**BENEFITS OF THE NEW ERA: Analyzing THE feasibility of INCORPORATIng virtual assistance withIN EDUCATION**

**By**

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**A Thesis Submitted in Partial Fulfillment of the Requirements**

**For the Degree of Bachelor of Science in The**

**Department of Mathematics and Computer Science**

**Claflin University**

**Orangeburg, South Carolina**

**February 2024**

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**ACKNOWLEDGEMENTS**

I would firstly like to thank and acknowledge God, because without God I not only would I not finish this project, but I would not have all the love, care, and success that I am blessed with today. Of course, right after would be my top two supporters being my mom and grandma, because without them I wouldn’t have the drive to finish college and continue to make them both proud. I would also like to thank all the professors and faculty members who played a part in the aid & support of this project and the aid towards the success of my college career. Finally, I would like to express sincere gratitude to the School of Natural Sciences and Mathematics for providing me with the tools and opportunities that I would need in order to begin my journey outside of school into the real world.

**PROFESSOR / FACULTY:**

* Dr. Ramaier Sriram
* Dr. Sriskanda Nesan
* Dr. Jessica Livingston
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**THESIS STATEMENT**

“Changes in the demands of education require innovation and creativity in the learning process.” (Fitria, 2021). Within the past couple of years, advancements within the technological field, specifically in this case Artificial Intelligence (AI) has made a massive impact in many different areas including that of education. The integration of these AI-powered virtual tutors within the educational system would introduce a new standing point for education, opening the opportunity to challenge the limitations of the already pre-installed traditional teaching methods. However, the lack of newer forms of comprehensive practices and studies that helps to evaluate the efficacy and impact of these tutors on student learning outcomes, engagement, and knowledge retention poses a significant research gap. If incorporated, the school system would benefit immensely due to the increase of student’s overall engagement, the rapid rise of their initial IQ, and the highly involved status of teachers. Effectively adapting and upgrading the systems set for the past in order to ensure a brighter future.

**ABSTRACT**

In the world today technology has improved so drastically that most traditional values and practices have gone practically extinct. The most recent of these technological advancements creating such a noticeably impactful change as of recently is the incorporation of Artificial Intelligence also known in short by the name of AI. Within the current educational landscape, the integration of artificial intelligence (AI) has emerged as a pivotal tool in transforming the original learning methods. Incorporating things such as adaptive subject learning, intelligent virtual resource tutoring bots, smart enhancements around campus, and quarterly teacher evaluations just to say a few. This study aims to address the increasing need for an in-depth analysis of the overall effectiveness of virtual assistance and specifically AI-powered virtual tutors and their use within the educational system. The research problem centers on evaluating how AI-powered virtual tutors influence student’s learning outcomes, overall engagement, and knowledge retention across diverse demographics within an educational setting while also at the same time analyzing the practicality of adding the concept. This is done by researching multiple sources while also including the early work for a Chatbot of my own. My hypothesis of this study is that with the incorporation of virtual assistance in education, both student intelligence and participation would expand and also teacher’s engagement with students would increase as well. So that eventually, education would also morph from the traditional stage that it is in currently and fully transition into a new age technological version of itself.

**KEYWORDS AND ABBREVIATIONS**

**Keywords** : Artificial Intelligence, Intelligence Quotient, (Science, Technologies, Engineering, and Math)

**Abbreviations**

AI – Artificial Intelligence

IQ- Intelligence Quotient

STEM – Science, Technology, Engineering, and Math

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**INTRODUCTION**

In the realm of education today, the continuous evolution of technological advancements has paved the way for innovative approaches to learning, especially in my own personal field as a STEM major. As said in one of the studied articles “Because many children are familiar with digital technology even before school enrolment, it's

