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The Confidentiality of Coding Video Games with Cheat Code and Bots for Cheating in a Virtual World

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Abstract

Video games have been around for several decades and have had many advancements from the original start of video games. Video games started as virtual games that were advertised towards children, and these virtual games created a virtual reality of a variety of genres. These genres included sports games, such as tennis, football, baseball, war games, fantasy, puzzles, etc. The start of these games was derived from a sports genre and now has a popularity in multiplayer-online-shooting games. The purpose of this paper is to investigate different types of tools available for cheating in virtual world making players have undue advantage over other players in a competition. With the advancement in technology, these video games have become more expanded in the development aspects of gaming. Video game developers have created long lines of codes to create a new look of video games. As video games have progressed, the coding, bugs, bots, and errors of video games have changed throughout the years. The coding of video games has branched out from the original video games, which have given many benefits to this virtual world, while simultaneously creating more problems such as bots. Analysis of tools available for cheating in a game has disadvantaged normal gamer in a fair contest.

Keywords

Video Games, Confidentiality, Virtual World, Cheat Code, Bots, Programming

1. Introduction

Video games have a large production team behind each of these games. A very important role of video games comes to be the programmers and development

team for these games. A video game programmer (Gameplay Programmer) is known to write the coding for a specific game, and this code will bring the game to life. [1]. Video game programmers (Computer programmers) write lines of code, and this code is run in order to create a gameplay for users. According to Wonderoplis, "Computer programmers must write millions of lines of computer language instructions—called code—that control all aspects of the game [2]." There are many different languages that these codes can be written in, such as Python, C++, Visual Basic, and Perl [2]. These languages are code languages that are written in editors, such as Notepad++, sublime text, atom, and brackets. The programmers will create lines of codes that are written in a specific language into an editor, and have these codes run until a video game is ready for a user.

The coding of a video is very complex in such a way that every aspect of the game is going to need lines of code. The millions of lines in a video game code include all the different parts of a game. This could be shown just by a character, and how the character looks in appearance, how the character moves throughout the video game, and how the character will advance in levels of this game. All of the possibilities of one single character will have a line of code written for this, and this creates a complex code for all video games [2].

Video games have become complex with the new gaming world, and this has had many benefits in bringing more people into this world. Along with the advancements in these games, there comes issues regarding code, bugs, and errors of these games. The modern video games are known to be open-world-shooting games. These modern video games are currently having many issues with the cheating or cheat codes written in the video games themselves. Cheat codes were not used in original video games as the advancement of these cheat codes have given greater benefits into this modern world of gaming. Cheat codes were made for programmers in order to work with the lines of codes and further the advancement of codes [3]. The development of codes and the future of gaming has changed with these cheat codes and caused many issues regarding gameplay for many video game players. The rest of the paper is arranged as follows: Section 2 highlights previous work done, In Section 3 we present The cheat codes and in Section 4 tools for cheating, Section 5 impact of cheating, and in Section 6 the game bots, in Section 7 we present the future of cheat codes and bots and finally the paper concludes in Section 8. This research will be discussing different cheating tools available in current video games, the difficulties cheating creates for players, and the problems cheating causes in pro league gaming. The modern world of video gaming has become not as enjoyable for everyday players and for pro video game players from the various cheating methods that are available.

2. Related Work on Bot User

There are many ways that bots are used in gaming, and this comes with different advantages in using them. An anonymous Bot User (Bot User One) has discussed the different ways their bots are used and the advantages of having these

bots. Bot User One says that there are many different types of bots, ranging for Webcrawling bots to Discord and Twitch bots. Other types of bots include ones used to hack into DOS based apps and ones that attack texts and emails. The coding of these bots changes when discussing the different variations of bots. Bot User One discusses these changes by saying that these codes change depending on what your bot is needed to do, such as online games. Online game bots are able to gather resources, preform calculations to determine troop amounts, and as well as how many resources are required to run each village, and determining a counterattack if a village becomes under siege. There are many different ways to code artificial intelligence bots, and these variations of code would be dependent on the type of bot to use.

The history of bots has changed with the changes in video games. Bot User One discusses these changes with the different in bots for different games as the bots varying in games. This would be dependent on the different games played. These bots would be used for different resources in the game and the bots are predetermined by sending single scouts to run calculations, and this is done within a bot emulator.

Bot User one discusses how often a recode/remake due to patching of games for their Bots usually is. Microsoft Windows changes firewall settings often and this causes small patch updates, which has a remake or modification to the bot every three to four months. The coding of a bot itself would be used using a bot emulator, and this makes it easier for new modern programming according to Bot User One.

Bot User One discusses the benefits and the selling of bots, where there could be advantages in having these bots or selling these bots for profit. Bot User One discusses that bots would be a great way to maintain gameplay when they are unable to play a game every day or when there needs to be resources in the game constantly and they are unable to reach this level of gameplay in a certain time. The game bot used for Bot User One maintains ten of their accounts and these accounts are ran simultaneously through random VPNs around the world. Bot User One discuses that the bot used for their accounts have been given (not sold) to family members and other players that are in their guild. Although, these bots have been given to other users, bots can be sold for profit, and this would be a way for bot creators to make money off of their gaming. In a study of a computer player giving fun to opponent, it is expected that the form of AI will be expanded. Previous studies are almost occupied by perfect information games, and research is being conducted to strengthen AI. However, this research is targeting imperfect information game [4]. In the AR technology-based game for finding treasures in museums, the goal of the game is to overcome many challenges, collect clues hidden throughout the museum, and finally obtain a "treasure" belonging to the visitors. Before entering the museum, users first download and install a mobile software installation package, then launch the game and scan the given picture next to the collection, and they can see the 3d model corresponding to the collection presented in front of the visitor [5].

