers a total of 324 undergraduate and graduate degrees (University of South Carolina, 2013). All three institutions are large four-year universities located in primarily nonresidential settings offering similar undergraduate instructional programs with high or very high enrollment profiles; student populations reported to Carnegie reflecting data from 2008 to 2010 show SHSU with 16,772 students, USU with 15,512 students, and USC Columbiana with 28,482 students (Carnegie Foundation for the Advancement of Teaching, 2013).
6. Since the publication of the original SHSU technology survey (2011), the availability of smart tablet technology has exploded onto the student stage, irrevocably changing perceptions and expectations of interactive touch-screen technology. The New Media Consortium (NMC) Horizon Report: 2013 higher education edition also identifies smart tablets as “not a new kind of lightweight laptop, but rather a completely new technology” (Johnson et al., 2013, p. 16) and reveals that they are being used as “a portable personalized learning environment” (p. 15).
7. The 2012 Pearson Foundation survey on students and tablets indicates that “[t]ablet ownership has more than tripled among college students since March 2011, with one-quarter of students now owning a standard tablet” (p. 2). While this study was broad in scale, surveying 1206 college students between the ages of 18 and 30 enrolled in a two-year college, four-year college, or graduate school, the popularity of smart tablet technology is difficult to argue. This same study also indicates that “tablets are just as valuable for educational purposes as they are for personal entertainment” (p. 2).
8. USU's 2011 survey collected data regarding students' use of mobile technology, specifically iPads, from 3074 students, approximately 11.9% of the USU's 2011 total student population of 25,767 (Dresselhaus & Shrode, 2012, p. 87). Of these 3074 students, only 3.9% indicated daily use of an iPad (p. 88). While iPads were perhaps one of the most visible smart tablet technologies early on, iPads are not the only, and certainly not the most affordable, smart tablet technology to which students have access.
9. USC's 2012 e-mail survey collected data regarding technology brought to campus, including smart tablets known as iPads, from students living in residence halls (graduate and undergraduate), from 1124 students, or just over 16% of the total resident student population of 6647 (University Housing, University of South Carolina, 2012, p. 1). Of these 1124 students, 18% “brought an iPad or other tablet machine to the campus” (p. 2).
10. Smartphones are an increasingly popular substitute for smart tablets. The Pearson Foundation's (2012) Survey on students and tablets indicate that 65% of college students surveyed indicate that they have a smartphone (p. 5). The ECAR study of undergraduate students and information technology, 2012, though focused on undergraduate students, reports that 62% of undergraduates report owning a smartphone (Dahlstrom, 2012, p 14).
11. Along the same lines of popular technology adoption, USC's 2012 e-mail survey collected data regarding technology brought to campus by undergraduate and graduate students living in resident halls. From the 1124 students polled, approximately 79% indicate that they have a smartphone, with 21% indicating that they did not have a smartphone (University Housing, University of South Carolina, 2012, p. 3). USC's survey was specific to the campus resident population, but it does echo the high adoption rate indicated in the 2012 ECAR study.
12. USU's 2011 survey also collected data regarding students' use of mobile technology, including smartphones (Dresselhaus & Shrode, 2012). Of the 3074 student respondents, 39.3% indicated daily use of a smartphone with Internet access (p. 88). While the overall numbers are lower than the ECAR study, USU focused more on the amount of daily use of the smartphone rather than simple ownership or possession.
13. Of interest also is the Pew Research Center's March 2012 report on Teens, smartphones & texting and its June 2013 Younger Americans' reading and library habits. While these Pew studies do not directly involve this project's current students, it does examine device ownership of the potential university student population at a national level: teenagers within the age range of 12 to 17. In 2012, approximately “one quarter (23%) of teens 12 to 17 indicate that their phone is a smartphone, while 54% have a regular phone (or are not sure what kind of phone they have), and another 23% of teens do not have a cell phone at all” (Lenhart, 2012, p. 7). Conversely, in 2013, approximately 93% of teens 16–17 years of age own a cell phone, with 63% reporting smartphone ownership: this same report indicates that 94% of college-age adults from 18 to 24 years old report ownership of a cell phone, while 65% indicates ownership of a smartphone (Zickuhr, Rainie, Purcell, Madden, & Brenner, 2013, p. 13). This information may be of interest in analyzing trends in smartphone ownership among current and future college students.
14. Another popular mobile technology option for students is the e-reader, a device specifically dedicated to the reading of e-books. Common options of e-readers include early generations of Amazon Kindle and Barnes & Noble NOOK, as well as the Sony Reader. In examining technology trends for students, some distinction is necessary to differentiate e-reader devices from smart tablets. Early distinctions typically included the limitation of a black and white display such as those found in the early Kindle and NOOK, as well as screen size, with tablets having larger displays than e-readers. However, with a continually evolving line of e-book technologies, smart tablet and e-reader hybrids are becoming more widely available (Tablets, e-book readers, 2011); distinctions become even more unclear as smart tablet display screens shrink for better mobility while e-readers and smartphones enlarge their screens for better visibility (Kim, 2012).
15. According to Pew's 2012 The rise of e-reading report, approximately 19% of adults age 18 and older own an e-book reader (Rainie, Zickuhr, Purcell, Madden, & Brenner, 2012, p. 32). Interestingly, this is the same percentage of adults age 18 and older who own a tablet computer. The report also shares an additional correlation that may interest technology researchers: “tablet users and e-reader users are more likely to own cell phones, desktops, tablets, and e-reading devices” (p. 32). An alternate interpretation of this statement is that individuals who own a smart tablet or e-reader device are more likely than those who do not own a smart tablet or e-reader device to own some of the other technologies included in this project.
16. USU's 2011 survey collected data regarding students' use of mobile technology, including e-book readers (Dresselhaus & Shrode, 2012). Of the 3074 student respondents, only 5.4% indicated daily use of e-book readers (p. 88). While this number is significantly lower than Pew Research indicates in its report, one point of contention may be that recently blurred line between smart tablets and e-reader devices.
17. Another technology from the original SHSU 2010 study that warrants further research is that of social networking sites (SNS). The popularity of student use of SNS is difficult to contest, as examined in the original 2010 SHSU technology study, but one burning question exists throughout much of the literature and is still up for debate: since SNS is popular with students for social interaction, should its use be incorporated into the academic arena?
18. One definitive answer is in the 2012 ECAR study, which identifies one of the “primary objectives of this year's study” as “to create a profile of undergraduate students' ownership and use of technology for academics” (Dahlstrom, 2012, p 6). The 2012 ECAR also indicates that although students prefer multiple options for the purposes of communication, “students use social networks for interacting with friends more than for academic communication” (Dahlstrom, p. 5).
19. Echoing the ECAR 2012 findings is USC's 2012 e-mail survey, which included the use of cell phones to access online social networks (University Housing, University of South Carolina, 2012). Of the 1124 student respondents, approximately 74% indicated that they use a cell phone for online social network activity (p. 3). Regarding the incorporation of SNS into the academic arena, however, only 3% of surveyed students responded that they preferred online social networking sites to communicate with fellow students: of specific interest for this study is that only 0.1% (.001) indicated that they preferred the university to contact them using SNS (p. 4). These numbers give clear indication that, at least within existing literature, there seems to have been little demand for integrating SNS use into student's academic arena.

## Methodology

1. A 53-item online survey was developed to assess students' perception and preferences for current and emerging information technologies at SHSU. The survey questionnaire was adopted from the previous SHSU student technology study (Cassidy et al., 2011). Questions from the original study regarding common technologies, such as laptops, Facebook, and mobile phones, were kept the same for comparison with the current study findings, and new questions regarding technologies that emerged since the last

## Results

1. Overall, 987 individuals responded to the survey. Forty-two responses (4.3%) were incomplete and therefore eliminated from the final results set. In addition, since the survey invitation was posted on the library website and social media pages, four SHSU alumni and staff members had responded to the survey despite the invitation's emphasis on student participants. These responses were also removed because the participants did not belong to the study's population of interest.
2. Discussion
3. The shift in survey responses from 2010 to 2013 demonstrates an overall increased student interest in accessing library services via popular technologies. This increased interest carries implications for continuing and enhanced library services, which will be investigated in more detail throughout the individual sections of this discussion. However, as in 2010, the 2013 study saw a high quantity of write-in comments requesting services that are already available, including Twitter, laptop

## Study limitations

1. Participant self-selection, a common concern with any survey, was also a challenge for this study. The most notable issue was the predominance of female respondents: at 70%, it was well above the actual gender ratio of the student population. Even though no significant differences in responses were found based on participants' gender, such disparity nonetheless reduces the strength of survey findings to represent the entire SHSU student population.
2. In addition, the survey format limits

## Conclusions

1. As compared to the 2010 study, the researchers found that students increased their use of laptops and e-readers, began using tablets, and showed more interest in mobile library services. The immediacy of mobile devices and their rising popularity are providing academics' with opportunities to advance learning and provide services, while also presenting challenges to ensure that students are both informed and trained. Mobile-device training for SHSU students, particularly with regard to
2. Further research
3. A general increase, since the 2010 study, in SHSU-student interest in technology-based library services is a positive finding. This finding may foster further research, especially regarding the use of social networking services for library-related interaction with SHSU students, given the interest indicated by adopters of Twitter and Facebook Chat.

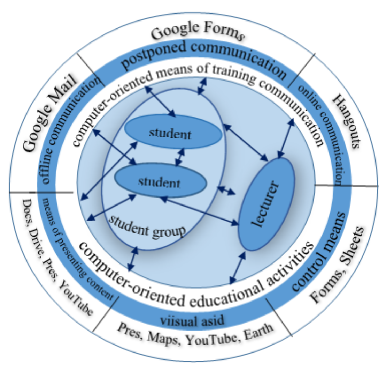
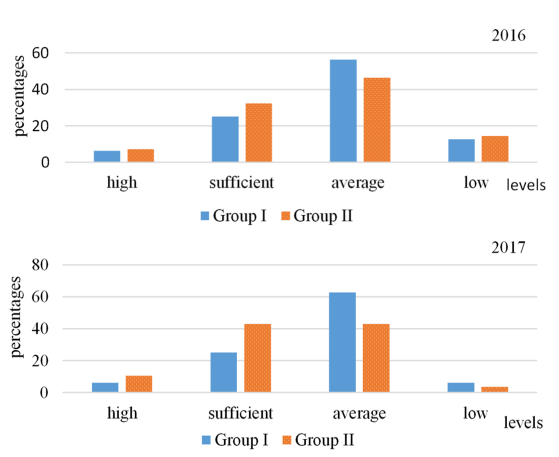
# Online Education Platforms

1. Abstract The traditional education methods may remain incapable to meet the today’s rising education demands by reason of the fact that it depends on a time, a place, and a person. On the other hand, the training programs in the online learning environments offer important advantages for meeting the rising education demands, and have been become more popular. However, the online education programs that have become more and more popular have disadvantages such as the limitation of instructor control, the boringness due to monotony and the lack of experiential learning. These disadvantages caused by the lack of platforms where online education programs are available, are being minimized by the help technological developments. In this regard, it has been needed to research what kind of disadvantages may arise based on the lack of platforms, and to create innovative solutions in the light of developing technology against these disadvantages. In line with this requirement, under the scope of this study, a comparative content analyze is performed on the most popular platforms (synchronous and asynchronous and blended) that are preferred by universities in Turkey, and it has also been examined that how these online educations can be transformed into a more effective structure with the help of developing technologies. As a result of this study it has been determined that innovative technologies such as Augmented Reality and Virtual Reality make significant contributions to the instructor control, interaction and the experiential learning (transforming theory into practice) in online educations.

## Introduction

1. All research of human history showing us; humans are living small groups for protecting them self to external threats. Another human kind attribute is educational activities for educational requirement to young people as a requirement of collective life. In old communities these educational activities are on the just fundamentals of life. But in the historical development; education activities changed to interdisciplinary structure and divided into several subjects. The historical evolution of educational activities continues with communication technologies. In this evolution process; most visible attribute is providing of individuals can take any education at any place by remote access to education institutions. As a though; the first distance education examples were found in the 1700s with letters, magazines and books. But multimedia based and interactive distance learning Works coincide of early days of 21st century. Distance learning Works of 21st century is opportunity for growing human population educational demands. With this development and success of distance education, caused at increasing distance education and traditional education comparison discussions. But despite long time discussions; in the close history, distance education works are spread rapidly. For example; in the USA only in 2011, more than 100 distance education institutions are accredited and 2 million individuals receive education. Other way; more than 40 distance undergraduate level education programs are approved (Engin, 2013).