critical to train skills needed to succeed in a digital environment.”(Asmar, 2022). One such revolutionary concept is the incorporation of Artificial Intelligence within the educational framework. Artificial Intelligence or AI for short is the theory and development of computer systems able to perform tasks that normally require human intelligence, such as visual perception, speech recognition, decision-making, and translation between languages (Coursera, 2023). As of the current year of 2023, AI has spread so vastly that it is gracefully incorporated into almost every technological environment that one may come across. Ranging from many different platforms and companies such as Apple’s “Siri”, Amazon’s “Alexa”, the new popularly mentioned “ChatGPT” just to say a few. One of the more commonly used tasks that AI exceeds and excels in nowadays is the ability to intake and disperse requested information and responses in a timely and correct manner, resembling that of an actual teacher. This piece delves into the feasibility of integrating AI-powered virtual tutors into the education system, aiming to redefine traditional teaching methods and enhance student learning outcomes. In my thesis statement I state that, “the lack of newer forms of comprehensive practices and studies that helps to evaluate the efficacy and impact of these tutors on student learning outcomes, engagement, and knowledge retention poses a significant research gap.”, ultimately setting the stage for the detailed analysis and deep exploration of the transformative potential of what AI can be in education.

Background of the Study

The rapid progress in AI technology has sparked interest in a plethora of different fields with education being one of the more prominent areas of focus. The emergence of AI-powered virtual tutors presents a promising opportunity to revolutionize the learning experience for students. However, despite the growing enthusiasm surrounding AI in education, there exists a noticeable research gap in comprehensively evaluating the efficacy and impact of these AI tutors on student engagement, knowledge retention, and learning outcomes across diverse educational settings. The current literature underscores the need for empirical studies to assess the effectiveness of AI-powered virtual tutors in enhancing student learning experiences. While initial findings suggest the potential benefits of integrating AI in education, there is a lack of in-depth analysis on the long-term implications and outcomes of this integration. This gap in research highlights the significance of conducting a thorough investigation to bridge the divide between theoretical possibilities and practical implementation of AI in education.

Purpose of the Study

The primary objective of this study is to explore the feasibility and implications of incorporating AI-powered virtual tutors within the educational system. By examining the potential impact this could have on students, the research sheds light on the transformative potential of AI and its potential place within education. The integration of these AI-powered virtual tutors would introduce a whole new standing point for education, opening the opportunity to challenge the limitations of the already pre-installed traditional teaching/learning methods. Seeking to pave the way for a more dynamic and adaptive approach to education, emphasizing the importance of embracing innovation to meet the evolving demands of the modern educational landscape.

Research Question(s)

The research question(s) guiding this study is/are:

1. How would this benefit the university and other schools within the education system?

2. How vast can this concept travel outside of its initial base state?

3. What are the major differences and improvements that these devices brings to the traditional educational format?

4. How do educators perceive and adapt to the idea of AI integration and what are the challenges and opportunities perceived in implementing these technological innovations within educational settings?

5. How can AI-powered virtual tutors influence students’ overall learning outcomes?

**LITERATURE REVIEW**

The future is now, and times are changing immensely so certain practices have to change along with them and that includes the traditional learning/teaching style. Based off of the information within these articles, the integration of Artificial Intelligence (AI) within education has brought about significant changes and innovations to the initial learning process. This literature review explores the multifaceted impact of AI in both teaching and learning, highlighting the transformative potential of artificially intelligent technology and addressing how it is reshaping current traditional educational practices.

One key aspect emphasized within each of the articles that I reviewed is the specific role of Artificial Intelligence within daily activities based around the education sector. AI applications such as Virtual Mentors, Voice Assistants, Smart Content, and Presentation Translator are revolutionizing the way educational content is delivered and accessed. Some examples of these applications consist of assistants like Google’s Google Assistant, Apple’s Siri, and Microsoft’s Cortana. Additionally, the newfound rise of things Global Courses, Automatic Assessment, Personalized Learning, Educational Games, and Intelligent Tutoring Systems (ITS) are enhancing the learning experience for students currently by providing a consistent personalized and adaptive environment to learn in.

Within all of these sources that I reviewed they all underscore the current shift towards a more digitized and personalized academic environment that is facilitated by AI technologies. The accessibility of educational resources through smart devices and online platforms has made learning easily accessible, enabling students to engage in remote learning experiences. Furthermore, the digitization of administrative tasks in schools is empowering teachers to focus more on student interaction and engagement, ultimately enhancing the quality of education delivery.