3. Cheat Codes

According to Techopedia, "Cheat codes are special codes or methods which allow gamers access to advantages such as extra lives, more power, extra equipment and higher levels [3]." **Figure 1** below shows cheat GTA V PS3|Gta v cheats, Gta 5 cheats ps4, cheating. The special advantages of cheat codes were developed by program developers to allow access to special parts in a video game, this special access would allow a video game programmer to edit, read, and execute certain parts of codes to work on these features in the game for quicker access. Without the use of cheat codes, a programmer would not be

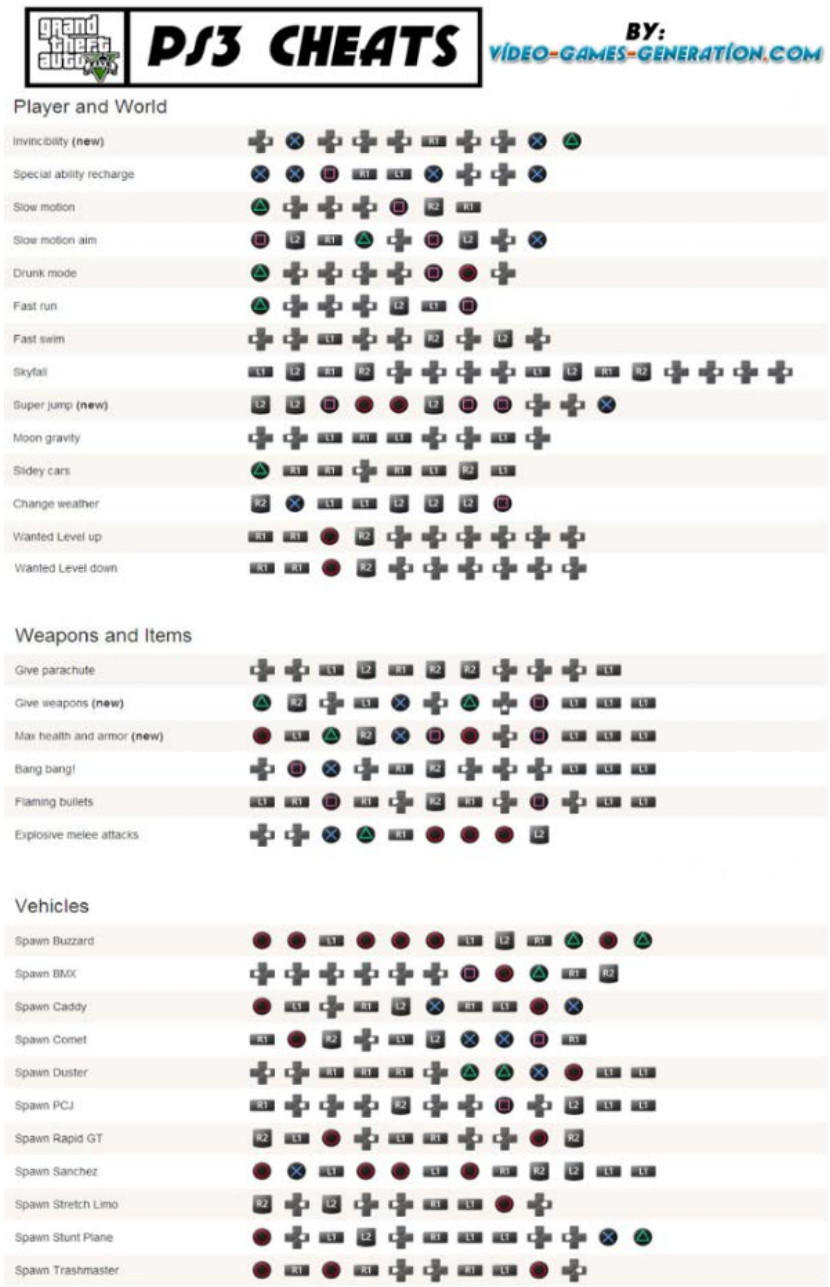

Figure 1. Cheat GTA V PS3|GTA v cheats, GTA 5 cheats ps4, Cheating.

granted access to further parts in the game and could not get the edits to be done as quick. Techopedia discusses the original use of cheat codes in a form of development help, where "Cheat codes were initially used as a tool to aid development and testing of the various modules of the game and kept hidden until a user makes the discovery of the cheat code and uses it to gain an advantage [3]." The video game programmers have purposely put these cheat codes in the line of code in order for their own personal advantage for the coding of a game; however, public users of the game are able to find this code and create a personal advantage when playing these games. When playing multiplayer with many online users, the usage of cheat codes can become a heavily unfair advantage for one player versus another player.

There are many different versions of cheat codes, which can be secret textual information, or this could be executable codes with the video game input controllers [3]. Many people see cheat codes as forms of input from a controller, which allows you to have advantages in the game, such as a character level up, adding guns/cars, and/or adding special abilities to your character. In figure one, a setup of video game cheat codes is shown for a new modern game called Grand Theft Auto. These cheat codes are shown as video game controller input, which is a common type of cheat code. The user can use their controller to read the lines of the code to create special advantages in the game. The cheat code shows the input of the controller lines, which could be the up button on the D-pad along with a combination of other buttons such as circle, square, triable, or the X button. Another popular form of cheat codes is a line of numbers and letters put into an editor cheat code. In the new modern game of Pokémon, a user is able to type in a line of letters and numbers to get special advantages in the game. **Figure 2** below shows the most used Pokémon Emerald cheats. In **Figure 2**, there is a line of code of special numbers and letters to create an advantage to a user playing Pokémon Emerald. Cheat codes are found in many variations for modern

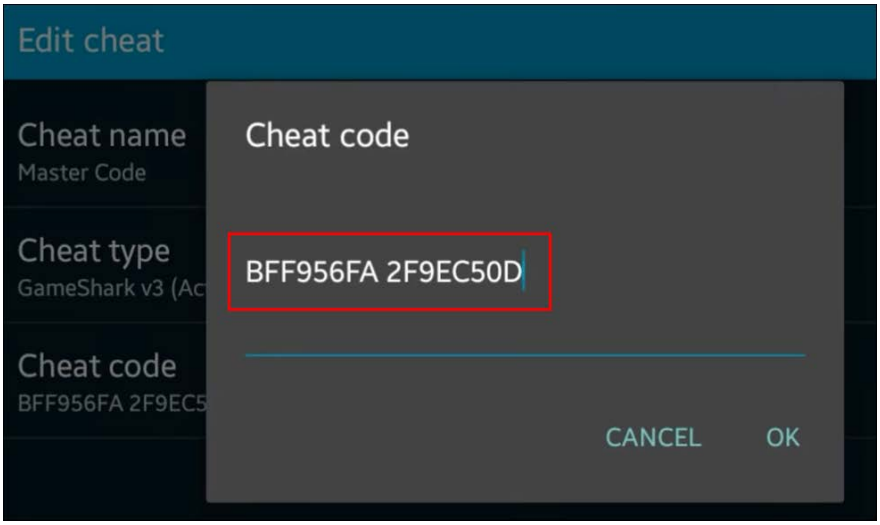

Figure 2. The most used pokémon emerald cheats.