2. Today; because of opportunities of the distance educations and rapid developments in communication technologies and especially the use of online technologies like internet for the distance learning; many respected educational institutions are started own distance learning systems and off course this situation has led to the emergence of a competitive environment. In this competitive environment; naturally, many of online distance education platforms developed. With this reality; how to serve online distance education programs more effective and witch platforms more useful for this objective question are born. As a result of all these; on the one hand continuation of discussions and the other hand rapid spread of the educational activities with this style; revealed the need for research in this field. In this context; comparing distance online education platforms and revealing their disadvantages; provides important contributions to the positive impact of the educations provided by this method and distance online education field. With this research; most preferred distance online education platforms content analysis of universities of Turkey and answering how to turn more effective structure with today’s emerging technologies question. Literature In early days of history; humans are created natural information stream with between individuals due to human’s community life requirement. Believed to be as old as humanity education activities, systematically stream process of this information. We don’t know what is the time of starting these activities. But after the invention of writing, all this information accessible (Arslan, 2009: 28). The invention of the writing is a most important milestone for education activities off course below other effects of culture, geography and prosperity. The simplest form; defined as process of behavior change education (Şişman, 2007:7) has evolved, changed and improved itself over the ages (Arslan, 2009: 27). Last one of the education activities historical development, connected with development of communication technologies in the 21st century; development of communication technologies that causes radical changes in every part of life, providing to us communications with audio and video (İşman, 2011: 2). But; distance learning activities discussions based on improve or worse learning have been going on for a long time (Beynon, 2007; Clark, 2001). From the first years of distance education to the present day, based on communication technologies with these discussions, distance education effectiveness has been questioned (Şimşek, 2012). As a concept, research of distance education some sources based on 1700s (İşman, 2011: 14) other sources based on 1800st (Saba, 2003: 3); can be summarized shortly. From a wide angle of distance education; researcher of working this field adopt two different approach (Schlosser, Anderson, 1994: 7). B¨orje Holmberg, Charles A. Wedemeyer and Michael G. Moore are known as pioneering theorists of conceptual approach. In this approach, student and student interactive education process are center and this situation is distinguishing feature of distance educations. On the other hand; Desmong Keegan, Otto Peters, Randy Garrison and John Anderson are known as pioneering theorists of structural approach. With this approach focusing, industrialism issues and effect on education process of these issues without losing student centrality (Saba, 2003: 4). From historical development of distance learning, then four different classification revealed. In this classification, first stage is learning model using letters. Second stage is called multi-media model. In this model, pressed materials and electronic communication devices like radio and television used for education. Third stage a synchronous model called by tel-learning. Fourth stage of distance learning is flexible learning model. With this model, using of internet comes to the fore (Aşkar, 2003). Fourth stage of distance education that became spread in the late of 20th century, observed essential changes of distance learning tools, distribution and methods with spread of computers and internet technologies (Epignosis LLC, 2014: 8). In this development process; individuals gained access for many information and learning opportunities with virtual learning environments (Preece, vd 2003). Final of these development; at the present day, online education activities giving communication capability for learner and teachers. A student in a country of the world can learn from another teacher of another country of the world via audio, video communication network and some universities giving educations to students from different countries of the world with called by “open university” structures. Today; increasing education demands, diversification of educational needs, individualization of education and become many educational applications feasible through distance education comes to fore as determining factors off course in the light of technological development. (İşman, 2011: 4) There are some issues to be considered for complex teaching and learning processes through online systems because of includes individuals of different skills, expectations and demands (Campanella, et al., 2008). Each of these issues should be considered as a seperate research topic. But in this research; based on surveying technological issues because of comparing online education platforms. Learning Management Systems and E-Learning Author Tools are technological issues to be considered. (Aşkar, 2003; Watson & Watson, 2007). Learning Management Systems (LMS) are computer softwares for publishing content at the same time education recording and managing, skill tracking, analysing and reporting (Watson & Watson, 2007). Other hand, E- Learning Author Tools are advanced softwares for creating e learning content like contentinteractive presentations, educational presentations. (Özkeskin, 2007) LMS and e-learning author tools software’s must be including some parameters for technological issues. We can classify these parameters as follows (Campanella, et al., 2008; Aslan, 2013; Bayram, vd. 2009; Growth Engineering; E-Learning Industry; Trivantis; Uzaktan Eğitim, Öğrenme Yönetim Sistemi (LMS); Edutechnica); System Parameters: Authentication and security, gamification, support of power point, availability of storyboard, conference manager, content library, content manager, data import and export, data manager, document manager, installation of system (hosted, cloud or local installation), licensing (free, trial, paid), maintenance and backup, availability of API (Application Programming Interface), mobile application, user interface with multiple language support, education system with multiple language support, live streaming capabilities, multimedia environment, multiple export formats, platform independence, notifications with e-mail, notifications with sms, podcast manager, education content manager system – LCMS, interactive lessons. Interface Parameters: Mobile friendly interface, customizable interface, user friendly interface. Educational and Administrative: Reporting tools, rating tools, certificate manager, virtual class manager, cooperation manager, lecturer’s planner, user access controllers, course system, simulations, curriculum management, lesson ratings, availability of the glossary of terms, development monitoring, activity manager, quiz manager, education criterion and outputs, wish lists, support of webinar. Harmony Parameters: Third party authoring tools, third party teleconference tools, availability of Tin Can Api, AICC, SCORM. Customizable Parameters: Customizable fields, customizable functions, customizable reporting’s. Student Parameters: Lesson register system, selfcontrolled education, social learning, student manager, student register system, student portal. ELearning Types: Offline learning, online learning. Learning Models: Synchronous learning, asynchronous learning, blended learning. Research Flexible learning model, the fourth stage of distance education and starting with the use of the internet allows giving more effective distance learning and rapid spreading together with development of communication technologies. With these improvements, distance education can be online and used as a preferred method by reputable educational institutions. This situation increasing platforms of online education systems and creating competition environment between platforms and education institutions. At the final, created research fields for how to transferring information more effective with online education programs and identification of advantages and disadvantages provide by or produce educational content platforms. In this context; disadvantages of the lack of online education platforms and what need to produce innovative solutions in the light of developing technologies revealed. With this research to this requirement, performed comparative analysis of online education platforms and researching these online educations how to turn more effective structure with emerging technologies. The scope of this research, universities of Turkey’s most preferred LMS platforms Moodle, Canvas, Blackboard and Sakai determined in order. At the research; developing their own platforms or unknown LMS platforms were excluded from the scope because of content analysis is not possible. In the scope of the research, surveyed LMS platforms can obtain e-Learning Author tools contents and produce own contents. In the content analysis Articulate Storyline because of global market share and Adobe Captivate E-Learning Author Tool due to support of virtual reality has been examined with all other criteria (Market Insight Reports). The following hypotheses were developed within the scope of the research; Hypotheses 1: Platforms of using online education programs have similar features and capabilities. Hypotheses 2: Platforms of using online education programs have innovative media technologies like virtual reality, augmented reality, mixed reality. Hypotheses 3: Platforms of using online education programs have limitations of live streaming like webinar. Hypotheses 4: Platforms of using online education programs have limitations of mobile applications. Hypotheses 5: Authoring tools softwares for produce online education programs have not innovative media technologies like virtual reality, augmented reality, mixed reality. Hypotheses 6: Authoring tools softwares for produce online education programs have similar features and capabilities. Hypotheses 7: Authoring tools softwares for produce online education programs have not compatibility issues. Hypotheses 8: Authoring tools softwares for produce online education programs and platforms of using online education programs; compatible with online educatiın standarts like SCORM and AICC.

# Google Classroom

1. Abstract. The article reveals the experience of organizing blended learning for geography students using Google Classroom, and discloses its potential uses in the study of geography. For the last three years, the authors have tested such inclass and distance courses as “Cartography and Basics of Topography”, “Population Geography”, “Information Systems and Technologies in Tourism Industry”, “Regional Economic and Social World Geography (Europe and the CIS)”, “Regional Economic and Social World Geography (Africa, Latin America, Asia, Anglo-America, Australia and Oceania)”, “Socio-Economic Cartography”. The advantages of using the specified interactive tool during the study of geographical disciplines are highlighted out in the article. As it has been established, the organization of the learning process using Google Classroom ensures the unity of in-class and out-of-class learning; it is designed to realize effective interaction of the subjects learning in real time; to monitor the quality of training and control the students’ learning achievements in class as well as out of it, etc. The article outlines the disadvantages that should be taken into account when organizing blended learning using Google Classroom, including the occasional predominance of students’ external motivation in education and their low level of readiness for work in the classroom; insufficient level of material and technical support in some classrooms; need for out-of-class pedagogical support; lack of guidance on the content aspect of Google Classroom pages, etc. Through the test series conducted during 2016-2017, an increase in the number of geography students with a sufficient level of academic achievements and a decrease of those with a low level of it was revealed. Keywords: Google Classroom, blended learning, in-class and distance learning. 1 Introduction 1.1 The Problem Statement The topicality of the problem using the Google Classroom is determined by a wide range of problems that can be presented in the form of contradictions between the social requirements for geography students’ professional training, its specific characteristics (the need for organizing systematic educational activities outside the specially equipped laboratories of higher educational institutions (HEI): field practices, integrated practices, etc.) and the prevalence of higher educational institutions providing traditional didactic forms, methods and tools; between the constant growth of the volume of students’ independent and individual work and the need for the facilitation of all types of educational activities of geography students at any time and in any place of its course using the available and corresponding tools of information and communication technologies (ICT), including the mobile ones; between the potential use of modern ICTs and inadequate level of readiness for their implementation by university lecturers and students. One of the ways to overcome these contradictions is the implementation of combined geography training, which, according to the research carried out by Andrii M. Striuk [21], is understood as a Geography training technique, integrating the in-class and outof-class educational activities, provided that a pedagogically balanced combination of traditional as well as innovative techniques for the in-class, distance and mobile training is carried out for the effective educational goals achievement. 1.2 Theoretical background Some aspects of the problem under study are highlighted in the scientific articles devoted to theoretical and methodological principles and the methodology of distance education (Aleksandr A. Andreev [1], Myroslav I. Zhaldak [24], Volodymyr M. Kukharenko [3], Yukhym I. Mashbyts [8], Svitlana V. Shokaliuk [17]); blended training organization (Volodymyr M. Kukharenko [6], Natalia V. Rashevska [12], Serhii O. Semerikov [16], Andrii M. Striuk [21], Yurii V. Tryus [23], Bohdan I. Shunevych [18]); development of information-and-education environment (Aleksandr A. Andreev [1], Kateryna I. Slovak [20], Mariia A. Kyslova [7], Liubov F. Panchenko [11], Maiia V. Popel [19], Mariia P. Shyshkina [19]); the use of innovative ICT in the educational process (Valerii Yu. Bykov [3], Illia O. Teplytskyi [14, 15]). The interest in solving the chosen problem is caused by research on geography methods of teaching, which reveals tendencies of educational space renewal by means of informatization of higher education (Oleh M. Topuzov [22]); geographic information systems and technologies (Viktor M. Samoilenko [13]); possibilities of providing geography distance learning (Yurii A. Fedorenko [4]). The blended learning of geography is represented on a larger scale in the writings of foreign scholars: the implementation of combined learning in the study of geography in the first year (Phillipa Mitchell and Pip Forer [9]), the influence of combined geography teaching on critical thinking of students (Özgen Korkmaz and Ufuk Karakuş [5]) and others. The analysis of scientific developments and information resources of domestic higher educational institutions suggests that Moodle is a traditional tool of supporting blended learning in higher education [10], although nowadays there are other alternative options for open learning management systems, Google Classroom in particular. 3 At the same time, Google Classroom as a tool of supporting the blended training for geography students, has not yet found a comprehensive study and full coverage in the scientific writings of domestic researchers. 1.3 The objective of the article The objective of the article is to highlight the experience of supporting the blended training for geography students by using Google Classroom. 2 Presenting the Main Material Google Classroom is an educational interactive tool that allows creating an informatively rich educational environment integrating the Google Docs text editor, Google Drive cloud storage, Gmail and other applications (YouTube, Google Sheets, Google Slides, Google Forms, etc.) [7]. In terms of the interactive on-line interaction the Google Classroom is to: ensure the integrity of classroom and out-of-class work (group, independent, individual, etc.); realize effective interaction of learning subjects in real time through: creating tasks for each particular course and group with hyperlink onto multimedia content; editing and commenting on the state of a student’s tasks; compiling individual tasks into thematic modules; publishing announcements, questions, information digests, etc.; controlling the students’ individual tasks in both classroom and out-of-class time; setting deadlines for each task; commenting on the revised multimedia content offered for the tasks; assessing students’ academic achievements on a national or international scale; copying the academic achievements to the Google Sheets to generate statistical reports, visual monitoring of the quality of training [2]. Within the Google Classroom, the interaction of all learning subjects (“student – student”, “student – student group”, “teacher – student”, “teacher – student group”) takes place not only for distance education (training communication outside the HEI), but also for the traditional in-class learning (training communication within the HEI) using e-mail, electronic conferences and other Internet communication tools. The most common forms of learning tools provided by the Google Classroom include: e-mail (Google Mail), e-conferencing (Hangouts), Google Forms, communication via chats, and others. The revealing of the content of geographic disciplines, as well as the monitoring and control of geography students’ academic achievements, is possible through the implementation of computer-based learning tools, in particular content delivery tools (Docs, Drive, Presentations, YouTube), visualization tools (Presentations, Maps, YouTube, Earth), control tools (Sheets, Forms), etc. (Fig. 1). According to the developed model there have been developed in-class and distance learning courses in the following geographic disciplines: “Cartography and Basics of Topography”, “Population Geography”, “Information Systems and Technologies in Tourism Industry”, “Regional Economic and Social World Geography (countries of Europe and the CIS)”, “Regional Economic and Social World Geography (Africa, Latin America, Asia, Anglo-America, Australia and Oceania)”, “Socio-Economic Cartography” which have been tested for three years of study. Let’s have a closer look at the specific features of implementing the blended teaching of geographic disciplines in Google Classroom.
2. 