The incorporation of AI in education is driving a massive shift from traditional teaching methods to smart education approaches. The utilization of AI-powered digital educational platforms is revolutionizing approaches that require things like instruction, offering innovative learning technologies aimed at improving learning outcomes and student engagement. The reviewed articles also highlight the importance of equipping students with essential skills such as analytical thinking, communication, and cooperation to prepare them for the future workforce.

Moreover, the implementation of AI in education is not without challenges and concerns. While AI technologies offer dynamic and automated learning solutions, they do not possess the nuanced self-learning capabilities inherent in human intelligence. The reviewed studies emphasize the irreplaceable role of teachers in delivering new knowledge and fostering critical skills development in students. The symbiotic relationship between AI technologies and human educators is crucial in creating a balanced educational ecosystem that maximizes the potential of both technological advancements and human expertise.

Summary and Conclusions

In conclusion, all of the reviewed literature showcases the evolving landscape that is AI. Most importantly within education, highlighting the opportunities and challenges that comes with integrating AI into the original teaching and learning process. The ongoing exploration of AI applications within education underscores the need for continuous innovation and adaptation to ensure that educational practices align with the changing demands of the digital age. As AI continues to advance, the education sector must strive to leverage technology effectively to create a holistic and engaging learning environment that caters to the diverse needs of students and educators alike.

**METHODOLOGY**

Population and Sampling Procedure

This section will discuss the research methods that I used to conduct the study and what was applicable to use in response to the problem statement which focused on the feasibility of AI virtual assistance being introduced into education. This section relied primarily on research that consisted of various different documents of the same general topic area and data collection in order to collect the data that was found. This section will also present various procedures and strategies that were done in order to gain as much insight as possible on AI virtual assistance.

Research Design and Development Procedures

Step 1:

The first step to be made within this process of research is defining the research objective. For me specifically my objective was to assess the feasibility of incorporating artificial intelligence in education and its potential impact on learning outcomes.

Step 2:

The second step to take would be to conduct and address a literature review on the topic. My literature review’s focus was on the use of AI in education and was mainly based around identifying existing studies, research papers, and projects related to AI in education and analyzing the benefits, challenges, and best practices of integrating it within an educational setting.

Step 3:

The third step would consist of identifying your key audience for the idea. The audience that I planted focus around were broken into three groups which are the Consumers (Students), Facilitators (Teachers/Parents), and Patrons (School Board).

Step 4:

The fourth step would consist of acknowledging the overall impact that the topic has. I did this by assessing the impact of AI on teaching/learning outcomes while also analyzing the effectiveness of AI-based interventions in improving student engagement, performance, and personalized learning experiences.

Limitations

In working on this project, I have come to realize that even though the concept and idea is borderline revolutionary it still does have a long way to go. As far as flaws go, the idea is limited in certain areas due to past history. The most important example to be exact would be the idea of cheating floating around the conversation. AI assistants like Siri, Alexa, and Chat GPT have always had the notion of “cheating” attached to them, which is ultimately preventing them from being used as a tool in education even till this day. While my goal currently is to move those assistance out of the bracket of cheating and into the bracket of aid like Calculators and Textbooks. This may be my own personal bias, but I would prefer these resources due to their quick and efficient responses and I feel like that is what would give them the advantage over their predecessors.

Ethical Procedures & Considerations

Ethical Issues: Identify any ethical issues raised by your project.

* This project is completely user friendly towards both the user and his/her privacy.
* The project would not be able to cause any harm seeing as it is a Virtual Assistant, and the code would be based around that.
* Describe the treatment of human participants. Ethical concerns related to recruitment materials and processes and a plan to address them.
* Everyone who participates in being one of our subjects for testing will get treated with the upmost respect and will be gifted the luxury of us being flexible for them.
* As far as data collection from a physical subject there is no consequence of not wanting to continue and if ideals change, we welcome them with open arms.

Legal Issues: Identify any legal issues raised by your project.

* The project is not violating any licensing agreements.
* No users cannot use the project to break any law.

Security Issues: Identify any security issues raised by your project.

* There is no need for worry, the only thing that my project would “store” for right now is the User’s preferred name and whatever equation they choose to enter.
* Since the system is planned to be approved and distributed by the educational system, I doubt anything malicious would occur outside of student and teacher assistance.
* No initial agreements needed.
* No concerns needed towards either anonymous or confidential data due to the fact that the system is not designed for this type of data consumption.