video games, and this creates issues when the general public has access to these codes. When there are many users versing another user in a game, then advantages could be made to a user with these codes. As video games become more popular, and users having a career off of these games, then cheat codes could become a bigger issue when versing others. There are many problems when discussing cheat codes, and another issue arises when artificial intelligence is added to video games, known as Game Bots.

4. Cheating Tools

The modern video games have many different cheating tools currently available to use. Specifically discussing popular first-person shooter games, such as Counterstrike: Global Offensive, Halo 3, Battlefield: Bad Company 2, Apex Legends, and Titanfall 2, have many cheating tools actively being used in these games [10]. The cheating tools are used in the software of these video games and allows players to benefit in these games. In a first-person shooting game, there are software cheating tools that allow for wallhacking, aim-botting, and speed hacking. The cheating tool known as wallhacking will allow a player to see through a wall, which allows for a player to see where an enemy player is. The cheating tool known as aim-botting allows for a player to aim assistance and this allows the computer to perfectly align the gun to shoot enemy teams. The third cheating tool, known as speed hacking, allows for a player to have an increased speed during gameplay, which could allow for players to move faster than their enemy teams [11].

A second type of cheating tool is known as hardware cheating, which is not commonly used today due to most games not needing a hardware drive to be inserted into their gaming system. Modern games today are downloaded software, but in the earlier years of video games there were cartridges used to play games. According to Commercial litigation blog, "In the early years of console gaming, players used cheat cartridges to inject cheat codes into games to gain otherwise unobtainable items or advantages. For example, Gameboy cheat cartridges were used for *Pokémon* games to allow players to catch Pokémon, which were unobtainable in the unmodified version of the game [11]." Hardware cheating tools could still be used today, and these would be known as macro buttons being used on a mouse and keyboard, and these macro buttons are used for specialized input commands. These input commands would be similar to software programs, such as increased player speed, would not be obtainable by the skill of a human [11].

Focusing the attention on one first person shooter game, *Apex Legends*, as discussed before, this video game has an encountered many cheating reports in its short amount of video game life thus far. *Apex Legends* was first launched February 4th, 2019, and one year later, a report was shown of how many cheating reports had been made within its first-year launch [12]. According to The Gamer, Respawn Entertainment had made a report that *Apex Legends* had 25 million players in the first week of the game's launch; however, this number had

been decreased by 16,000 due to banning of cheaters in the game. The developers of *Apex Legends* made statements allowing for gameplayers to ban these cheaters and capturing the evidence of cheating to help support the claims [13]. As previously discussed, the capturing of wallhacking, aim-botting, and speed hacking, would give substantial evidence of a cheater in this first-person shooter game. *Apex Legends* has had a cheating problem from the start of its launch and continues to face these same issues today. The cheating from either cheating tool, software, or hardware, makes a difficult time to have fair gameplay for casual players, and makes a bigger concern when pro players have been affected in tournaments.

5. Impact of Cheating

The focus of one first-person shooter game will still be discussed, where *Apex Legends* has an ongoing issue with cheating. The impact of this cheating does not only affect the level of casual game players butgoes into more professional leagues of gameplaying. *Apex Legends* hosts a professional tournament, "Apex Legends Global Series Pro League", where professional *Apex Legends* game players can play against other pro players for $100k in prize money [14]. The fairness of online gaming can be unethical when pro league players have careers from this game, and winning tournament can be tampered with during these games due to cheating. According to the GGrecon article, "Professional Apex Legends Team Claims Squads 'Cheated' in 450k ALGS Grand Finals", there have been reports of entire professional squads cheating in professional league tournaments. The accounts of cheating discussed the cheating tools that had been previously discussed, "third-placed Athaim players believe that opposition players were using aimbot in the ALGS APAC South Grand Finals [15]." The impact of cheating could cause many issues when the professional players that depend on *Apex Legends* gameplay as a career are having tampered games and tournaments from various cheating tools.

6. Game Bots

According to Science Direct, "A Game Bot is an automated program that plays the game on behalf of human players. Since they can play without break, game bots can accumulate money and items much faster than normal human players [6]." Game Bots are another form of disadvantages when discussing modern video game multiplayer gaming. There is an unfair advantage when a video game player is versing an artificial intelligence bot. There are many video games, such a new modern video game—Rocket League, that discusses these Game bots as cheating. According to Game spot, "Using bots in online play represents a form of cheating and it violates Rocket League's terms of use and its code of conduct [7]." Many video games have discussed the use of cheat codes as a form of cheating in the games, and artificial intelligence bots are now being put in the terms of use as a form of cheating as well. Although a user is not directly putting in a code for cheating, there are Game Bots being used for cheating in these

games. According to Techopedia, in gaming, a bot is a character controlled by a computer. In one sense, bots are all the non-player characters (NPCs) in a game, including those that fight alongside as well as against the gamer [3]. There are different variations of Game bots, and the two most common type of game bots are known as static game bots and dynamic game bots [8]. According to Game Designing, static game boots are known for needing assistance for proper use and small agency for their own Movement, and have linear functions, while dynamic game bots can learn levels and complex strategies. The dynamic game bots would be found in more complex game, which would be found in more modern types of games such as Counter Strike [8]. There are many disadvantages to video game players when versing artificial intelligence bots and having cheat codes written in the coding of a game.