3. The model of the information and education environment of blended learning for geography students in HEI based on Google Classroom
4. Each of the offered courses has a clearly defined structure. In the e-class, there are three pages “Stream”, “Students”, “Information", which have a certain content. So, the following basic elements are traditionally presented in “Stream”: “practical / laboratory classes”, “independent work”, “nomenclature”, “individual tasks” etc. For every practical or laboratory lesson contained on the “Stream” page, you can not only add guidance to the tasks, but also attach any necessary file, vocation, and video, i.e., all the elements revealing the content of the subject being studied. The “Students” page usually shows the class code and the contingent of the course attendees with access to their e-mail. The “Information” page, as a rule, provides such elements as “the course tasks and objectives, the classroom, the calendar / schedule of classes”, “curriculum program”, “list of recommended literature (basic, additional)”, “contour maps”, “maps and atlases”, “reference sources”, “methodical materials”, “multimedia gallery”, “Internet resources for creating maps”. The contents of the page “Information” may vary depending on the specifics of the discipline content. The “Information” page contains electronic resources necessary for the tasks provided in 5 “Stream” and provides a wide access to multimedia content, electronic libraries, textbooks, articles, maps, atlases, sites of international organizations, research institutes, databases, etc. The extra benefits of using the specified resource for geographic courses is determined by the fact that most classes require work with contour maps, charts, diagrams, etc. In the Google Classroom, students can create maps by themselves using various editors and resources (DataGraf, Google Earth), tasks (learningapps.org); work with interactive maps (MigrationsMap, kartograph.org), statistical sources (USS\Ukrainian State Statistics Service, countrymeters.info); analytical data of international organizations (UNO, WHO, etc.); demonstrate knowledge of geographic nomenclature (online.seterra.net); conduct thematic control of knowledge (Google Forms) and others. A compulsory element in geography students’ professional training is the knowledge of the geographical nomenclature. As a rule, students pass the nomenclature by oral questioning using wall maps. The disadvantages of such a method of training are considered to be: a large time amount spent on the survey of one student and a group as a whole; the obsolete content of the wall social and economic maps; subjective assessment of knowledge of the nomenclature, etc. Google Classroom allows replacing the traditional methodic of compiling the nomenclature for the interactive one. For example, second-year students are offered the Seterra online resource (https://online.seterra.com) and the Click-that-hood (http://click-that-hood.com) has been adjusted for the third-year students. The content of the task is that a student is to demonstrate the knowledge of the nomenclature within the time limit, save the version and send it to the teacher for marking. The advantages of such a check of the nomenclature are: the individual pace of the task; objectivity of assessment; mapping skills; rational in-class time management. When studying the above-mentioned disciplines, Google Classroom is used with a different didactic purpose. Thus, students of the first year use it with a propaedeutic purpose, as a multimedia library (without downloading works and sending it for correcting analysis to the teacher). This is explained by the fact that in practical classes of the “Cartography and Basics of Topography” course geography students are, first of all, to be able to work with geographic maps and carry out topographical surveys of the area. Therefore, the Google Classroom use will in no way replace work with a map or field surveys. However, freshmen performing such tasks as the definition of the scale of distances and areas, orientation angles, absolute heights on a topographic map face various difficulties. Unfortunately, the degree of understanding of the new material in the classroom in the presence of pedagogical support is much higher than during the independent extra-curriculum knowledge acquisition. In addition, at home, the student is not able to work with most geodesic instruments, whereas in the practical class one needs to know not only their structure, but also use them in practice. The multimedia library content allows revising in full extend what has been learned in class, and it provides access to the video, which demonstrates the algorithm of topographic, promotes a better acquisition of means and methods of topographic survey of the area. While studying the “Population Geography” course the main emphasis is placed on the fact that second-year students, unlike freshmen, should not only review the content of the study material and reproduce it, but also perform constructive tasks, find information in various sources characterizing the population of the world and particular countries, to analyze processes and to identify demographic tendencies, to characterize quantitative and qualitative indices of the country’s population based on the aggregation of cartographic and statistical data – all of it is impossible without having access to relevant record-statistics, which are of a dynamic nature. However, independent search for the necessary data carried out by students often causes difficulties. The teacher can help: by restricting the search field by offering linking to the sites of reputable statistical organizations (“Information – Reference Sources” page). While studying the “Regional Economic and Social Geography” and “Socio-economic Cartography” courses in Year III-IV for Bachelor Degree and Year I for Master Degree, geography students work with Google Classroom in a complex way: they perform the proposed tasks in the required editors (Docs, Sheets, Slides, etc.), send them to the teacher for checking up, comment on the multimedia content of the class, monitoring their academic achievements, offer discussion and data analysis of the information found during the self-search to the colleagues, etc. [2]. Google Classroom acquires a particular importance during the study of “Information Systems and Technologies in Tourism Industry” course, as it can be perceived from the course name, ICT is its inalienable part. Thus, within the Google Classroom it is convenient to consider the hardware and software of the automation work of tourist enterprises; to demonstrate the organizational and communicational provision of the work of the tourist office, etc. In studying this discipline, students learn to use office applications (Google Docs, Microsoft Office 365), specific products (Quick Sales 2.0, SELF-Agent, etc.), get acquainted with automated reservation systems in tourism (Amadeus, Galileo) and others.
5. 
6. Levels of students’ academic achievements in the course “Regional Economic and Social World Geography”
7. At the final stage of the study of the mentioned above geographical disciplines during 2016 and 2017 the students’ academic achievements have been monitored and summed up. As the proof of the developed distance learning courses effectiveness, the results of studying the course “Regional Economic and Social World Geography” are presented in Fig. 2. (traditional training method was used in Group I, and blended learning with Google Classroom – in Group II). Analysis of Fig. 2 illustrates the positive dynamics in the levels of students’ academic achievements in Group II. So, it is noticeable to observe an increase in the number of students with a sufficient level and a decrease in those who have shown a low level. In Group II, the number of high-level students increased from 7.1 % to 10.7 %; with sufficient – from 32.2 % to 42.9 %; with an average decreased from 46.4 % to 42.9 %; with a low – from 14.3 % to 3.5 %. There were no significant changes in Group I. 3 Conclusion 1. Summarizing the above stated, we may claim the benefits of using the Google Classroom for blended learning organization are as follows: real-time interaction of realtime learning subjects, which is particularly valuable if the volume of independent work is increased; the presence of constant pedagogical support and ensuring the integrity of both in-class and out-of-class work; increasing the visual aids in learning; development of critical thinking; formation of professional geographic competencies; attracting students to the familiar electronic environment with the use of ICT; operational control of educational achievements. 2. The disadvantages to take into account when organizing distance learning through the Google Classroom are to be considered: the predominance of external learning motivation and the low level of readiness of individual students for working in the new environment; lack of proper material and technical support for particular academic classrooms in HEI; the need for extra-curriculum pedagogical support, which requires additional time consuming from the teacher; inadequate attention of individual teachers to the problem of in-class and distance learning implementation. 3. Further study of the problem on organizing the blended learning for geography students is planned in the direction of developing a model and methodic of using Google Classroom as a tool of blended training future teachers of geography.
8. Seterra
9. Seterra is a versatile, educational software application that enables users to learn about geography and related topics in an interactive, engaging way. The software is designed to help people of all ages learn about the world around them and explore the different countries, cultures, and landmarks that make up our planet.
10. This book aims to provide an in-depth exploration of Seterra and its features, highlighting the benefits of using this software for educational purposes, and exploring the different ways it can be used to enhance learning outcomes for students and educators alike. The book will begin by providing an overview of Seterra, its history, and its features. It will then explore the different ways in which Seterra can be used in educational settings, including classroom settings, homeschooling environments, and for self-directed learning.
11. **Overview of Seterra**
12. Seterra is a software application designed to help users learn about geography and related topics. The application features a range of interactive maps, quizzes, and games that help users explore the different regions of the world and learn about the countries, cultures, and landmarks that make up our planet. Seterra was first released in 1998 and has since become a popular tool for educators, students, and anyone who wants to learn more about the world around them.
13. One of the key features of Seterra is its interactive maps. These maps allow users to explore different regions of the world and learn about the different countries, capitals, cities, and landmarks that are located within them. The maps are highly detailed, and users can zoom in and out to explore specific regions in greater detail. Users can also click on different locations on the map to learn more about them, including their population, area, and other relevant information.
14. In addition to the interactive maps, Seterra also features a range of quizzes and games that help users test their knowledge of geography and related topics. These quizzes cover a wide range of subjects, including country names, flags, landmarks, and more. The quizzes are highly customizable, allowing users to focus on specific regions or topics and adjust the difficulty level to suit their needs.
15. Seterra also features a range of other tools and resources that make it a valuable learning tool. For example, the software includes a database of country information, including population, GDP, and other key indicators. Users can access this information directly from the software, making it easy to find and learn about different countries around the world.
16. **Using Seterra in Educational Settings**
17. Seterra is a versatile tool that can be used in a range of educational settings. It can be used in traditional classroom settings, as well as in homeschooling environments and for self-directed learning. Here are some of the key benefits of using Seterra in educational settings:
18. **Interactive Learning**
19. One of the key benefits of using Seterra in educational settings is that it promotes interactive learning. The software features a range of interactive maps, quizzes, and games that help students engage with the material in a more meaningful way. By exploring different regions of the world and learning about the countries, cultures, and landmarks that make up our planet, students are able to develop a deeper understanding of geography and related topics.
20. **Customizable Quizzes**
21. Another benefit of using Seterra in educational settings is that the quizzes are highly customizable. Educators can adjust the difficulty level of the quizzes to suit the needs of their students, and can focus on specific regions or topics as needed. This makes it easy to tailor the software to the specific needs of each student or class.
22. **Accessibility**
23. Seterra is also highly accessible, which makes it a valuable tool for students with disabilities or other special needs. The software is available in multiple languages, including English, Spanish, French, German, and others. This means that students who speak different languages can use the software to learn about geography and related topics in their native
24. In conclusion, Seterra is a versatile and powerful software application that offers a range of tools and resources to help users learn about geography and related topics. Its interactive maps, customizable quizzes, and database of country information make it an invaluable learning tool for educators, students, and anyone who wants to learn more about the world around them.
25. Seterra is particularly beneficial in educational settings, where it promotes interactive learning and can be tailored to meet the specific needs of each student or class. Its accessibility, with multiple language options, also makes it a valuable tool for students with disabilities or special needs.
26. Overall, Seterra is an excellent tool for anyone interested in geography and related topics. Its engaging and interactive features make learning about different regions of the world and the countries, cultures, and landmarks within them, a fun and enjoyable experience. Whether you are a student, educator, or just someone interested in learning more about the world, Seterra is a great way to expand your knowledge and explore the different parts of our planet.
27. **Ptable.com**
28. **Introduction**
29. Ptable.com is a website that serves as an interactive periodic table of the elements. It is a valuable tool for students, educators, and professionals in the fields of chemistry and related sciences. The website provides a wealth of information on the properties and characteristics of each element, and it also offers a range of interactive features that help users explore and learn about the periodic table in a fun and engaging way. In this essay, we will explore the different features of Ptable.com, its history and development, and its impact on the field of chemistry.
30. **History and Development**
31. Ptable.com was created by Michael Dayah, a software developer and chemist, in 1997. The website was originally designed as a tool to help Dayah learn the properties and characteristics of the elements more easily. However, it soon became popular among students and educators in the field of chemistry, and Dayah continued to develop and refine the website over the years.
32. Today, Ptable.com is one of the most popular websites for learning about the periodic table of the elements. It has won numerous awards for its design and functionality, and it has been praised by educators and students alike for its ease of use and valuable resources.
33. **Features of Ptable.com**
34. Ptable.com offers a range of features and resources that make it an invaluable tool for learning about the periodic table of the elements. Here are some of the key features of the website:
35. **Interactive Periodic Table**
36. The interactive periodic table is the centerpiece of Ptable.com. It provides a wealth of information on each element, including its name, symbol, atomic number, and weight. Users can click on each element to learn more about its properties and characteristics, including its electron configuration, melting and boiling points, and common compounds.
37. **Customizable Periodic Table**
38. In addition to the standard periodic table, Ptable.com also offers a customizable periodic table. Users can choose which information is displayed for each element, such as atomic radius, electronegativity, or ionization energy. This allows users to focus on the information that is most relevant to their needs.
39. **Visualizations**
40. Ptable.com also offers a range of visualizations that help users explore the periodic table in new and interesting ways. For example, the website includes a 3D periodic table that allows users to rotate and zoom in on each element. There are also interactive graphs and charts that show the trends and patterns in the properties of the elements.
41. **Quiz and Games**
42. Ptable.com also includes a range of quizzes and games that help users test their knowledge of the periodic table. These quizzes cover a range of topics, including the properties of the elements, their symbols and names, and their electron configurations. There are also games that help users learn about the different groups and periods of the periodic table.
43. **Impact of Ptable.com**
44. Ptable.com has had a significant impact on the field of chemistry and related sciences. Here are some of the key ways in which the website has contributed to the field:
45. **Increased Accessibility**
46. Ptable.com has made the periodic table more accessible to students and educators around the world. The website is available for free online, and it provides a wealth of information and resources that can be accessed from anywhere with an internet connection. This has helped to democratize access to knowledge about the periodic table and the elements.
47. **Improved Learning Outcomes**
48. Ptable.com has also contributed to improved learning outcomes for students in the field of chemistry. The website's interactive features and customizable tools help students engage with the material in a more meaningful way, and its quizzes and games help students test their knowledge and reinforce their understanding of the subject matter.
49. **Increased Interest in Chemistry**
50. Finally, Ptable.com has helped to increase interest in the field of chemistry and related sciences.
51. 3d4medical
52. **Introduction:**
53. 3D4Medical is a leading medical technology company that develops advanced 3D anatomy platforms. The company was founded in 2004 and has since revolutionized the way healthcare professionals and students learn and understand the human body. This essay will explore the various features and benefits of 3D4Medical's anatomy platforms, and how they have transformed the way we study and understand human anatomy.
54. **Chapter 1: History of 3D4Medical**
55. 3D4Medical was founded in Ireland in 2004 by John Moore and Niall Johnston. The company started as a small operation focused on developing medical applications for Apple's new iPhone platform. In 2008, the company released its first medical app, "iMuscle," which quickly became a hit among fitness enthusiasts and medical professionals. Since then, the company has expanded its product line and developed a range of advanced 3D anatomy platforms that are used by healthcare professionals and students around the world.
56. **Chapter 2: Features of 3D4Medical's Anatomy Platforms**
57. 3D4Medical's anatomy platforms offer a range of features that make them an incredibly powerful and versatile tool for studying and understanding human anatomy. These include:
58. Detailed 3D models of the human body: 3D4Medical's anatomy platforms provide detailed 3D models of the human body, allowing users to explore the various structures and organs in incredible detail. The models can be rotated, zoomed in and out, and manipulated to provide a comprehensive understanding of the human body.
59. Interactive animations: 3D4Medical's anatomy platforms include interactive animations that demonstrate how different structures and organs in the body function. These animations are an excellent tool for explaining complex concepts and processes in a way that is easy to understand.