**RESULTS**

Review briefly the purpose, research questions, and/or objectives. *Note*: This introduction to the chapter should be less than 1 page in length.

Study Results

Report findings, organized by research questions and/or objectives. Include tables and figures to illustrate results, as appropriate, and per the current edition of the *Publication Manual of the American Psychological Association*.

For statistical analyses include:

* Exact statistics and associated probability values.
* Confidence intervals around the statistics, as appropriate
* Effect sizes, as appropriate.

Report results of post-hoc analyses of statistical tests, if applicable. Report any additional statistical tests of hypotheses that emerged from the analysis of main hypotheses, as appropriate for the study.

*Note*: This section should be about 5-7 pages in length, or as many needed to present the results.

**DISCUSSION AND CONCLUSIONS**

Summarize the problem and purpose with similar language to what you used in the introduction. Summarize the methodology. *Note*: Consult your Research Advisor for further assistance with any of the sections in this chapter. This introduction to the chapter should be less than 1 page in length.

Summary of the Findings

This is where you will summarize the findings in your own words. Organize it by the research questions and/or objectives. This is where you are discussing how your results either answer or do not answer your research question (or support your research objective). Think of how you would describe your study findings to an interested colleague or family member. Keep the writing scholarly, but not overly technical or statistically heavy. Describe in what ways findings confirm, refute, or extend knowledge in the discipline by comparing them to the literature featured in your literature review. *Note:* This section can be at minimum 1-2 pages in length, but he length of this section varies depending on the study and design.

Global Impact of Computing Solution on Individuals, Organizations & Society

 Discuss the local and global impact of computing solutions on individuals, organizations or society regarding your problem and proposed solution. Remember, computing solutions are software programs, applications, and systems that leverage technology to solve problems and streamline processes. Choose at least two of the five impacts to discuss their implications (local, global, individuals, organizations, society). Be sure to discuss potential benefits and challenges posed by these impacts.   *Note:* This section can be at about 1 pages in length.

Recommendations

Describe recommendations for further research that are grounded in the strengths and limitations of the current study as well as the literature reviewed in earlier sections. This is where you can bring a bit of yourself into the research. Think of ways that, in hindsight, you may have approached the study to elicit different results.

Ensure recommendations do not exceed study or ethical boundaries. *Note*: This section should be less than 1 pages in length.

Conclusions

Close with a strong “take away” message where you capture the key essence of the study for your reader. Be sure to mention the Significance of the Study as described in terms of (a) advancing theory, (b) advances in practice, and/or (c) filling a gap in the literature. **Why did this study matter.** *Note*: This section should be less than 1 page in length.

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**Appendix A: Title of Appendix**

**H0M3R00M Virtual Assistant Starter Code:**

package questions;

import java.util.Scanner;

public class Questions {

//The code is early stages.

 //Introduction between user and H0M3R00M

 public static void main(String [] args) {

 try (Scanner scanner = new Scanner(System.***in***)) {

 System.***out***.println("Hi! Welcome to the H0M3R00M virtual assistant! I am at your command, Let's start by telling me your name.");

 String name1 = scanner.nextLine();

 System.***out***.println("Hmmm lets see... Ah I know that name " + name1 + "! The task that needs to be completed for you today is your Linear Equations Test provided by your professor.");

 System.***out***.println("If you are ready to begin say Yes");

 String yes = scanner.nextLine();

 System.***out***.println("Ok lets Begin!");

 }

 try (Scanner scan = new Scanner(System.***in***)) {

 //Strings for answer key and user input sections

 String[] answers = {"a", "a", "b", "b", "a", "a", "c", "a", "b", "c", "c", "b", "c", "b", "a"};

 String[] responses = {"", "", "", "", "", "", "", "", "", "", "", "", "", "", ""};

//------------------------------------------------------------------------------------------------------------------------------------------------------------------------------Easy Question 1

 //Starting set of the easier questions on the test

 System.***out***.println("Number 1: Solve the linear equation for (x): [3x + 5 = 17]");

 System.***out***.println("a)(x = 4)");