7. Future of Cheat Codes and Bots

According to Game Rant, the future of cheat codes is bound to becoming non-sexist due to the advancement in gaming. The world of cheat codes is becoming part of the old way of gaming, and the multiplayer games will not have these old forms of cheat codes coded into the lines of these games. Game Rant states, "Cheat codes have largely gone away in the modern gaming landscape. With the advent of online multiplayer, achievements, and trophies, getting an advantage by putting in a code seems unfair [9]." The actual coding of cheat codes could become non exist in a near future for modern video games; however, artificial intelligence bots will still be on the rise in these modern video games. According to Game Singing, "Game bots are present in nearly every multiplayer game, from Halo to MMORPGs. Game bots perform various tasks, everything from acting as the player would or NPCs doing farm work [8]." The future of cheat codes could be coming to a distance end, while the future of artificial intelligence video game bots seems to be on the rise in new modern video games.

8. Conclusion

The coding of video games has become very complex in modern game, but the actual coding for cheats from video game programmers might be coming to an end of an era. While video game programmers will still be needed to code a video game, an artificially intelligent bot could be useful for creating advantages in the games. The artificial intelligence bots could be used in place of cheat codes, creating more advantages for each user. The current modern video games have changed drastically from the beginning of video games and have complex lines of codes to give extra games life. The future of games could be changing, and the artificial intelligent bots could be taking over.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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Impact of Remote Learning on Student Performance and Grade: A Virtual World of Education in the COVID-19 Era

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Abstract

The COVID-19 pandemic has had a profound influence on education around the world, with schools and institutions shifting to remote learning to safeguard the safety of students and faculty. Concerns have been expressed about the impact of virtual learning on student performance and grades. The purpose of this study is to investigate the impact of remote learning on student performance and grades, as well as to investigate the obstacles and benefits of this new educational paradigm. The study will examine current literature on the subject, analyze data from surveys and interviews with students and educators, and investigate potential solutions to improve student performance and participation in virtual classrooms. The study's findings will provide insights into the effectiveness of remote learning and inform ideas to improve student learning and achievement in an educational virtual world. The purpose of this article is to investigate the influence of remote learning on both students and educational institutions. The project will examine existing literature on the subject and collect data from students, instructors, and administrators through questionnaires and interviews. The paper will look at the challenges and opportunities that remote learning presents, such as the effect on student involvement, motivation, and academic achievement, as well as changes in teaching styles and technology. The outcomes of this study will provide insights into the effectiveness of remote learning and will affect future decisions about the usage of virtual learning environments in education. The research will also investigate potential solutions to improve the quality of remote education and handle any issues that occur.

Keywords

Remote Learning, Student Performance, Virtual World, Covid-19, Grade, Student Learning

1. Introduction

The COVID-19 epidemic hastened the introduction of distance learning, which has both and drawbacks. Remote learning highlights the digital divide that exists in some areas while also providing flexibility, better access to resources, and the freedom to study from anywhere. The epidemic has shown that remote learning is an effective teaching strategy, and numerous academic institutions have invested in remote learning technologies and included remote learning choices in their long-term strategies [1]. This essay investigates how communication between students and teachers is affected by distance learning. Communication has been impacted in a number of ways, including by making it less personal and making time management more difficult. Due to the absence of fast feedback and reliance on digital platforms, has also impacted the effectiveness of communication [1]. Despite these difficulties, remote learning has given students and instructors the chance to become used to new communication methods and collaborate to ensure effective learning. Due to the COVID-19 epidemic, remote learning has gained popularity, but there are concerns about how it may affect students' grades. Students now learning remotely instead of in person find it challenging to focus, get rapid feedback, and efficiently manage their time. In-person instruction enables more individualized engagement and prompt feedback, which may result in higher marks. Remote learning has also given some students the chance to enhance their grades, especially those who might find it difficult to learn in a typical classroom setting. Whether through in-person or online learning, it is crucial for students and professors to collaborate to guarantee that students obtain a high-quality education. Remote learning has a bright future since it provides benefits including flexibility, resource availability, and opportunity for collaborative learning. Artificial intelligence (AI) and other technological breakthroughs like virtual and augmented reality can improve learning. Yet, issues like the digital divide, which restricts access for some students, and a potential loss of social connection are of concern. It is crucial to use remote learning to maximize benefits and raise educational standards [2]. The rest of the paper is arranged as follows: In Section 2 we discuss the rise in remote learning, In Section 3 we considered the impact of remote learning on communication between teachers and learnings, and in Section 4 we considered the impact of remote learning on grades, and then in Section 5 the future of remote learning, in Section 6 we have the survey and the paper was concluded in Section 7.

2. Literature Review

Means *et al.* (2010) did a meta-analysis and evaluation of online learning research to evaluate evidence-based strategies in online education. The researchers examined 51 independent effect sizes from controlled experiments that evaluated the efficacy of online learning to face-to-face education. The purpose was to discover empirically verified strategies in online education and to understand the conditions under which online learning is most effective. According to the

study, on average, online learning was determined to be more successful than traditional face-to-face training. It is important to highlight, however, that the observed advantage for online learning was often minimal and varied depending on the unique educational situation. The expanded studying time, the utilization of additional instructional tools, and the capacity to give students personalized training all contributed to the efficacy of online learning. Blended learning, which mixes online and in-person training, was found to be more effective than either online or in-person instruction alone. According to the authors, blended learning can deliver the best of both worlds by allowing for personalized learning, connection with teachers, and peer collaboration. The study also discovered that older learners, such as college students and adult learners, were more adept at online learning than K-12 students. More research, however, is required to assess the usefulness of online learning for younger pupils. The authors identified numerous instructional techniques related to more effective online learning, such as giving learners choice over their learning speed, utilizing multimedia resources, and enabling contact between learners and instructors [3].

According to another study called Hodges *et al.* (2020), the fundamental contrasts between emergency remote teaching (ERT) and online learning are found in this paper. The authors underline that these two forms of instruction are distinct, and recognizing their differences is critical for educators and institutions dealing with abrupt changes in educational delivery techniques, such as during the COVID-19 pandemic. Online learning refers to courses that are well-planned and purposefully designed to be given digitally. Emergency remote teaching, on the other hand, is a brief change from face-to-face to remote training in reaction to an unexpected crisis or event.