60. Customizable models: 3D4Medical's anatomy platforms allow users to customize their models by adding or removing different structures and organs. This feature is particularly useful for educators who want to tailor their lessons to specific topics or areas of study.
61. Augmented reality: 3D4Medical's anatomy platforms also include an augmented reality feature that allows users to view 3D models of the human body in real-time using a smartphone or tablet. This feature provides a unique and immersive learning experience that is both engaging and effective.
62. Cross-sectional views: 3D4Medical's anatomy platforms provide cross-sectional views of the human body, allowing users to see how different structures and organs are positioned in relation to each other. This feature is particularly useful for understanding the relationships between different structures and organs.
63. Quizzes and assessments: 3D4Medical's anatomy platforms include quizzes and assessments to test users' knowledge of human anatomy. This feature is particularly useful for educators who want to assess their students' understanding of a particular topic or area of study.
64. **Chapter 3: Benefits of 3D4Medical's Anatomy Platforms**
65. 3D4Medical's anatomy platforms have numerous benefits that make them an incredibly valuable tool for healthcare professionals, educators, and researchers alike. These benefits include:
66. Improved learning outcomes: Studies have shown that using 3D models and animations to teach human anatomy leads to better learning outcomes than traditional methods. 3D4Medical's anatomy platforms provide a comprehensive and interactive way to learn about the human body, making them an effective tool for educators and students. The detailed 3D models, interactive animations, and customizable features allow for a deeper understanding of the human body.
67. Accessibility: 3D4Medical's anatomy platforms are accessible from anywhere with an internet connection, making them an ideal tool for distance learning and remote education. This feature is particularly important during the COVID-19 pandemic, where many students and educators are unable to attend traditional in-person classes. The ability to access the platform from anywhere in the world allows for more flexibility in learning.
68. Cost-effective: 3D4Medical's anatomy platforms are a cost-effective alternative to traditional anatomy textbooks and atlases. They eliminate the need for expensive dissection equipment and cadavers, making them a more affordable option for educators and students. Additionally, the platform's customizable features allow for a more personalized learning experience, reducing the need for multiple textbooks and resources.
69. Time-saving: 3D4Medical's anatomy platforms allow for a more efficient learning experience by providing immediate access to the information needed. Traditional methods of learning anatomy, such as dissection, can be time-consuming and require significant preparation. With 3D4Medical's anatomy platforms, the information is readily available, saving valuable time for both educators and students.
70. Engaging and interactive: 3D4Medical's anatomy platforms are highly engaging and interactive, providing a unique and immersive learning experience. The ability to manipulate the 3D models, explore cross-sectional views, and access interactive animations makes learning about the human body more engaging and memorable. This can lead to increased motivation and interest in the subject matter.
71. Professional development: 3D4Medical's anatomy platforms are not just for students but also for healthcare professionals. The platform provides a comprehensive resource for continuing education, allowing healthcare professionals to stay up-to-date with the latest research and developments in their field. This can lead to better patient care and improved professional skills.
72. **Conclusion:**
73. In conclusion, 3D4Medical's anatomy platforms are an innovative and effective tool for learning about the human body. The platforms provide a comprehensive and interactive way to explore the complex structures and functions of the human body, leading to improved learning outcomes and a deeper understanding of anatomy. Additionally, the accessibility, cost-effectiveness, time-saving, engaging, and professional development benefits make the platform a valuable resource for healthcare professionals, educators, and students alike. With the continued advancements in technology and education, 3D4Medical's anatomy platforms will undoubtedly continue to transform the way we learn and understand human anatomy.
74. **icell.hudsonalpha**
75. iCell from HudsonAlpha is a unique and innovative platform for exploring human biology at the cellular level. It provides a comprehensive set of tools and resources for scientists, researchers, and educators to study and analyze human cells and their interactions with various drugs and chemicals.
76. iCell offers a range of human cell types, including cardiac, neuronal, and hepatic cells, that can be cultured and manipulated in vitro. These cells can be used to model various human diseases and disorders, allowing researchers to study the underlying mechanisms and develop new treatments and therapies.
77. One of the main advantages of iCell is its ease of use. The platform is designed to be user-friendly, even for those without extensive experience in cell culture or biology. The cells are provided in a ready-to-use format, eliminating the need for time-consuming and complicated culture protocols. This feature makes iCell accessible to a wider range of researchers and educators, including those in non-biological fields such as engineering, physics, and chemistry.
78. iCell also provides a range of tools for analyzing cellular functions and responses to various stimuli. These include high-throughput assays for drug screening, gene expression analysis, and imaging technologies for visualizing cellular structures and processes. The platform is also fully integrated with various software tools and databases for data analysis and interpretation.
79. Another advantage of iCell is its ability to generate large-scale data sets. This allows researchers to conduct comprehensive studies of cellular responses to various drugs and chemicals, providing a deeper understanding of the mechanisms underlying human diseases and disorders. This data can also be used to develop new predictive models for drug toxicity and efficacy, reducing the need for costly and time-consuming animal studies.
80. In addition to its research applications, iCell is also a valuable tool for education and outreach. The platform provides a range of educational resources, including lesson plans, tutorials, and interactive tools for learning about human biology and the applications of cell culture technology. This makes iCell a valuable resource for high school and undergraduate students, as well as for educators and the general public.
81. However, iCell does have some limitations. As with any in vitro system, it may not fully capture the complexity of human biology and disease. Additionally, the cost of using iCell can be a barrier for some researchers and educators, particularly those at smaller institutions or in developing countries.
82. In conclusion, iCell from HudsonAlpha is a unique and innovative platform for studying human biology at the cellular level. Its ease of use, comprehensive set of tools and resources, and ability to generate large-scale data sets make it a valuable tool for research, education, and outreach. While it does have some limitations, its many benefits make it a valuable resource for those seeking to understand and explore human biology.
83. **Learning management systems (LMS)**
84. Learning management systems (LMS) are computer-based systems designed to manage and deliver educational content and training programs. They have become increasingly popular in recent years as technology has advanced and the demand for online learning has grown. LMS platforms offer a range of benefits, including greater flexibility and accessibility, improved tracking and reporting, and increased collaboration and communication between instructors and students. In this essay, we will explore the various benefits of learning management systems and how they can be used to enhance the learning experience.
85. **Flexibility and Accessibility**
86. One of the most significant advantages of LMS platforms is the flexibility and accessibility they offer. With an LMS, students can access course materials and assignments from anywhere with an internet connection, at any time that is convenient for them. This is particularly beneficial for students who have work or family commitments, or who live in remote or underserved areas. LMS platforms also allow for greater flexibility in course delivery, enabling instructors to offer a range of learning activities, including videos, simulations, and interactive exercises.
87. **Improved Tracking and Reporting**
88. LMS platforms also provide improved tracking and reporting capabilities. With an LMS, instructors can monitor student progress and track their performance in real-time. This enables them to identify areas where students may be struggling and provide additional support as needed. Additionally, LMS platforms offer detailed reporting capabilities, allowing instructors to analyze student performance and assess the effectiveness of their teaching methods.
89. **Increased Collaboration and Communication**
90. LMS platforms also facilitate increased collaboration and communication between instructors and students. With an LMS, instructors can create online discussion forums, chat rooms, and other collaborative tools to encourage student interaction and engagement. Additionally, LMS platforms allow for real-time communication between instructors and students, enabling them to provide immediate feedback and support.
91. **Enhanced Learning Experience**
92. Overall, the use of LMS platforms can enhance the learning experience for both students and instructors. LMS platforms offer a range of tools and resources that can be used to create engaging and interactive learning activities, such as gamification and social learning. Additionally, LMS platforms allow instructors to personalize the learning experience for each student, providing customized content and activities based on their individual learning needs and preferences.
93. **Challenges and Limitations of Learning Management Systems**
94. While learning management systems offer many benefits, there are also some challenges and limitations to consider. One of the main challenges is the initial cost of implementing an LMS. Many LMS platforms require significant upfront investments in hardware, software, and training. Additionally, ongoing maintenance and upgrades can be costly, particularly for larger institutions.
95. Another challenge is the need for technical support and training. While LMS platforms are designed to be user-friendly, they can be complex and require specialized knowledge and skills to manage effectively. This can be a barrier for some instructors and students, particularly those who are not comfortable with technology.
96. Finally, some educators argue that the use of LMS platforms can lead to a more passive learning experience for students. While LMS platforms offer a range of interactive and engaging learning activities, some students may still prefer traditional classroom-based learning environments.
97. **Conclusion**
98. Learning management systems have become an increasingly popular tool for managing and delivering educational content and training programs. They offer a range of benefits, including greater flexibility and accessibility, improved tracking and reporting, and increased collaboration and communication between instructors and students. While there are some challenges and limitations to consider, the overall impact of LMS platforms on the learning experience is positive. As technology continues to advance and the demand for online learning grows, the use of LMS platforms is likely to become even more widespread in the years to come.
99. StarBoardSoftware
100. StarBoardSoftware is a powerful tool that is widely used in education to facilitate learning and teaching. This software is designed to enable educators to create interactive lessons, collaborate with students, and provide engaging and interactive content that enhances the learning experience. In this essay, we will discuss the features of StarBoardSoftware and explore how it can be used in education.
101. Overview of StarBoardSoftware
102. StarBoardSoftware is an interactive whiteboard software that enables educators to create dynamic and engaging presentations. The software offers a range of tools, including drawing tools, annotation tools, and multimedia tools, to facilitate the creation of interactive content. It also includes a range of templates and pre-designed graphics that can be used to create visually appealing presentations.
103. One of the key features of StarBoardSoftware is its integration with other technologies, such as projectors, interactive displays, and tablets. This enables educators to deliver presentations and lessons in a variety of formats, making it more accessible and engaging for students.
104. Using StarBoardSoftware in Education
105. There are many ways in which StarBoardSoftware can be used in education to facilitate learning and teaching. Some of the most common applications of this software include:
106. Creating Interactive Presentations - StarBoardSoftware enables educators to create interactive presentations that engage students and encourage active learning. The software includes a range of tools, such as drawing tools, multimedia tools, and annotation tools, which can be used to create dynamic and engaging content.
107. Collaborating with Students - StarBoardSoftware facilitates collaboration between educators and students. The software enables students to interact with the content being presented and to participate in group activities and discussions. This collaborative approach to learning can help to foster engagement and motivation among students.
108. Providing Feedback - StarBoardSoftware enables educators to provide immediate feedback to students. The software includes a range of assessment tools, such as quizzes and polls, which can be used to gauge student understanding and provide feedback on their progress.
109. Supporting Different Learning Styles - StarBoardSoftware can be used to support different learning styles. The software includes a range of multimedia tools, such as videos and audio files, which can be used to accommodate different learning preferences.
110. Enhancing Accessibility - StarBoardSoftware can enhance accessibility for students with disabilities. The software includes features, such as text-to-speech and screen readers, which can be used to make content more accessible for students with visual or auditory impairments.
111. Best Practices for Using StarBoardSoftware in Education
112. To maximize the benefits of StarBoardSoftware, educators should follow some best practices when using the software. These include:
113. Planning Lessons in Advance - Educators should plan their lessons in advance to ensure that they are well-organized and engaging. This can help to maximize student engagement and improve learning outcomes.
114. Using Multimedia Content - Educators should use multimedia content, such as videos and images, to enhance the learning experience. This can help to make content more engaging and accessible for students.
115. Encouraging Interaction - Educators should encourage interaction and collaboration among students. This can help to foster engagement and motivation, and can lead to better learning outcomes.
116. Providing Feedback - Educators should provide feedback to students to help them to identify areas where they need to improve. This can be done through quizzes, polls, or other assessment tools included in StarBoardSoftware.
117. Training and Support - Educators should receive training and support on how to use StarBoardSoftware effectively. This can help to ensure that they are able to use the software to its full potential and can maximize the benefits for their students.
118. Conclusion
119. StarBoardSoftware is a versatile tool that offers educators the ability to create dynamic and engaging content, collaborate with students, and provide immediate feedback. Its integration with other technologies, such as projectors, interactive displays, and tablets, allows for a variety of presentation formats that cater to different learning preferences.
120. Moreover, the software's range of multimedia tools and assessment features can support different learning styles and enhance accessibility for students with disabilities. By following best practices, such as planning lessons in advance, using multimedia content, encouraging interaction, providing feedback, and receiving training and support, educators can maximize the benefits of StarBoardSoftware and improve learning outcomes for their students.
121. Overall, StarBoardSoftware is a powerful asset for educators in the digital age, enabling them to create interactive and engaging learning environments that foster collaboration, critical thinking, and knowledge retention. Its versatility and accessibility make it a valuable tool for educators at all levels of education, from K-12 to higher education institutions. As technology continues to advance, StarBoardSoftware will undoubtedly play an increasingly important role in shaping the future of education.
122. **Smart board**
123. **Introduction**
124. Hitachi board is a digital whiteboard developed by Hitachi, a multinational conglomerate headquartered in Tokyo, Japan. The Hitachi board offers an interactive and collaborative learning experience by integrating a range of multimedia tools and features that allow educators to create dynamic and engaging content. This essay explores the various benefits of Hitachi board and its impact on education.
125. **Benefits of Hitachi Board**
126. **Improved Engagement** 
     1. The Hitachi board encourages student engagement by creating an interactive and immersive learning experience. The board allows teachers to create visually appealing presentations, integrate multimedia content such as videos and images, and annotate in real-time. This feature helps students stay engaged and focused, leading to improved learning outcomes.
127. **Collaborative Learning** 
     1. The Hitachi board enables collaborative learning by allowing multiple students to work on the same board simultaneously. This feature encourages students to work together, brainstorm ideas, and engage in discussions, which helps them develop critical thinking and problem-solving skills.
128. **Digital Writing and Drawing** 
     1. Hitachi board enables digital writing and drawing, which allows educators to create dynamic and interactive content on the board. The digital writing feature enables the creation of handwritten notes, diagrams, and math equations that can be saved and shared with students. This feature also allows for easy editing and erasing, which facilitates more efficient teaching and learning.