 System.***out***.println("b)(x = 6)");

 responses [0] = scan.next();

 if(answers.equals("a"))

 {

 System.***out***.println("Correct good job!");

 }

 else

 {

 System.***out***.println("Sorry but this is incorrect. The correct solution is x = 4, not x = 6. Solving the equation step by step would lead to x = 4.");

 }

//-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------Easy Question 2

 //Starting set of the easier questions on the test

 System.***out***.println("Number 2: Find the slope of the line passing through the points (2, 4) and (6, 10).");

 System.***out***.println("a)(2)");

 System.***out***.println("b)(1.5)");

 System.***out***.println("c)(2.5)");

 responses [1] = scan.next();

 if(answers.equals("a"))

 {

 System.***out***.println("Correct good job!");

 }

 else if(answers.equals("a"))

 {

 System.***out***.println("Sorry but this is incorrect. The slope between the given points is not 1.5 it is 2. It is important to calculate the slope correctly using the formula.");

 }

 else

 {

 System.***out***.println("Sorry but this is incorrect. The slope should be 2, not 2.5. Slope is calculated as (change in y) / (change in x).");

 }

//--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------Easy Question 3

 //Starting set of the easier questions on the test

 System.***out***.println("Number 3: Write the equation of a line in slope-intercept form passing through the point (3, 5) with a slope of 2.");

 System.***out***.println("a) y = 2x + 1");

 System.***out***.println("b) y = 2x + 4");

 System.***out***.println("c) y = 5x + 3");

 responses [2] = scan.next();

 if(answers.equals("a"))

 {

 System.***out***.println("Correct good job!");

 }

 else if(answers.equals("b"))

 {

 System.***out***.println("Sorry but this is incorrect. The y-intercept should be 1, not 4. The equation is y = mx + b, where b is the y-intercept.");

 }

 else

 {

 System.***out***.println("Sorry but this is incorrect. The correct slope-intercept form is y = 2x + 1, not y = 5x + 3. The slope of 2 is given in the question.");

 }

//---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------Easy Question 4

 //Starting set of the easier questions on the test

 System.***out***.println("Number 4: If the equation of a line is y = 2x - 1, what is the y-intercept?");

 System.***out***.println("a) 1");

 System.***out***.println("b) -1");

 System.***out***.println("c) 2");

 responses [3] = scan.next();

 if(answers.equals("b"))

 {

 System.***out***.println("Correct good job!");

 }

 else if(answers.equals("a"))

 {

 System.***out***.println("Sorry but this is incorrect. The y-intercept is -1, not 1. The y-intercept is the constant term in the equation when x = 0.");

 }

 else

 {

 System.***out***.println("Sorry but this is incorrect. The y-intercept in the given equation y = 2x - 1 is -1, not 2. The y-intercept is the value of y when x = 0.");

 }

//----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------Easy Question 5

 //Starting set of the easier questions on the test

 System.***out***.println("Number 5: Determine the x-intercept of the equation 4x + 2y = 8.");

 System.***out***.println("a) (2,0)");

 System.***out***.println("b) (0,2)");

 System.***out***.println("c) (0,4)");

 responses [4] = scan.next();

 if(answers.equals("a")) {

 System.***out***.println("Correct good job!");

 }

 else if(answers.equals("b"))

 {

 System.***out***.println("Sorry but this is incorrect. The x-intercept is not at (0, 2) in the given equation. The x-intercept occurs when y = 0.");

 }

 else

 {

 System.***out***.println("Sorry but this is incorrect. The x-intercept is (2, 0) in the equation 4x + 2y = 8. The x-intercept is the point where the line crosses the x-axis (y = 0).");

 }

//----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------Medium Question 1

 //Starting set of the more medium questions on the test

 System.***out***.println("Number 6: Find the point of intersection for the system of equations y = 2x - 1 and y = x + 1");

 System.***out***.println("a) (x = 3, y = 5)");

 System.***out***.println("b) (x = 2, y = 3)");

 System.***out***.println("c) (x = 4, y = 7)");

 responses [5] = scan.next();

 if(answers.equals("a"))

 {

 System.***out***.println("Correct good job!");

 }

 else if(answers.equals("b"))