Online learning frequently entails a well-prepared curriculum, extensive planning, and a heavy emphasis on interaction between instructors and students, as well as among students themselves. ERT, on the other hand, ERT frequently lacks the comprehensive support mechanisms, infrastructure, and training found in a well-designed online learning environment. This could result in a poorer learning experience than planned online courses. According to the authors, institutions and educators should recognize the limitations of ERT and avoid equating it with online learning. This distinction is critical to ensuring that the quality of online learning is not jeopardized by the difficulties encountered during emergency scenarios. The paper also offers advice to institutions and educators on how to overcome ERT, such as focusing on vital course content, maintaining regular communication with students, using existing resources, and offering support for both instructors and students [4].

3. The Rise of Remote Learning

The COVID-19 pandemic has resulted in radical changes in the way we live and work, with one of the most significant being the fast rise of remote learning. With schools and colleges closed around the world to combat the virus's spread,

educators and students have had to quickly adjust to online and remote learning platforms. The transition to remote learning has been difficult, but it has also opened new educational chances and possibilities. Remote learning platforms enable students to join classes from anywhere in the world, and they provide a variety of tools and resources to help students learn more effectively [5]. The COVID-19 pandemic has accelerated the adoption of remote learning, dramatically changing the landscape of education across the globe. As schools and universities shifted to online platforms, remote learning has emerged as an essential and viable alternative to traditional face-to-face education. This essay aims to analyze and interpret data from various articles and studies to better understand the impact of remote learning on student performance, engagement, and access to education. Teachers are also experimenting with new ways to engage students, such as using virtual reality and gamification to make classes more interactive and engaging. Simultaneously, remote learning has revealed the digital divide that exists in many parts of the globe. Students from low-income families may lack the necessary hardware and internet access to access remote learning platforms, posing a significant challenge for educators and lawmakers. Overall, the growth of remote learning has been a mixed bag of advantages and disadvantages. As we navigate the COVID-19 pandemic and its aftermath, remote learning is likely to remain a major part of the educational landscape in both the short and long term [5].

In 2016, 21 million students enrolled in Coursera's online classes, a figure that will rise by around 7 million per year over the next two years. However, as the pandemic struck, a threefold increase in new registrations occurred, bringing the total to 71 million in 2020 and 92 million in 2021. Figure 1 below shows the statistics of rising of remote learning. Enrollment in online courses followed a similar trend, with pre-pandemic gains overshadowed by massive spikes. Enrollment more than doubled in 2020, then grew 32% the following year, reaching 189 million. These increases represent the increasing global acceptance of

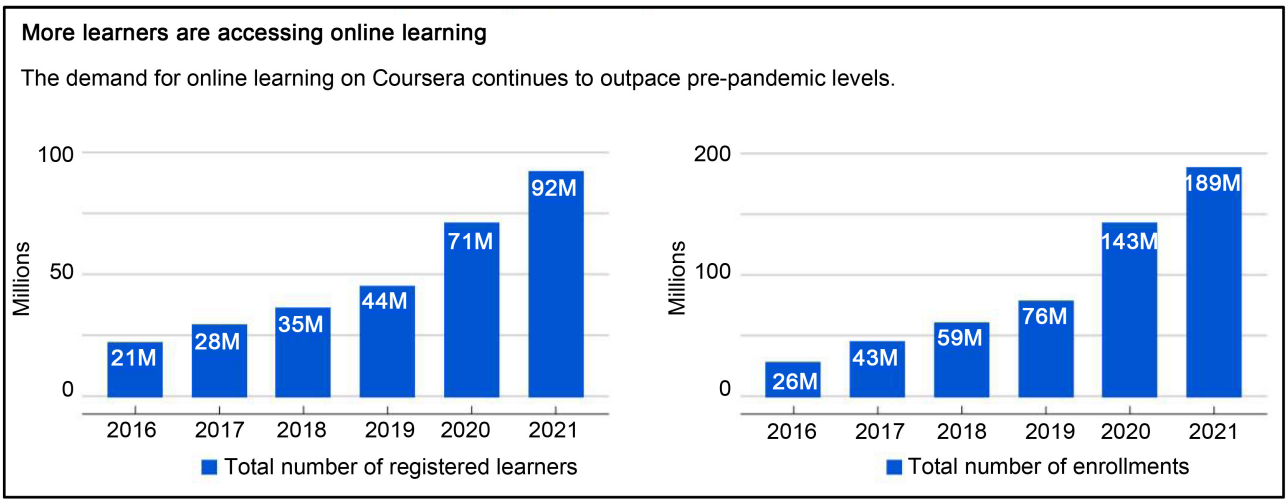

Figure 1. Statistics of rising of remote learning.

online education, including an increase in remote learners enrolled in higher education courses and those from vulnerable or remote communities [6].

After COVID-19 forced schools and universities around the globe to close their doors and shift to online learning, remote learning became widespread. The pandemic demonstrated that remote learning was not only a temporary solution, but also a viable choice for future education. During the pandemic, the benefits of remote learning, such as scheduling flexibility, the ability to study from anywhere, and increased access to resources, became more evident. Consequently, many educational institutions have invested in remote learning technologies and built remote learning options into their long-term plans [6].

4. The Impact of Remote Learning on Communication between Student and Teacher

Remote learning has grown in popularity in recent years, owing in part to the COVID-19 epidemic. It has resulted in numerous changes in the educational sphere. One major change is the shift from in-person to online communication between students and instructors. This has raised concerns about the effect of remote learning on student-teacher communication. A study conducted by Bao (2020) compared student performance in remote and face-to-face learning environments. The study found mixed results, with some students experiencing improvements in their grades, while others faced challenges due to the lack of in-person interaction and the need for increased self-discipline. This finding was supported by a meta-analysis by Means *et al.* (2013), which indicated that remote learning could be as effective as traditional face-to-face instruction when implemented correctly [7]. This paper investigates the effect of remote learning on student-teacher communication. Remote learning has had an impact on student-teacher contact in a variety of ways. One of the most important consequences is that communication has become less personal. In-person communication enables students and instructors to have more personalized interactions. Research by Al Lily *et al.* (2020) investigated the impact of remote learning on student engagement. The study found that although online platforms offered numerous opportunities for collaborative learning, the absence of in-person interaction made it challenging to maintain student motivation and participation. A study by Marinoni *et al.* (2020) similarly highlighted the importance of finding innovative ways to foster student engagement in remote learning environments [7]. However, communication in remote learning is confined to online platforms such as video conferencing, email, and instant messaging. These platforms lack the personal touch that in-person communication provides, which can lead to misinterpretation of messages and misunderstandings. Another impact of remote learning on communication between student and teacher is the challenge of time management. With remote learning, students and teachers must manage their time effectively to ensure that they meet deadlines and communicate effectively. However, this can be challenging, especially for students who may be

dealing with other responsibilities outside of school [7].