129. **Integration with other Technologies** 
     1. The Hitachi board is compatible with other technologies such as projectors and interactive displays, which enhances its versatility. This integration allows educators to use different presentation formats that cater to different learning preferences.
130. **Accessibility** 
     1. Hitachi board features make it accessible to students with disabilities. Its range of multimedia tools and assessment features can support different learning styles and enhance accessibility for students with visual and hearing impairments. The board's touch screen feature enables students with motor impairments to interact with the board easily.
131. **Impact of Hitachi Board on Education**
132. **Improved Learning Outcomes** 
     1. The Hitachi board's features improve learning outcomes by encouraging student engagement, collaboration, and critical thinking. Interactive and dynamic learning environments created by the board help students to remember and retain knowledge.
133. **More Efficient Teaching** 
     1. The digital writing and drawing features of Hitachi board make teaching more efficient. Educators can create and save notes, diagrams, and equations that can be reused in future lessons. This feature also enables teachers to modify content and tailor their teaching methods to suit individual students' needs.
134. **Increased Accessibility** 
     1. Hitachi board features make education more accessible to students with disabilities. The board's multimedia tools and assessment features support different learning styles and enhance accessibility for students with visual and hearing impairments. This accessibility allows all students to access quality education.
135. **Preparation for the Future** 
     1. The Hitachi board prepares students for the future by introducing them to technology and digital learning environments. As technology continues to advance, digital tools such as Hitachi board will become increasingly important in shaping the future of education.
136. **Conclusion**
137. In conclusion, the Hitachi board is a valuable tool for educators seeking to create interactive and engaging learning environments. Its integration with other technologies, digital writing and drawing, collaboration features, and accessibility make it a versatile and powerful asset for educators at all levels of education. The board's impact on education is positive, with improved learning outcomes, more efficient teaching, increased accessibility, and preparation for the future. Hitachi board's development of innovative digital tools that enhance education and enable inclusive education is a step in the right direction.
138. **Prometan**
139. Introduction
140. The Promethean board is an interactive whiteboard developed by Promethean, a multinational education technology company based in the United Kingdom. The board provides an innovative and engaging learning experience by integrating various multimedia tools and features that enable teachers to create dynamic and interactive content. This essay explores the benefits of Promethean board and its impact on education.
141. Benefits of Promethean Board
142. Interactive Learning
     1. The Promethean board promotes interactive learning by providing teachers with a platform to create engaging and interactive content. The board's touch-screen feature allows students to interact with the content in real-time, which makes learning more engaging and memorable. This interactive feature helps to create a more engaging learning environment that helps students to understand complex concepts.
143. Increased Collaboration
     1. Promethean board's features encourage collaboration among students by providing a platform for teamwork and brainstorming. The board's interactive features enable multiple students to work together on the same content, which encourages communication and collaboration. This collaboration helps students to develop critical thinking skills and problem-solving skills, which are essential in the real world.
144. Multi-Modal Learning
     1. The Promethean board supports multi-modal learning by incorporating various multimedia tools and features. These tools allow teachers to incorporate images, videos, and other interactive content, which improves students' understanding of complex concepts. The board's multi-modal approach also accommodates different learning styles and preferences, making it an inclusive and accessible tool for all learners.
145. Flexible Teaching
     1. Promethean board enables flexible teaching by allowing teachers to modify content in real-time. Teachers can easily add, delete or modify content as needed, making it easier to cater to individual student needs. This flexibility helps to create a more personalized learning environment that caters to the needs of individual students.
146. Improved Learning Outcomes
     1. Promethean board's features help to improve learning outcomes by creating an engaging and interactive learning environment. The board's interactive features promote active learning, which improves student engagement and retention. The board's multi-modal approach accommodates different learning styles, making it easier for students to understand and retain information.
147. Impact of Promethean Board on Education
148. Enhanced Student Engagement
     1. The Promethean board's features improve student engagement by creating a dynamic and interactive learning environment. This environment helps students to understand complex concepts, which improves their engagement and motivation to learn.
149. Improved Teacher Efficiency
     1. Promethean board features help to improve teacher efficiency by making it easier to create and modify content. The board's interactive features make it easier to create engaging and interactive content, which saves time and improves efficiency.
150. Increased Collaboration
     1. Promethean board's features improve collaboration among students by providing a platform for teamwork and brainstorming. This collaboration helps students to develop critical thinking and problem-solving skills, which are essential in the real world.
151. Inclusive Education
     1. Promethean board's multi-modal approach makes education more inclusive by accommodating different learning styles and preferences. The board's accessibility features also make it easier for students with disabilities to engage with the content.
152. Preparation for the Future
     1. Promethean board prepares students for the future by introducing them to technology and digital learning environments. This technology helps to prepare students for the digital world, where technology is an essential part of everyday life.
     2. Conclusion
     3. The Promethean board is a valuable tool for educators seeking to create interactive and engaging learning environments. Its features, such as interactive learning, multi-modal learning, increased collaboration, flexible teaching, and improved learning outcomes, make it a versatile and valuable tool for educators at all levels of education. The Promethean board's impact on education is positive, with improved student engagement, increased teacher efficiency, increased collaboration, inclusive education, and preparation for the future. The Promethean board's development of innovative digital tools that enhance education and transform traditional classrooms make it a key player in the evolution of education. Its features, including its interactivity, multi-modal approach, and flexibility, make it an essential tool for educators seeking to enhance student engagement and improve learning outcomes. As technology continues to advance, the Promethean board will continue to play a critical role in transforming the education landscape and empowering students with the skills they need to succeed in the digital age.
     4. **Smart board**
153. Introduction
154. Smartboard is an interactive whiteboard designed to provide a dynamic and interactive learning experience for students and educators. It is a revolutionary technology that has transformed traditional classrooms by allowing educators to create engaging and interactive lessons. This essay explores the benefits of Smartboard and its impact on education.
155. Benefits of Smartboard
156. Interactive Learning
157. Smartboard promotes interactive learning by allowing educators to create interactive and engaging lessons. Students can interact with the content displayed on the board, making learning more engaging and memorable. This interactive feature helps to create a more engaging learning environment that helps students to understand complex concepts.
158. Multi-Modal Learning
159. Smartboard supports multi-modal learning by incorporating various multimedia tools and features. These tools allow educators to incorporate images, videos, and other interactive content, which improves students' understanding of complex concepts. The board's multi-modal approach also accommodates different learning styles and preferences, making it an inclusive and accessible tool for all learners.
160. Increased Collaboration
161. Smartboard's features encourage collaboration among students by providing a platform for teamwork and brainstorming. The board's interactive features enable multiple students to work together on the same content, which encourages communication and collaboration. This collaboration helps students to develop critical thinking skills and problem-solving skills, which are essential in the real world.
162. Flexible Teaching
163. Smartboard enables flexible teaching by allowing educators to modify content in real-time. Educators can easily add, delete or modify content as needed, making it easier to cater to individual student needs. This flexibility helps to create a more personalized learning environment that caters to the needs of individual students.
164. Improved Learning Outcomes
165. Smartboard's features help to improve learning outcomes by creating an engaging and interactive learning environment. The board's interactive features promote active learning, which improves student engagement and retention. The board's multi-modal approach accommodates different learning styles, making it easier for students to understand and retain information.
166. Impact of Smartboard on Education
167. Enhanced Student Engagement
168. Smartboard's features improve student engagement by creating a dynamic and interactive learning environment. This environment helps students to understand complex concepts, which improves their engagement and motivation to learn.
169. Improved Teacher Efficiency
170. Smartboard features help to improve teacher efficiency by making it easier to create and modify content. The board's interactive features make it easier to create engaging and interactive content, which saves time and improves efficiency.
171. Increased Collaboration
172. Smartboard's features improve collaboration among students by providing a platform for teamwork and brainstorming. This collaboration helps students to develop critical thinking and problem-solving skills, which are essential in the real world.
173. Inclusive Education
174. Smartboard's multi-modal approach makes education more inclusive by accommodating different learning styles and preferences. The board's accessibility features also make it easier for students with disabilities to engage with the content.
175. Preparation for the Future
176. Smartboard prepares students for the future by introducing them to technology and digital learning environments. This technology helps to prepare students for the digital world, where technology is an essential part of everyday life.
177. Conclusion
178. In conclusion, Smartboard is a powerful tool for educators seeking to create engaging and interactive learning environments. Its features, such as interactive learning, multi-modal learning, increased collaboration, flexible teaching, and improved learning outcomes, make it a versatile and valuable tool for educators at all levels of education. Smartboard's impact on education is positive, with improved student engagement, increased teacher efficiency, increased collaboration, inclusive education, and preparation for the future. Smartboard's development of innovative digital tools that enhance education and transform traditional classrooms make it a key player in the evolution of education.
179. **Microsoft Visio**
180. Microsoft Visio is a powerful tool for creating diagrams, flowcharts, and other visual representations of complex concepts. While it is often used in the business world, it can also be a valuable tool for educators seeking to create engaging and interactive educational materials. In this essay, we will explore the benefits of using Microsoft Visio in education and how it can be used effectively in the classroom.
181. One of the main benefits of using Microsoft Visio in education is its ability to simplify complex concepts. Often, students struggle to understand abstract or complicated ideas that are presented in text or lecture form. By using Visio to create diagrams, flowcharts, and other visual representations, educators can provide students with a more tangible understanding of these concepts. For example, a teacher could use Visio to create a flowchart that illustrates the process of photosynthesis, making it easier for students to understand how the process works.
182. Another benefit of using Microsoft Visio in education is its ability to promote collaboration. Visio makes it easy for multiple users to work on the same document simultaneously, allowing students to work together on group projects or presentations. This can be especially valuable for distance learning, where students may be physically separated but can still collaborate effectively using Visio's collaborative tools.
183. Microsoft Visio is also highly customizable, which makes it a versatile tool for educators. Educators can create their own templates for various diagrams and flowcharts, allowing them to tailor the tool to their specific needs. This can save time and effort in creating new materials, as educators can simply modify existing templates to suit their needs.
184. Additionally, Microsoft Visio can be used to create interactive materials that engage students in the learning process. For example, educators can use Visio to create interactive quizzes or games that test students' understanding of complex concepts. This can make the learning process more engaging and enjoyable for students, which can lead to better retention of information.
185. One example of how Microsoft Visio can be used in education is to create a visual representation of a literature analysis. By using Visio to create a diagram that outlines the main characters, themes, and plot points of a novel, educators can help students better understand the material and prepare for exams. Similarly, Visio can be used to create diagrams that illustrate complex mathematical or scientific concepts, making it easier for students to visualize and understand these ideas.
186. In conclusion, Microsoft Visio is a valuable tool for educators seeking to create engaging and interactive educational materials. Its ability to simplify complex concepts, promote collaboration, and create customizable and interactive materials makes it a versatile tool for educators at all levels of education. By incorporating Microsoft Visio into their teaching materials, educators can enhance the learning experience for their students and prepare them for success in the digital age.
187. Microsoft PowerPoint
188. Microsoft PowerPoint is a powerful presentation software that has become a staple in both the business and education worlds. While it is often used for creating business presentations, it can also be a valuable tool for educators seeking to create engaging and interactive educational materials. In this essay, we will explore the benefits of using Microsoft PowerPoint in education and how it can be used effectively in the classroom.
189. One of the main benefits of using Microsoft PowerPoint in education is its ability to create engaging and interactive presentations. Educators can use PowerPoint to create visually appealing and interactive presentations that capture students' attention and help them better understand complex concepts. By incorporating multimedia elements such as images, videos, and audio, educators can create engaging and interactive presentations that keep students interested and focused.
190. Another benefit of using Microsoft PowerPoint in education is its versatility. Educators can use PowerPoint to create a wide variety of materials, including lectures, handouts, and quizzes. For example, a teacher could use PowerPoint to create a lecture on the Civil War that includes images, maps, and other visual aids. Alternatively, an educator could use PowerPoint to create a quiz that tests students' understanding of the material covered in class.
191. Microsoft PowerPoint is also highly customizable, which makes it a valuable tool for educators. Educators can create their own templates, incorporating their own logos and colors to create a consistent look and feel across all of their educational materials. Additionally, educators can modify existing templates to suit their specific needs, saving time and effort in creating new materials.
192. Another benefit of using Microsoft PowerPoint in education is its ability to promote collaboration. PowerPoint makes it easy for multiple users to work on the same presentation simultaneously, allowing students to work together on group projects or presentations. This can be especially valuable for distance learning, where students may be physically separated but can still collaborate effectively using PowerPoint's collaborative tools.
193. Microsoft PowerPoint can also be used to create interactive materials that engage students in the learning process. For example, educators can use PowerPoint to create interactive quizzes or games that test students' understanding of complex concepts. This can make the learning process more engaging and enjoyable for students, which can lead to better retention of information.
194. One example of how Microsoft PowerPoint can be used in education is to create a visual timeline of historical events. By using PowerPoint to create a timeline that includes images and descriptions of key events, educators can help students better understand the sequence of events and how they led to important historical outcomes. Similarly, PowerPoint can be used to create presentations that teach students about complex scientific or mathematical concepts, making it easier for students to visualize and understand these ideas.
195. In conclusion, Microsoft PowerPoint is a valuable tool for educators seeking to create engaging and interactive educational materials. Its ability to create visually appealing and interactive presentations, promote collaboration, and create customizable and interactive materials makes it a versatile tool for educators at all levels of education. By incorporating Microsoft PowerPoint into their teaching materials, educators can enhance the learning experience for their students and prepare them for success in the digital age.
196. Crocodile Mathematics
197. Crocodile Mathematics is a powerful mathematics software designed for students and teachers of all levels. This software enables users to create mathematical equations, graphs, and charts easily, making it a valuable tool for learning and teaching mathematics. In this essay, we will explore the benefits of using Crocodile Mathematics in education and how it can be used effectively in the classroom.