 {

 System.***out***.println("Sorry but this is incorrect. The correct point of intersection is (x = 3, y = 5), not (x = 2, y = 3).");

 }

 else

 {

 System.***out***.println("Sorry but this is incorrect. The correct solution is not (x = 4, y = 7). The point of intersection needs to satisfy both equations simultaneously.");

 }

//-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------Medium Question 2

 //Starting set of the more medium questions on the test

 System.***out***.println("Number 7: Write the equation of a line parallel to y = 3x - 2 passing through the point (1, 4)");

 System.***out***.println("a) y = 3x + 4");

 System.***out***.println("b) y = 3x - 1");

 System.***out***.println("c) y = 3x + 1");

 responses [6] = scan.next();

 if(answers.equals("c"))

 {

 System.***out***.println("Correct good job!");

 }

 else if(answers.equals("a"))

 {

 System.***out***.println("Sorry but this is incorrect. The correct equation should pass through the point (1, 4), not have y-intercept at 4. Parallel lines have the same slope.");

 }

 else

 {

 System.***out***.println("Sorry but this is incorrect. This equation does not pass through the point (1, 4) as required. The equation of the line must satisfy the given conditions.");

 }

//--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------Medium Question 3

 //Starting set of the more medium questions on the test

 System.***out***.println("Number 8: Determine the solution set for the system of inequalities x + y < 3 and y < 1");

 System.***out***.println("a) x < 3 , y < 1");

 System.***out***.println("b) x < 1 , y < 3");

 System.***out***.println("c) x > 3 , y < 1");

 responses [7] = scan.next();

 if(answers.equals("a"))

 {

 System.***out***.println("Correct good job!");

 }

 else if(answers.equals("b"))

 {

 System.***out***.println("Sorry but this is incorrect. The correct solution set is not (x < 1, y < 3). Each inequality condition must be considered to determine the solution set.");

 }

 else

 {

 System.***out***.println("Sorry but this is incorrect. The solution set does not include x > 3. It is important to consider both inequalities together to find the correct solution.");

 }

//---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------Medium Question 4

 //Starting set of the more medium questions on the test

 System.***out***.println("Number 9: Find the sum of the solutions to the system of equations: 2x + y = 5 and x - y = 2");

 System.***out***.println("a) 2");

 System.***out***.println("b) 3");

 System.***out***.println("c) 4");

 responses [8] = scan.next();

 if(answers.equals("b"))

 {

 System.***out***.println("Correct good job!");

 }

 else if(answers.equals("a"))

 {

 System.***out***.println("Sorry but this is incorrect. The sum of solutions is not 2. Adding the solutions of both equations correctly will lead to the sum of 3.");

 }

 else

 {

 System.***out***.println("Sorry but this is incorrect. The sum of solutions is not 4.");

 }

//----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------Medium Question 5

 //Starting set of the more medium questions on the test

 System.***out***.println("Number 10: Write the equation of a plane in standard form with the normal vector <1, -3, 2> passing through the point (2, -1, 3)");

 System.***out***.println("a) x - 3y + 2z = 7");

 System.***out***.println("b) x - 3y + 2z = 9");

 System.***out***.println("c) x - 3y + 2z = 11");

 responses [9] = scan.next();

 if(answers.equals("c")) {

 System.***out***.println("Correct good job!");

 }

 else if(answers.equals("a"))

 {

 System.***out***.println("Sorry but this is incorrect. The correct standard form equation should pass through the point (2, -1, 3) with the given normal vector.");

 }

 else

 {

 System.***out***.println("Sorry but this is incorrect. The equation provided does not satisfy the conditions of the normal vector and the given point.");

 }

//----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------Hard Question 1

 //Starting set of the harder questions on the test

 System.***out***.println("Number 11: Find the eigenvalues of the matrix [2, -1], [4, -3]");

 System.***out***.println("a) λ = 1, 2");

 System.***out***.println("b) λ = -3, -4");

 System.***out***.println("c) λ = -1, -2");

 responses [10] = scan.next();

 if(answers.equals("c"))

 {

 System.***out***.println("Correct good job!");

 }

 else if(answers.equals("a"))