The quality of communication between students and instructors has also been impacted by remote learning. In-person communication provides instant feedback, which remote learning does not. Students may struggle to grasp concepts and pose questions due to a lack of immediate feedback. Furthermore, with remote learning, communication is confined to digital platforms, which may be difficult for some students, particularly those without reliable internet or digital devices. Remote learning has had a significant effect on student-teacher communication. It has made conversation less personal, has made time management difficult, and has impacted communication quality. Despite these difficulties, remote learning has enabled students and teachers to adapt to new modes of communication and collaborate [7].

5. The Impact of Remote Learning on Grade

Remote learning has grown in popularity in recent years, owing in part to the COVID-19 epidemic. It has resulted in numerous changes in the educational sphere. The shift from in-person to remote learning is a major change. Concerns have been raised about the effect of remote learning on student grades. This paper investigates the effect of remote learning on pupil grades. Remote learning has had a variety of effects on students' scores [7]. One critical aspect of remote learning is its potential to increase access to education. UNESCO (2020) reported that during the COVID-19 pandemic, millions of students worldwide experienced disruptions in their education. Remote learning, however, provided an opportunity to continue their studies. A study by Bozkurt *et al.* (2020) emphasized the role of remote learning in bridging the digital divide, but also acknowledged that students from disadvantaged backgrounds might face challenges in accessing the necessary technology and resources for remote learning. One of the most important consequences is that it has made it difficult for some students to focus on their studies. Remote learning requires students to learn in a less structured setting, which may make it difficult for them to focus on their studies. Furthermore, remote learning has made it difficult for students to receive immediate feedback from their teachers, which can have an impact on their learning and comprehension of ideas [8].

Figure 2 below shows the distribution of participants according to their age. According to the most recent statistics, the average evaluation was 4.02 1.11 points. Most participants, 96.7% (n = 1346), felt that the COVID-19 pandemic lockdown had an impact on their academic achievement to varying degrees. Almost half of the participants (47.5%, n = 661) were severely impacted, 19.9% (n = 278) were significantly affected, 23.3% (n = 324) were moderately affected, and 6.0% (n = 83) were slightly affected. Only 3.3% (n = 46) of participants said lockdown had no impact on their academic performance [9].

Another effect of remote learning on student scores is the difficulty in managing time. Students must manage their time efficiently when using remote learning to make deadlines and complete assignments. However, this can be difficult,

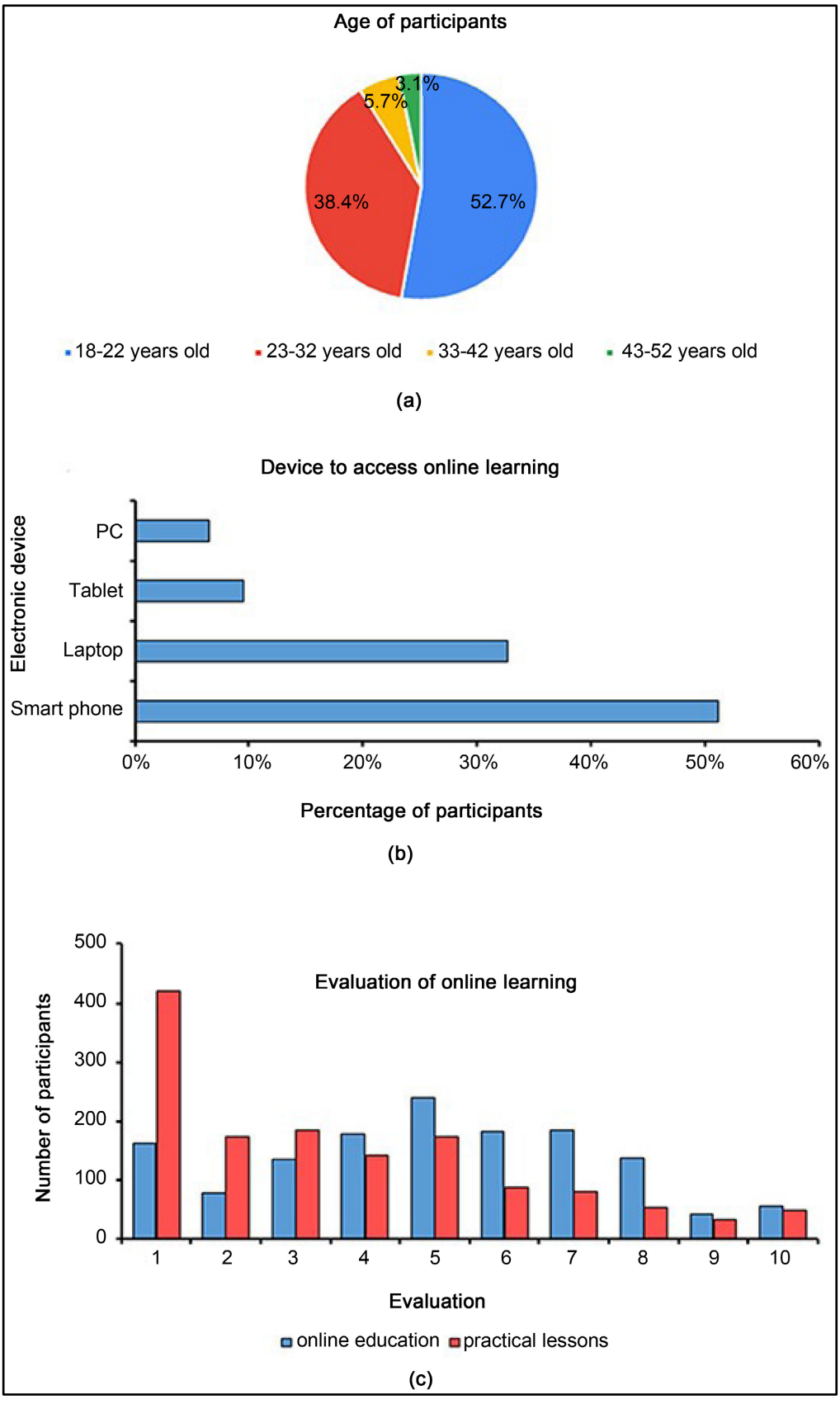

Figure 2. The distribution of participants according to their age.