198. One of the main benefits of using Crocodile Mathematics in education is its ability to create mathematical equations and graphs quickly and easily. Students can use this software to solve complex mathematical problems in a matter of minutes, improving their problem-solving skills and understanding of mathematical concepts. Teachers can use this software to create engaging and interactive lessons that help students better understand complex mathematical concepts.
199. Another benefit of using Crocodile Mathematics in education is its ability to create graphs and charts quickly and easily. Teachers can use this software to create graphs and charts that illustrate complex mathematical concepts, making it easier for students to visualize and understand these concepts. This can be especially valuable for visual learners who may struggle with abstract mathematical concepts.
200. Crocodile Mathematics is also highly customizable, which makes it a valuable tool for educators. Teachers can create their own templates, incorporating their own logos and colors to create a consistent look and feel across all of their educational materials. Additionally, teachers can modify existing templates to suit their specific needs, saving time and effort in creating new materials.
201. Another benefit of using Crocodile Mathematics in education is its ability to promote collaboration. This software makes it easy for multiple users to work on the same project simultaneously, allowing students to work together on group projects or assignments. This can be especially valuable for distance learning, where students may be physically separated but can still collaborate effectively using Crocodile Mathematics' collaborative tools.
202. Crocodile Mathematics can also be used to create interactive materials that engage students in the learning process. For example, teachers can use this software to create interactive quizzes or games that test students' understanding of complex mathematical concepts. This can make the learning process more engaging and enjoyable for students, which can lead to better retention of information.
203. One example of how Crocodile Mathematics can be used in education is to create a visual representation of a geometric shape. By using this software to create a three-dimensional model of a shape, students can better understand its properties and how it relates to other mathematical concepts. Similarly, Crocodile Mathematics can be used to create interactive visualizations of mathematical concepts, making it easier for students to visualize and understand these ideas.
204. In conclusion, Crocodile Mathematics is a valuable tool for educators seeking to create engaging and interactive educational materials. Its ability to create mathematical equations, graphs, and charts quickly and easily, promote collaboration, and create customizable and interactive materials makes it a versatile tool for educators at all levels of education. By incorporating Crocodile Mathematics into their teaching materials, educators can enhance the learning experience for their students and prepare them for success in the digital age.
205. Crocodile Physics
206. Crocodile Physics is a simulation software program used for educational purposes in the field of physics. It is designed to help students understand the basic concepts of physics by allowing them to create virtual experiments and observe the results in a safe and controlled environment. In this essay, we will explore the features, benefits, and limitations of Crocodile Physics.
207. One of the main features of Crocodile Physics is its user-friendly interface. The software has a simple drag-and-drop functionality that allows users to create circuits and experiments easily. The software also provides a range of tools and options that can be used to customize experiments and simulations according to the user's requirements.
208. Crocodile Physics also includes a library of pre-built circuits and simulations that cover a wide range of topics in physics. These pre-built simulations can be used as a starting point for students to understand the concepts before they create their own experiments. The simulations cover topics such as electricity, magnetism, waves, optics, and mechanics.
209. Another key feature of Crocodile Physics is its ability to simulate real-world phenomena. The software uses advanced physics engines to simulate the behavior of objects and circuits accurately. This allows students to observe and understand the behavior of physical phenomena that are difficult to visualize in real life.
210. One of the main benefits of Crocodile Physics is its ability to engage students in learning. The software provides an interactive learning experience that encourages students to explore and experiment with different concepts. This approach to learning makes the subject more enjoyable and memorable, leading to better retention of knowledge.
211. Crocodile Physics also allows students to work at their own pace. The software provides immediate feedback on the results of each experiment, allowing students to correct their mistakes and learn from their experiences. This makes the learning process more effective and efficient.
212. However, Crocodile Physics also has some limitations. The software is limited to simulation-based learning and does not provide hands-on experience with physical objects. This can be a disadvantage for students who prefer hands-on learning. Additionally, the software is limited to basic physics concepts and does not cover advanced topics in detail.
213. In conclusion, Crocodile Physics is a useful tool for teaching basic physics concepts in an interactive and engaging way. The software's user-friendly interface and range of pre-built simulations make it easy for students to explore and experiment with different concepts. While the software has its limitations, it is still a valuable resource for students and educators alike.
214. **Crocodile Chemistry Programı**
215. Crocodile Chemistry is a computer software program designed for teaching and learning chemistry. It was developed by Crocodile Clips Ltd, a UK-based educational software company, and is available for Windows and Macintosh operating systems. The program provides a virtual laboratory environment where students can simulate and experiment with different chemical reactions and concepts.
216. One of the main features of Crocodile Chemistry is the extensive collection of interactive simulations, which cover a wide range of topics in chemistry, such as chemical bonding, reaction kinetics, acid-base chemistry, and electrochemistry. The simulations are designed to be highly interactive and user-friendly, with intuitive drag-and-drop interfaces and real-time feedback. This makes it easy for students to experiment and explore different chemical phenomena and to visualize the effects of different variables on chemical reactions.
217. In addition to the simulations, Crocodile Chemistry also includes a range of other tools and resources to support chemistry learning. These include virtual lab equipment, such as burettes, pipettes, and beakers, as well as a range of virtual chemicals and substances. The program also includes a database of chemical properties and information, as well as a glossary of key terms and concepts.
218. One of the benefits of using Crocodile Chemistry is that it provides a safe and cost-effective way to teach and learn chemistry. With the program, students can experiment with different chemical reactions and phenomena without the need for actual chemicals or lab equipment, which can be expensive and potentially hazardous. This also means that students can repeat experiments as many times as they like, without the need to restock or clean up after each experiment.
219. Another advantage of Crocodile Chemistry is that it can be used to supplement traditional classroom teaching, providing students with an additional tool to reinforce their understanding of key concepts and principles. The program is also highly customizable, with the ability to tailor simulations and resources to the specific needs of different students and classes.
220. In conclusion, Crocodile Chemistry is a highly useful and effective tool for teaching and learning chemistry. Its interactive simulations, virtual lab equipment, and extensive resources provide students with a safe and engaging way to experiment with different chemical reactions and concepts. By supplementing traditional classroom teaching, Crocodile Chemistry can help to reinforce students' understanding of key chemistry principles and prepare them for future study and research in this important field.
221. **Yenka Technology**
222. Yenka is a powerful educational technology platform that provides interactive and engaging tools for teaching science, technology, engineering, and mathematics (STEM) subjects. Developed by Crocodile Clips Ltd., Yenka is a software suite designed to help teachers and students across the world to improve their understanding of STEM subjects and promote learning in a fun and engaging manner.
223. The Yenka suite includes several software tools, including Yenka Electronics, Yenka Physics, Yenka Chemistry, Yenka Mathematics, and Yenka Technology. Each of these tools offers a unique set of features designed to help teachers and students learn and teach STEM subjects more efficiently.
224. Yenka Technology, in particular, is an advanced simulation and modeling software that helps students learn the principles of electrical engineering, circuit design, and control systems. The software enables students to create virtual circuits, test and modify them, and observe the results in real-time. This interactive approach to learning helps students develop a deeper understanding of how electrical circuits work and how they can be used in various applications.
225. One of the key features of Yenka Technology is its extensive library of virtual components. These include resistors, capacitors, diodes, transistors, and other electronic components that can be used to build complex circuits. Students can drag and drop these components onto a virtual breadboard, connect them using wires, and test their circuits by applying voltage and current.
226. In addition to the virtual components, Yenka Technology also includes a range of virtual instruments, such as oscilloscopes, multimeters, and function generators. These instruments enable students to measure the voltage, current, and frequency of their circuits, providing them with real-time feedback on their designs.
227. Another notable feature of Yenka Technology is its ability to simulate control systems. This includes systems that use microcontrollers, sensors, and actuators to control physical devices such as motors, lights, and switches. The software allows students to design, simulate, and test these systems, helping them to develop a deeper understanding of how control systems work and how they can be used in various applications.
228. Yenka Technology also offers a range of pre-built simulations and activities that cover a range of topics, from simple circuits to complex control systems. These activities can be used by teachers to supplement their classroom instruction or by students to practice their skills and test their understanding of the material.
229. Overall, Yenka Technology is a powerful educational technology platform that offers a range of features designed to help students learn and teachers teach STEM subjects more effectively. Its interactive approach to learning, extensive library of virtual components, and simulation capabilities make it a valuable tool for anyone looking to improve their understanding of electrical engineering and control systems.
230. **Virtual Laborotoriya Sistemləri**
231. Virtual laboratory systems, also known as online or remote laboratories, are digital environments that allow students and researchers to conduct scientific experiments and investigations using a computer or mobile device. These systems provide a cost-effective and flexible solution for institutions that cannot afford traditional physical laboratories or need to supplement their existing laboratory resources.
232. Virtual laboratory systems are designed to simulate real-world experiments, enabling students to practice skills and techniques in a safe and controlled environment. These systems allow students to repeat experiments multiple times, which helps to reinforce their understanding of scientific concepts and principles. In addition, virtual laboratory systems offer a level of interactivity and flexibility that is not possible with traditional laboratories. Students can interact with virtual equipment and tools, observe the effects of different variables, and adjust experimental parameters in real-time.
233. One of the key advantages of virtual laboratory systems is that they can be accessed from anywhere, at any time. This makes them particularly useful for distance learning programs, where students may not have access to physical laboratory resources. Virtual laboratory systems can also be used to supplement traditional laboratory resources, allowing students to complete experiments outside of scheduled laboratory sessions.
234. Another advantage of virtual laboratory systems is that they can reduce the costs associated with laboratory equipment and supplies. Because virtual laboratory systems are digital, there is no need to purchase or maintain expensive laboratory equipment or supplies. This can result in significant cost savings for institutions, particularly those with limited budgets.
235. However, virtual laboratory systems also have some limitations. For example, they may not be able to replicate the full range of experiences and challenges that students may encounter in a physical laboratory. In addition, virtual laboratory systems may not provide the same level of tactile feedback or sensory experiences that students can get from physical laboratory equipment.
236. Despite these limitations, virtual laboratory systems have become an increasingly popular tool for teaching and research in many fields, including biology, chemistry, physics, engineering, and computer science. As technology continues to evolve, it is likely that virtual laboratory systems will become even more sophisticated and effective, offering students and researchers new opportunities to explore and discover the world around them.
237. **Labster**
238. Labster is a virtual laboratory simulation platform that provides students with an interactive and engaging learning experience. The platform is designed to enhance science education by providing students with a unique opportunity to experiment and explore scientific concepts in a virtual environment.
239. One of the primary advantages of Labster is its ability to simulate real-world laboratory scenarios in a safe and risk-free environment. This means that students can conduct experiments without the risk of injury or damage to equipment. Additionally, Labster enables students to explore complex scientific concepts that may be difficult to demonstrate in a traditional laboratory setting.
240. Labster offers a range of virtual laboratory simulations across various scientific fields, including biology, chemistry, and physics. Each simulation is designed to be immersive and interactive, providing students with a hands-on learning experience. For example, in the biology simulations, students can explore the human body and its functions, while in chemistry simulations, they can conduct experiments with different chemical reactions.
241. Another benefit of Labster is that it provides students with instant feedback on their progress. The platform offers quizzes and assessments that enable students to test their knowledge and understanding of the scientific concepts they are exploring. This feedback is critical in helping students identify areas where they may need to focus more attention and improve their understanding of the material.
242. In addition to its educational benefits, Labster is also environmentally friendly. The platform reduces the need for physical laboratory equipment and supplies, which can be expensive and wasteful. By using virtual simulations, Labster promotes sustainability and reduces the environmental impact of science education.
243. One of the key strengths of Labster is its accessibility. The platform is available online and can be accessed from anywhere with an internet connection. This makes it an excellent resource for distance learning and remote education. Additionally, Labster is compatible with a range of devices, including smartphones, tablets, and laptops, making it easy for students to access the platform from their preferred device.
244. In conclusion, Labster is an innovative and engaging platform that provides students with a unique opportunity to explore and experiment with scientific concepts in a safe and risk-free environment. The platform's immersive simulations, instant feedback, and accessibility make it an excellent resource for science education. With Labster, students can develop a deeper understanding of science while also promoting sustainability and reducing the environmental impact of laboratory education.
245. **PhET (Physics Education Technology) Interactive Simulations**
246. Introduction
247. PhET Interactive Simulations is an educational resource developed at the University of Colorado Boulder in 2002 with the aim of enhancing the learning of physics through interactive simulations. These simulations are designed to provide a hands-on and immersive learning experience that helps students understand complex physics concepts in an easy and fun way. In this paper, we will explore the background and development of PhET simulations, how they work, their impact on physics education, and their future prospects.
248. Background and Development
249. PhET Interactive Simulations is the brainchild of Nobel Laureate Carl Wieman, a physics professor at the University of Colorado Boulder. In 2002, Wieman noticed that students in his physics class were struggling to grasp the fundamental concepts of the subject. He realized that the traditional methods of teaching physics, which relied heavily on lectures and textbooks, were not engaging students in the way that he had hoped.
250. Wieman realized that there was a need for a new approach to teaching physics, one that was more interactive and immersive. He teamed up with his colleague, Katherine Perkins, and a group of graduate students to develop PhET Interactive Simulations.
251. PhET Interactive Simulations were developed using Java applets, a technology that was popular at the time. However, in 2011, the team began to switch to HTML5 technology, which allowed for better compatibility with different devices and platforms. Today, PhET simulations are available in HTML5, and users can access them from any web browser without the need for any additional software or plugins.
252. How PhET Simulations Work
253. PhET simulations are designed to provide an interactive and immersive learning experience. Each simulation consists of a virtual environment that allows users to explore different physics concepts through hands-on experimentation. Users can manipulate different variables and observe the effects of their actions in real-time.
254. For example, one simulation might allow users to explore the behavior of objects under different gravitational forces, while another might allow users to explore the behavior of waves in different media. Users can change variables such as mass, velocity, frequency, and amplitude to see how they affect the system under study.