 {

 System.***out***.println("Sorry but this is incorrect. The eigenvalues of the matrix are -1 and -2, not 1 and 2. Eigenvalues are the values of λ that satisfy det(A - λI) = 0.");

 }

 else

 {

 System.***out***.println("Sorry but this is incorrect. The eigenvalues of the matrix are not -3 and -4. It is important to correctly calculate the eigenvalues using the determinant equation.");

 }

//-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------Hard Question 2

 //Starting set of the harder questions on the test

 System.***out***.println("Number 12: Calculate the determinant of the matrix [3, -1, 2], [4, 1, 0], [2, -3, 1]");

 System.***out***.println("a) 2");

 System.***out***.println("b) -1");

 System.***out***.println("c) -2");

 responses [11] = scan.next();

 if(answers.equals("b"))

 {

 System.***out***.println("Correct good job!");

 }

 else if(answers.equals("a"))

 {

 System.***out***.println("Sorry but this is incorrect. The determinant of the matrix is -1, not 2. Determinants are calculated using a specific formula for the given matrix.");

 }

 else

 {

 System.***out***.println("Sorry but this is incorrect. The determinant of the matrix is not -2. It is crucial to accurately perform the determinant calculation for the given matrix.");

 }

//--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------Hard Question 3

 //Starting set of the harder questions on the test

 System.***out***.println("Number 13: Find the inverse of the matrix [1, 2], [3, 4]");

 System.***out***.println("a) [4 , -2], [-3, 1]");

 System.***out***.println("b) [3, -2], [-1, 1]");

 System.***out***.println("c) [-2, 1], [1.5, -0.5]");

 responses [12] = scan.next();

 if(answers.equals("c"))

 {

 System.***out***.println("Correct good job!");

 }

 else if(answers.equals("a"))

 {

 System.***out***.println("Sorry but this is incorrect. The inverse of the matrix is not [4, -2], [-3, 1].");

 }

 else

 {

 System.***out***.println("Sorry but this is incorrect. This is not the correct inverse of the matrix [1, 2], [3, 4]. The inverse matrix must satisfy specific conditions.");

 }

//---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------Hard Question 4

 //Starting set of the harder questions on the test

 System.***out***.println("Number 14: Solve the differential equation dy/dx = 2x - 3");

 System.***out***.println("a) y = x^2 - 3");

 System.***out***.println("b) y = x^2 - 3x + C");

 System.***out***.println("c) y = 2x - 3");

 responses [13] = scan.next();

 if(answers.equals("b"))

 {

 System.***out***.println("Correct good job!");

 }

 else if(answers.equals("a"))

 {

 System.***out***.println("Sorry but this is incorrect. The solution is not y = x^2 - 3. It is necessary to include the constant of integration C when solving differential equations.");

 }

 else

 {

 System.***out***.println("Sorry but this is incorrect. This is the integrated form of the differential equation, but it is missing the constant term C in the solution.");

 }

//----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------Hard Question 5

 //Starting set of the harder questions on the test

 System.***out***.println("Number 15: Find the global maximum or minimum of the function f(x) = x^3 - 3x^2 + 4 on the interval [-2, 4]");

 System.***out***.println("a) Global minimum at x = 3, Global maximum at x = -2");

 System.***out***.println("b) Global minimum at x = -2, Global maximum at x = 2");

 System.***out***.println("c) Global minimum at x = 1, Global maximum at x = -1");

 responses [14] = scan.next();

 if(answers.equals("a")) {

 System.***out***.println("Correct good job!");

 }

 else if(answers.equals("b"))

 {

 System.***out***.println("Sorry but this is incorrect. The correct points for global minimum and maximum are x = 3 and x = -2, respectively.");

 }

 else

 {

 System.***out***.println("Sorry but this is incorrect. These points are not the global minimum and maximum of the function on the given interval.");

 }

//----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

 //Final score on the test

 int score = 0;

 for(int i = 0; i <15; i++) {

 if(responses[i].equalsIgnoreCase(answers[i])) {

 score++;

 }

 }

 System.***out***.println("Your final score is: " + score + "/15");

 System.***out***.println("Come back whenever im literally open 24/7, 365.");

 }

 }

}