particularly for students who have other responsibilities outside of school. Remote learning has also had an impact on the educational quality of pupils. In-person learning provides instant feedback and interaction with teachers, which remote learning does not. Students may struggle to comprehend concepts and ask questions due to the lack of quick feedback, which may have an impact on their grades. Remote learning has given some students the chance to improve their grades. For example, students who struggle with conventional in-person learning may find that remote learning is better suited to their learning style [10]. Furthermore, remote learning has given students greater flexibility by allowing them to study at their own pace. Students' scores have improved significantly because of remote learning. It has made it difficult for some students to focus on their studies, effectively manage their time, and receive instant feedback from their instructors. Despite these challenges, remote learning has given some students the chance to improve their grades. Finally, students and instructors must collaborate to ensure that students receive quality education, whether through in-person or remote learning [10].

6. The Future of Remote Learning

Remote learning has transformed the way education is provided. Remote learning has a bright future and could significantly improve educational quality. One of the major benefits of remote learning is that it gives pupils more flexibility. Students can learn at their own speed and on their own schedule, resulting in a more personalized learning experience [11]. Furthermore, remote learning has increased students' access to educational materials, which can aid in their learning. Another benefit of remote learning is the increased opportunity for collaborative learning. Remote learning has made it possible for students from all over the world to work together on projects and exchange ideas. As a result, the learning setting may become more diverse and dynamic [11]. Furthermore, remote learning allows students to attend classes and learn from experts who may be in various parts of the globe. The future of remote learning holds great promise for enhancing educational quality using technology. Virtual and augmented reality, for example, can be used to provide pupils with a more immersive and interactive learning experience. Furthermore, artificial intelligence can be used to personalize the learning process and provide students with relevant information [12].

There are also worries about the future of distance education. One major worry is that it may result in a loss of social interaction and connection between students and teachers. Furthermore, there is concern about the digital divide, which may restrict some students' access to remote learning. Remote learning has a bright future and can significantly improve educational quality. It gives students more flexibility, chances for collaborative learning, and access to educational resources. There are, however, worries about the loss of social interaction and the digital divide. Finally, it is critical to ensure that remote learning is used

in a way that optimizes its potential for improving educational quality while minimizing its drawbacks [12].

7. Survey

This paper includes a survey among two teachers and two students about their experience and opinion about remote learning.

First interview: This is the interview conducted by the writer with an instructor named Surekha Rao of Indiana University Northwest. She is a lecturer of Business faculty, and she is working with Indiana university northwest from 2003. Below is the written interview script:

Writer: Good afternoon! and thank you for being here today. Can you tell us a little bit about your teaching experience and how long you have been teaching?

Surekha Rao: Thank you for having me today. For the past 20 years, I have mainly taught in-person in a traditional classroom setting at Indiana University Northwest campus.

Writer: As a result of the COVID-19 pandemic, many schools and teachers were forced to rapidly adapt to remote learning. How did you find the experience?

Surekha Rao: It was a major departure from my previous teaching experience. Adapting to remote learning has brought with it a slew of new challenges and roadblocks, but it has also brought with it some unique possibilities.

Writer: What specifically have you found challenging about remote teaching?

Surekha Rao: One of the biggest challenges has been keeping students engaged and motivated. When teaching in-person, there is a sense of camaraderie and community that can be difficult to replicate virtually. It can also be challenging to provide individualized attention to students and to ensure that they are understanding the material. Also, less student engagement in person is creating difficulty.

Writer: Have there been any advantages to remote teaching that you've experienced?

Surekha Rao: Absolutely! Remote teaching has allowed me to be more flexible with my schedule, which has been helpful in balancing my personal life with my professional responsibilities. It has also opened new opportunities for collaboration and professional development with other educators outside of my usual network.

Writer: Do you think remote learning has changed the way you approach teaching in general?

Surekha Rao: Yes, I think it has helped me become more adaptable and creative in my teaching approach. Remote learning has forced me to try new strategies and methods to keep my students engaged and motivated, which I believe will be beneficial as I continue to teach in the future.

Writer: Lastly, do you think remote learning will continue to have a place in education even after the pandemic ends?

Surekha Rao: I do believe that remote learning will continue to have a place in education, especially as technology continues to evolve and improve. However, I also believe that in-person learning and the sense of community that comes with it will remain an important and valuable part of the educational experience.

Writer: Thank you so much for the interview. I really appreciate your time and opinion.

Surekha Rao: No problem! I was happy to contribute.

Second interview: This is the interview conducted by the writer with an instructor and academic advisor named HelenMarie Harmon of Indiana University Northwest. She is Director, Student Success & Career Development. She is working with Indiana university northwest from 2002. Below is the written interview script:

Writer: Good morning! Thank you for joining me today and giving me your valuable time. Could you please start by introducing yourself?

Helen: Good morning! My name is HelenMarie Harmon, and I am the director of student success and career development department with over 20 years of experience in education. I primarily teach English and Literature.

Writer: We have seen a massive shift towards remote learning in recent years. How has this impacted your teaching experience?

Helen: Remote learning has changed the dynamics of teaching or connecting with students. It has allowed us to reach students who might not have access to traditional schooling, and it has made education more flexible for students who juggle multiple responsibilities. However, it has also posed challenges in terms of student engagement, technical issues, and building strong relationships with students.

Writer: Can you share some of your experiences with remote teaching or advising curriculum?