255. PhET simulations are designed to be user-friendly and accessible to learners of all ages and backgrounds. They come with a range of support materials, such as lesson plans, teacher guides, and student guides, that help users get the most out of the simulations.
256. Impact on Physics Education
257. PhET simulations have had a significant impact on physics education. They have been used in classrooms around the world to supplement traditional teaching methods and provide a more engaging and interactive learning experience for students.
258. A study conducted by the University of Colorado Boulder found that students who used PhET simulations in their physics classes scored significantly higher on exams than those who did not. The study also found that students who used PhET simulations had a better understanding of fundamental physics concepts and were more likely to continue studying physics at higher levels.
259. PhET simulations have also been used to enhance teacher training programs. Teachers who use PhET simulations in their classrooms are better equipped to engage their students and provide a more effective learning experience. This, in turn, can lead to increased student interest and engagement in physics, as well as improved student outcomes.
260. Future Prospects
261. PhET simulations are continually evolving, with new simulations and features being added regularly. The team behind PhET is committed to improving the simulations and making them accessible to as many users as possible.
262. One area of focus for the PhET team is the development of simulations that are specifically designed for younger learners. The team recognizes the importance of introducing physics concepts at an early age and is working to create simulations that are engaging and accessible to children.
263. PhET Interactive Simulations have been a game-changer in the field of physics education, and their impact is likely to continue to grow in the future. In this section, we will explore some of the future prospects of PhET simulations and how they are likely to evolve in the coming years.
264. Expansion to Other Science Fields
265. PhET simulations have primarily focused on physics, but there is potential to expand them to other science fields such as chemistry, biology, and earth sciences. The PhET team has already started developing simulations for these fields, and we can expect to see more in the future. This expansion will provide a broader range of educational resources for students and teachers in these fields.
266. Integration with Virtual Reality (VR)
267. Virtual reality is becoming increasingly popular in education, and there is potential for PhET simulations to integrate with VR technology. This integration would allow users to immerse themselves in the simulation environment and interact with it in a more realistic way. This would provide an even more engaging and immersive learning experience for students.
268. Adaptive Learning
269. Adaptive learning is a teaching approach that uses technology to personalize the learning experience for each student. With PhET simulations, adaptive learning could involve adjusting the simulations to match the learning needs of each student. This would help students learn at their own pace and provide a more effective learning experience.
270. Gamification
271. Gamification is the process of adding game-like elements to non-game contexts to make them more engaging and interactive. PhET simulations could be gamified by adding elements such as rewards, points, and badges. This would make the simulations more enjoyable for students and increase their motivation to learn.
272. Integration with Learning Management Systems (LMS)
273. Learning Management Systems (LMS) are platforms used by schools and universities to manage and deliver educational content. Integration with LMS platforms would make it easier for teachers to incorporate PhET simulations into their teaching and provide a seamless learning experience for students.
274. Conclusion
275. PhET Interactive Simulations have revolutionized the way physics is taught and learned. Their impact on physics education has been significant, and their future prospects are exciting. With new developments such as expansion to other science fields, integration with VR technology, adaptive learning, gamification, and integration with LMS platforms, PhET simulations are likely to become even more engaging, interactive, and effective in the years to come.
276. Introduction:
277. Symbolab is an online mathematics tool that allows users to perform a wide range of mathematical computations, including solving equations, simplifying expressions, and graphing functions. It was founded in 2011 by mathematicians from Israel and is now owned by the educational technology company Chegg. Symbolab has become popular among students, teachers, and professionals alike due to its ease of use, accuracy, and extensive range of features. In this article, we will discuss the key features of Symbolab, its pricing, and the pros and cons of using the tool.
278. Features:
279. Symbolab has an extensive range of features that make it a powerful tool for mathematics. Some of the key features are as follows:
280. Equation Solver: Symbolab's equation solver can solve a wide range of equations, including linear, quadratic, polynomial, trigonometric, exponential, logarithmic, and many more. Users can input an equation in the text box, and Symbolab will provide step-by-step solutions, including explanations of each step.
281. Expression Simplifier: Symbolab's expression simplifier can simplify complex mathematical expressions, including radicals, fractions, and exponents. It can also combine like terms and factor polynomials. Users can input an expression in the text box, and Symbolab will simplify it, providing step-by-step solutions.
282. Graphing Calculator: Symbolab's graphing calculator allows users to graph functions and equations in two and three dimensions. Users can input an equation or a function, and Symbolab will graph it, providing a visual representation of the equation. It also allows users to customize the graph by adjusting the axes, adding labels, and changing the colors.
283. Derivative Calculator: Symbolab's derivative calculator can compute the derivative of a function with respect to a variable. It can also compute partial derivatives and higher-order derivatives. Users can input a function in the text box, and Symbolab will provide step-by-step solutions for computing the derivative.
284. Integral Calculator: Symbolab's integral calculator can compute the definite and indefinite integrals of a function. It can also compute improper integrals and integrals with limits. Users can input a function in the text box, and Symbolab will provide step-by-step solutions for computing the integral.
285. Matrix Calculator: Symbolab's matrix calculator can perform various matrix operations, including addition, subtraction, multiplication, and inversion. It can also compute the determinant and the rank of a matrix. Users can input a matrix in the text box, and Symbolab will provide step-by-step solutions for performing the selected operation.
286. Series Calculator: Symbolab's series calculator can compute the sum of a series, including arithmetic, geometric, and infinite series. Users can input a series in the text box, and Symbolab will provide step-by-step solutions for computing the sum.
287. Pricing:
288. Symbolab offers a range of pricing plans, including a free plan and premium plans. The free plan allows users to perform basic computations and access limited features. The premium plans offer more advanced features and unlimited access to the tool. The premium plans are as follows:
289. Monthly Plan: The monthly plan costs $4.99 per month and offers unlimited access to all features.
290. Annual Plan: The annual plan costs $49.99 per year and offers unlimited access to all features.
291. Lifetime Plan: The lifetime plan costs $99.99 and offers unlimited access to all features for life.
292. Pros and Cons:
293. Symbolab has several advantages that make it a popular tool for mathematics. Some of the advantages are as follows:
294. Ease of Use: Symbolab is easy to use and provides step-by-step solutions for various computations. It also allows users to customize the graphs and provides explanations for each step.
295. Accuracy: Symbolab is accurate and can solve equations, simplify expressions, and perform other mathematical computations with high precision. It can also graph functions with great accuracy.
296. Speed: Symbolab is fast and can perform computations quickly, allowing users to save time.
297. Range of Features: Symbolab offers a wide range of features that can help users solve various mathematical problems. These features include equation solver, expression simplifier, graphing calculator, derivative calculator, integral calculator, matrix calculator, and series calculator.
298. Accessible Anywhere: Symbolab is an online tool that can be accessed from anywhere, as long as users have an internet connection.
299. However, Symbolab also has some disadvantages that should be considered. Some of the disadvantages are as follows:
300. Cost: Although Symbolab offers a free plan, the premium plans can be costly for some users, especially if they require access to all features.
301. Dependence: Over-reliance on Symbolab can result in a lack of understanding of the underlying mathematical concepts, leading to difficulty in solving problems without the tool.
302. Limited Learning: While Symbolab can help users solve problems quickly, it does not provide a comprehensive understanding of mathematical concepts, which is important for learning.
303. Limited Customization: While Symbolab allows users to customize graphs and equations, there are limitations to the level of customization possible, which can be limiting for some users.
304. Conclusion:
305. Symbolab is a powerful tool for mathematics that offers a wide range of features, including equation solver, expression simplifier, graphing calculator, derivative calculator, integral calculator, matrix calculator, and series calculator. While it has several advantages, including ease of use, accuracy, and speed, it also has some disadvantages, including cost, dependence, limited learning, and limited customization. Overall, Symbolab is a useful tool for students, teachers, and professionals alike, but should be used in conjunction with a comprehensive understanding of mathematical concepts to achieve the best results.
306. MATLAB
307. Introduction to MATLAB
308. MATLAB, short for Matrix Laboratory, is a powerful software platform for numerical computing, data analysis, visualization, and programming. It was developed by MathWorks in the late 1970s and has become a standard tool in many fields of science, engineering, finance, and beyond. MATLAB is widely used for tasks such as signal processing, image and video processing, control systems design, optimization, machine learning, and more. It offers a high-level programming language that is easy to learn and use, along with a vast library of functions and toolboxes for various applications.
309. MATLAB Environment
310. MATLAB has a graphical user interface (GUI) that includes several windows and panels, allowing users to interact with the software in various ways. The main window is called the MATLAB desktop, which displays the current folder, command history, workspace, and other tools. Users can type commands directly in the command window or use the MATLAB Editor to write and save scripts and functions.
311. MATLAB also offers a variety of built-in tools for data analysis and visualization. For example, users can use the MATLAB Editor to create custom plots, including histograms, scatter plots, and surface plots. Additionally, MATLAB includes tools for 2D and 3D visualization, including graphics objects, colormap editors, and animation tools.
312. MATLAB Programming Language
313. MATLAB is built on top of a high-level programming language that allows users to perform complex computations and data analysis with just a few lines of code. The MATLAB language is easy to learn and use, thanks to its intuitive syntax and extensive documentation. Some of the key features of the MATLAB language include:
314. Matrix operations: MATLAB is designed to work with matrices and arrays, making it easy to perform operations on large datasets. For example, users can use the built-in functions to compute matrix multiplication, element-wise addition, and more.
315. Built-in functions: MATLAB includes a vast library of built-in functions for various tasks, including mathematical functions, signal processing functions, and more. These functions can be called directly in MATLAB code, making it easy to perform complex computations.
316. Data structures: MATLAB supports a variety of data structures, including arrays, cell arrays, and structures. These data structures allow users to store and manipulate data in various formats.
317. Functionality extensions: MATLAB can be extended using toolboxes, which are collections of functions and tools for specific tasks. For example, the Signal Processing Toolbox provides functions for signal filtering, analysis, and more.
318. MATLAB Toolboxes
319. MATLAB offers a variety of toolboxes that extend the functionality of the software for specific tasks. These toolboxes include functions and tools for various applications, including:
320. Signal Processing Toolbox: This toolbox provides functions for signal filtering, analysis, and processing. It includes tools for Fourier analysis, wavelet analysis, filter design, and more.
321. Image Processing Toolbox: This toolbox provides functions for image processing, including image enhancement, segmentation, and feature extraction. It includes tools for image filtering, morphological operations, and more.
322. Control System Toolbox: This toolbox provides functions for control system design and analysis. It includes tools for modeling dynamic systems, designing controllers, and simulating closed-loop systems.
323. Optimization Toolbox: This toolbox provides functions for optimization, including linear programming, nonlinear optimization, and quadratic programming. It includes tools for constrained optimization, global optimization, and more.
324. Statistics and Machine Learning Toolbox: This toolbox provides functions for statistical analysis, including hypothesis testing, regression analysis, and multivariate analysis. It includes tools for machine learning, including classification, clustering, and deep learning.
325. MATLAB Applications
326. MATLAB is used in a variety of applications, including:
327. Engineering: MATLAB is widely used in engineering for tasks such as signal processing, control system design, and modeling and simulation. For example, engineers may use MATLAB to design and test control systems for vehicles, aircraft, and other complex systems.
328. Finance: MATLAB is used in finance for tasks such as risk management, portfolio optimization, and algorithmic trading. MATLAB's built-in functions for numerical analysis and optimization make it well-suited for financial modeling and analysis.
329. Biology: MATLAB is used in biology for tasks such as image analysis, data visualization, and modeling of biological systems. For example, biologists may use MATLAB to analyze images of cells and tissues or to simulate the behavior of complex biological systems.
330. Physics: MATLAB is used in physics for tasks such as data analysis, simulation, and modeling of physical systems. For example, physicists may use MATLAB to analyze data from particle accelerators or to model the behavior of complex physical systems.
331. Geosciences: MATLAB is used in geosciences for tasks such as image processing and analysis, data visualization, and modeling of geophysical systems. For example, geoscientists may use MATLAB to analyze satellite imagery or to model the behavior of geological systems.
332. Education: MATLAB is used in education at all levels, from elementary school to graduate school. MATLAB's ease of use and vast library of functions make it an ideal tool for teaching mathematical and scientific concepts.
333. Conclusion
334. MATLAB is a powerful tool for numerical computing, data analysis, visualization, and programming. Its high-level programming language, intuitive syntax, and vast library of functions make it easy to learn and use, while its graphical user interface and built-in tools for data analysis and visualization make it a versatile platform for a wide range of applications. MATLAB's toolboxes extend its functionality for specific tasks, while its wide adoption in various fields of science, engineering, finance, and beyond make it an indispensable tool for many professionals.
335. Quiz-Maker
336. Introduction:
337. Quiz-Maker is a web-based platform that allows users to create and manage quizzes. It has been designed to make the process of creating and administering quizzes easy and convenient. With Quiz-Maker, users can create quizzes for educational purposes, training, or entertainment. This article will provide an in-depth review of Quiz-Maker, including its features, benefits, and limitations.
338. Features of Quiz-Maker:
339. Customizable quiz templates: Quiz-Maker provides a variety of quiz templates that users can choose from. These templates can be customized to suit the user's needs. Users can also create their own quiz templates from scratch.
340. Question bank: Quiz-Maker provides a question bank feature that allows users to store and organize questions for future use. The question bank feature saves time and effort for users who want to create multiple quizzes with similar questions.
341. Multiple question types: Quiz-Maker supports various question types, including multiple-choice, true/false, fill-in-the-blank, and short answer. This feature allows users to create quizzes that cater to different learning styles.
342. Automated grading: Quiz-Maker automatically grades quizzes once they are completed. This feature saves time and effort for educators and trainers who need to grade multiple quizzes.
343. Analytics: Quiz-Maker provides analytics that allow users to monitor quiz performance. This feature enables educators and trainers to identify knowledge gaps and adjust their teaching methods accordingly.
344. Benefits of Quiz-Maker:
345. Convenience: Quiz-Maker provides a convenient way for users to create and administer quizzes. Users can access the platform from any device with an internet connection.
346. Time-saving: Quiz-Maker saves time for educators and trainers who need to create and administer quizzes. The platform automates the grading process, saving educators and trainers hours of time.
347. Customization: Quiz-Maker allows users to customize quiz templates and questions to suit their needs. This feature makes it easy for educators and trainers to create quizzes that cater to the specific needs of their students or trainees.
348. Engagement: Quizzes are a fun and engaging way for students and trainees to learn. Quiz-Maker makes it easy for educators and trainers to create quizzes that are both informative and entertaining.
349. Analytics: Quiz-Maker provides analytics that enable educators and trainers to monitor quiz performance. This feature helps educators and trainers identify knowledge gaps and adjust their teaching methods accordingly.
350. Limitations of Quiz-Maker:
351. Limited question bank: While Quiz-Maker provides a question bank feature, the bank may not have enough questions to cater to the needs of all users. Users may need to create their own questions or import questions from other sources.
352. Limited customization: While Quiz-Maker allows for some customization, users may not have complete control over the appearance and functionality of their quizzes. This limitation may be a concern for users who require a high degree of customization.
353. Pricing: Quiz-Maker is a paid platform, and users may need to pay a subscription fee to access certain features. This limitation may be a concern for users on a tight budget.
354. Security: Quiz-Maker may not be suitable for users who require a high level of security. The platform may be vulnerable to cyber attacks or data breaches.
355. Compatibility: Quiz-Maker may not be compatible with all devices and operating systems. Users may need to use a specific web browser or device to access the platform.
356. Conclusion:
357. Quiz-Maker is a useful tool for creating and administering quizzes. It offers a variety of customizable quiz templates, multiple question types, and automated grading, which can save time and effort for educators and trainers. Additionally, the analytics feature allows users to monitor quiz performance and adjust their teaching methods accordingly.
358. However, there are some limitations to Quiz-Maker, such as a limited question bank, limited customization options, and a subscription fee. The platform may also not be suitable for users who require a high level of security or compatibility with all devices and operating systems.
359. Overall, Quiz-Maker is a valuable tool for educators and trainers looking for a convenient and efficient way to create and administer quizzes. Users should consider their specific needs and requirements before choosing to use this platform.
360. HistoryView
361. [HistoryView.org](https://historyview.org) is a website that allows users to explore historical sites, events, and artifacts through virtual reality (VR) and augmented reality (AR) technologies. The site provides a unique opportunity for users to experience history in an immersive and interactive way, enabling them to learn about the past in a way that is both engaging and informative.
362. HistoryView.org was founded by Jeffery Donnelly in 2015, with the aim of creating a platform that would allow people to explore historical sites and artifacts from around the world. The platform is designed to be accessible to anyone with an internet connection and a VR headset or smartphone.
363. One of the key features of HistoryView.org is its collection of VR and AR tours of historical sites and landmarks. Users can explore famous sites such as the Pyramids of Giza, the Great Wall of China, and the Colosseum in Rome, as well as lesser-known sites such as the archaeological site of Tikal in Guatemala and the ancient city of Petra in Jordan.
364. In addition to its VR and AR tours, HistoryView.org also provides users with access to a range of historical artifacts and documents. These include items such as letters, diaries, and photographs, which offer a unique insight into the lives of people in the past.
365. One of the main advantages of using HistoryView.org is that it allows users to explore historical sites and artifacts in a way that is not possible through traditional methods such as books and documentaries. The use of VR and AR technologies allows users to immerse themselves in historical environments, providing a sense of presence and connection with the past.
366. Another advantage of HistoryView.org is that it is an accessible platform that can be used by anyone, regardless of their location or physical abilities. Users can explore historical sites and artifacts from the comfort of their own home, making it a convenient and affordable way to learn about history.
367. HistoryView.org also has significant educational value, particularly for students who may not have the opportunity to visit historical sites in person. The platform provides a visual and interactive way for students to learn about history, which can help to increase their engagement and interest in the subject.
368. In addition to its educational value, HistoryView.org also has cultural significance. The platform allows users to explore historical sites and artifacts from a range of different cultures and time periods, promoting cross-cultural understanding and appreciation.
369. Overall, HistoryView.org is a valuable resource for anyone interested in history. Its use of VR and AR technologies provides a unique and engaging way to explore historical sites and artifacts, while its accessibility and educational value make it an important tool for learning about the past.
370. GeaCron
371. Introduction:
372. [GeaCron](http://geacron.com/home-en/) is a web application that provides an interactive map of world history. The platform is designed to provide users with a visual representation of how borders and political entities have changed throughout time. The application allows users to navigate through various timelines, which span from 3000 BC to the present day. The platform also provides a wide range of information about different countries, including their population, area, and GDP, among other things.
373. In this article, we will explore GeaCron's features and functionalities in detail. We will discuss the different timelines available on the platform and the types of information that can be accessed through the maps. We will also explore how GeaCron can be used to teach history and geography, as well as the potential benefits and limitations of the platform.
374. Features and functionalities:
375. The GeaCron web application has a number of features and functionalities that make it a useful tool for exploring world history. One of the main features of the platform is the interactive maps. The maps are highly detailed and allow users to zoom in and out to explore different regions of the world. Users can also click on specific countries to access more information about them, such as their population, area, and GDP.
376. Another key feature of GeaCron is the ability to switch between different timelines. The platform provides a range of timelines that span from 3000 BC to the present day. Each timeline shows the political borders and entities that existed at that point in time, as well as any major historical events that occurred. Users can switch between timelines to see how borders and political entities have changed over time.
377. In addition to the interactive maps and timelines, GeaCron also provides a range of information about different countries. Users can access information such as a country's population, area, GDP, and capital city, among other things. This information can be useful for gaining a better understanding of different regions of the world.
378. Timelines:
379. GeaCron provides a wide range of timelines that cover different periods in world history. These timelines allow users to see how political entities and borders have changed over time. The timelines are organized by period, and users can switch between timelines to explore different periods in history.
380. Some of the timelines available on GeaCron include:
381. Ancient World (3000 BC - 476 AD): This timeline covers the period from the Bronze Age to the fall of the Western Roman Empire. It includes the major empires of the ancient world, such as Egypt, Greece, and Rome.
382. Middle Ages (476 AD - 1492 AD): This timeline covers the period from the fall of the Western Roman Empire to the discovery of America by Christopher Columbus. It includes the major medieval kingdoms and empires of Europe, such as the Byzantine Empire, the Holy Roman Empire, and the Kingdom of France.
383. Early Modern Era (1492 AD - 1789 AD): This timeline covers the period from the discovery of America to the start of the French Revolution. It includes the major European colonial empires, as well as the rise of the Ottoman Empire and the decline of the Holy Roman Empire.
384. Modern Era (1789 AD - present day): This timeline covers the period from the start of the French Revolution to the present day. It includes the major political events and conflicts of the 19th and 20th centuries, such as the Napoleonic Wars, World War I, and World War II.
385. Information about countries:
386. GeaCron provides a wealth of information about different countries around the world. Users can access this information by clicking on a specific country on the map or by selecting a country from a dropdown menu.
387. The information available about each country includes:
388. Country name and flag
389. Population
390. Area
391. GDP (nominal and PPP)
392. Capital city
393. Currency
394. Language(s)
395. Religion(s)
396. Government type
397. Head of state/government
398. National anthem
399. In addition to this basic information, GeaCron also provides more detailed information about each country. This includes a brief history of the country, information about its geography and climate, and a summary of its economy, among other things.
400. For example, if we look up information about Japan on GeaCron, we can see that the country has a population of approximately 126 million people and an area of 377,972 square kilometers. Its GDP (PPP) is estimated to be around $5.4 trillion, and its capital city is Tokyo. Japan is a constitutional monarchy with a parliamentary government, and its current head of government is Prime Minister Yoshihide Suga. The country's official language is Japanese, and its main religion is Shintoism. The national anthem of Japan is "Kimigayo."
401. Teaching history and geography:
402. GeaCron can be a useful tool for teaching history and geography in the classroom. The platform's interactive maps and timelines can help students to visualize the changes that have occurred in political entities and borders over time. This can be particularly helpful for understanding complex historical events and conflicts.
403. In addition, GeaCron's information about different countries can be used to teach students about the diversity of the world's cultures, languages, and religions. Teachers can use the platform to create interactive lessons and quizzes that test students' knowledge of different countries and their histories.
404. GeaCron can also be used to teach students about different geographic features and regions of the world. The platform's detailed maps and information about different countries can help students to understand the physical and cultural characteristics of different regions.
405. Benefits and limitations:
406. GeaCron offers a number of benefits as a tool for exploring world history and geography. Its interactive maps and timelines provide a visual representation of how political entities and borders have changed over time. The platform's information about different countries can be useful for gaining a better understanding of different regions of the world.
407. However, there are also some limitations to GeaCron. One of the main limitations is that the platform focuses primarily on political borders and entities. While this is important for understanding world history and geography, it does not provide a complete picture of the world's cultures and societies.
408. In addition, GeaCron's information about different countries may not always be up-to-date or accurate. The platform relies on data from a variety of sources, and there may be discrepancies or errors in the information provided.
409. Conclusion:
410. GeaCron is a powerful tool for exploring world history and geography. Its interactive maps and timelines provide a visual representation of how political entities and borders have changed over time, and its information about different countries can be useful for gaining a better understanding of different regions of the world. While there are some limitations to the platform, it can be a valuable resource for educators and students alike.
411. Natural history
412. Introduction:
413. [The National Museum](https://naturalhistory.si.edu/) of Natural History is a world-renowned museum located in Washington D.C. The museum is part of the Smithsonian Institution, which is a group of museums and research centers that make up the world's largest museum and research complex. The National Museum of Natural History is dedicated to the study and preservation of the natural world, and it is home to one of the most extensive collections of natural history specimens and artifacts in the world. This essay will explore the National Museum of Natural History and discuss its history, collections, exhibits, research, and educational programs.
414. History:
415. The National Museum of Natural History was founded in 1910, and it opened to the public in 1911. The museum's original building was designed by the architect James Renwick Jr. and was built in the Second Empire architectural style. The building was expanded in the 1960s with the addition of the east wing, which was designed by the architect Eggers & Higgins. In the 1980s, the museum underwent a major renovation and expansion project, which added new exhibit spaces and modernized the building's infrastructure.
416. Collections:
417. The National Museum of Natural History is home to an extensive collection of natural history specimens and artifacts. The museum's collections include over 145 million specimens and artifacts, making it one of the largest collections of its kind in the world. The collections are divided into several departments, including anthropology, botany, entomology, mineralogy, paleobiology, and zoology.
418. The anthropology department's collection includes artifacts and specimens related to human culture and history, including archaeological artifacts, ethnographic objects, and human remains. The botany department's collection includes over 4.5 million plant specimens, including specimens from all over the world. The entomology department's collection includes over 35 million insect specimens, making it one of the largest insect collections in the world. The mineralogy department's collection includes over 375,000 mineral specimens, including rare and valuable minerals. The paleobiology department's collection includes over 40 million fossil specimens, making it one of the largest fossil collections in the world. The zoology department's collection includes over 127 million specimens, including specimens of mammals, birds, reptiles, amphibians, fish, and invertebrates.
419. Exhibits:
420. The National Museum of Natural History has a wide variety of exhibits that showcase the diversity of the natural world. The museum's exhibits are organized into several categories, including anthropology, botany, entomology, mineralogy, paleobiology, and zoology. Some of the museum's most popular exhibits include:
421. The Hall of Human Origins: This exhibit explores the history of human evolution and features interactive displays and life-sized models of early human species.
422. The Butterfly Pavilion: This exhibit is a tropical garden filled with live butterflies from around the world.
423. The Hope Diamond: This exhibit features the famous Hope Diamond, which is one of the largest blue diamonds in the world.
424. The Ocean Hall: This exhibit explores the ocean's biodiversity and features a life-sized model of a North Atlantic right whale.
425. The Fossil Halls: These exhibits feature a wide variety of fossils from dinosaurs, prehistoric mammals, and other ancient animals.
426. Research:
427. The National Museum of Natural History is also home to a wide variety of research programs. The museum's research programs are organized into several departments, including anthropology, botany, entomology, mineralogy, paleobiology, and zoology. The museum's research programs are focused on understanding the natural world and preserving biodiversity.
428. The anthropology department's research programs focus on the study of human culture and history. The botany department's research programs focus on the study of plant diversity and evolution. The entomology department's research programs focus on the study of insect diversity, behavior, and ecology. The mineralogy department's research programs focus on the study of mineralogy and geochemistry. The paleobiology department's research programs focus on the study of fossils and the evolution of life on Earth. The zoology department's research programs focus on the study of animal diversity, behavior, and ecology.
429. The museum's research programs are conducted by a team of scientists, including curators, researchers, and staff scientists. The museum's scientists use the museum's collections and resources to conduct research and study the natural world. The museum's research programs have contributed to many important discoveries and have helped to advance our understanding of the natural world.
430. Educational Programs:
431. The National Museum of Natural History is also committed to providing educational programs to the public. The museum's educational programs are designed to educate visitors about the natural world and to inspire a love of science and nature. The museum's educational programs include:
432. School Programs: The museum offers a variety of programs for school groups, including guided tours, hands-on activities, and educational resources.
433. Youth Programs: The museum offers programs for children and teenagers, including summer camps, workshops, and after-school programs.
434. Adult Programs: The museum offers a variety of programs for adults, including lectures, workshops, and special events.
435. Online Resources: The museum offers a wide variety of online resources, including educational videos, virtual tours, and educational resources for teachers.
436. Conclusion:
437. The National Museum of Natural History is an important institution that is dedicated to the study and preservation of the natural world. The museum's extensive collections, exhibits, research programs, and educational programs have helped to advance our understanding of the natural world and to inspire a love of science and nature. The museum is an important resource for scientists, educators, and the public, and it will continue to play a vital role in the study and preservation of the natural world for many years to come.
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