Helen: Of course. When we first transitioned to remote learning, there was a steep learning curve in terms of adapting our teaching methods and using technology effectively. We had to find new ways to present material, keep students engaged, and assess their understanding.

Over time, we have found some successful strategies, like using interactive tools, breaking the advising into smaller segments, and incorporating real-time feedback. We have also learned to be more patient and empathetic, as we understand that students may be dealing with personal challenges during remote learning or academic advising.

Writer: In your opinion, what are the advantages and disadvantages of remote learning or interaction?

Helen: There are advantages to remote learning or having meetings with students, such as flexibility in scheduling, access to a wider range of resources, and the ability to reach students in remote areas or those with health concerns. Remote learning can also be more cost-effective for families and schools.

However, there are disadvantages as well. Remote learning can sometimes

lead to feelings of isolation, and it can be difficult to maintain motivation and engagement without the in-person interactions that students are used to. Additionally, not all students have equal access to technology and internet connectivity, which can create an unfair learning environment.

Writer: Do you believe remote learning should continue to play a role in education, even after the pandemic subsides?

Helen: I think remote learning has a place in education moving forward. It provides opportunities for students who may not thrive in traditional classroom settings or those who need more flexibility in their schedules. However, I believe we should also recognize the importance of in-person learning and social interaction for students. A blended approach that combines the best of both remote and in-person learning could be beneficial in creating a more inclusive and adaptive educational system.

Writer: Thank you for sharing your experiences and insights, Helen. We appreciate your time and dedication to education.

Helen: You are welcome! It was my pleasure to discuss this important topic.

Third interview: This is the interview conducted by the writer with an undergraduate student at Indiana University Northwest. Her name is Priya Karnam, and she is a sophomore in Business. Below is the written interview script:

Writer: Good evening and thank you for joining us today. Can you please start by introducing yourself?

Priya: Hi, my name is Priya Karnam. I am a sophomore at Indiana University with a Business major. I have experienced both in-person and remote learning during my time in school.

Writer: Remote learning has played a significant role in education in recent years. How has it impacted your learning experience?

Priya: Remote learning has been a mix of positives and negatives for me. On the one hand, it has provided a more flexible schedule, which has allowed me to pursue personal interests and take breaks when I need them. On the other hand, it has made it more challenging to stay engaged and motivated, and I have missed the social interactions that come with in-person learning.

Writer: How has your experience with remote learning changed since the pandemic began?

Priya: In the beginning, it was quite difficult to adjust to remote learning. There were technical issues, and it was challenging to adapt to new ways of learning and communicating with teachers and classmates. Over time, though, both students and teachers have become more comfortable with the technology and remote learning tools, so the experience has improved. However, I still miss the in-person interactions and the more structured learning environment that a physical classroom provides.

Writer: What is your opinion on remote learning? Do you see any advantages or disadvantages?

Priya: I believe remote learning has its advantages and disadvantages. One

significant advantage is the flexibility it provides, which can be helpful for students who need to balance school with other responsibilities or interests. Additionally, it can be an excellent option for students in remote areas or those with health concerns. The disadvantages are also quite clear. Remote learning can lead to feelings of isolation, and it can be challenging to stay engaged and motivated. Plus, not all students have equal access to technology and internet connectivity, which can create disparities in learning experiences.

Writer: Do you think remote learning should continue to be a part of education even after the pandemic subsides?

Priya: I think remote learning can be a valuable option for some students, but it should not replace in-person learning entirely. A blended approach that combines the best aspects of remote and in-person learning would be ideal. This would allow students who thrive in remote learning environments to continue benefiting from it, while still providing opportunities for in-person interaction and collaboration.

Writer: Thank you for sharing your experiences and thoughts, Priya. I appreciate your perspective on this important topic.

Priya: You are welcome! I am glad I could contribute to the conversation.

Fourth Interview: This is the interview conducted by the writer with a graduate student at Indiana University Bloomington (virtually via zoom). His name is Benjamin Dewes, and He is a senior in Computer Information systems. Below is the written interview script:

Writer: Good afternoon and thank you for joining us today. Can you please start by introducing yourself?

Benjamin: Hi, my name is Benjamin Dewes. I am a high school senior in graduate school at Indiana University Bloomington campus. My most classes are hybrid anyway but during my undergraduate I did have face to face classes more.

Writer: Since the pandemic has subsided, how has your remote learning experience evolved?

Benjamin: The remote learning experience has improved significantly since the pandemic began. Teachers and students have become more adept at using digital platforms, and there's been a more comprehensive understanding of how to make remote learning engaging and effective. The resources and tools available have also improved, making remote learning feel more seamless.

Writer: How has remote learning impacted your academic performance, particularly in terms of your grades?

Benjamin: Remote learning has had both positive and negative impacts on my grades. On one hand, the flexible schedule, and the ability to work at my own pace have helped me excel in some subjects. On the other hand, the lack of in-person interaction and the challenges of staying motivated have made it harder to perform well in other areas, particularly in subjects that require more hands-on learning or group collaboration.

Writer: In your opinion, what are the pros and cons of remote learning?

Benjamin: Some pros of remote learning include the flexibility it offers, the ability to work at your own pace, and the opportunity for students in remote areas or with health concerns to access education. It can also be more cost-effective for families and schools. There are several cons as well. Remote learning can lead to feelings of isolation, and it can be difficult to stay motivated without the social interactions and structured environment of a physical classroom. There is also the issue of unequal access to technology and internet connectivity, which can create disparities in the quality of learning experiences.

Writer: Based on your experiences, would you recommend remote learning to other students?

Benjamin: I think remote learning can be a great option for some students, but it is not for everyone. It is essential to consider each student's individual needs and learning style. Remote learning can be a good fit for students who require more flexibility, have health concerns, or live in remote areas. For those who thrive in a more structured environment or need the social interaction that comes with in-person learning, a traditional classroom setting might be more suitable. A blended approach that combines the advantages of both remote and in-person learning could be the best solution for many students.

Writer: Thank you for sharing your experiences and thoughts, Benjamin. Your perspective is valuable in understanding the impacts of remote learning on students.

Student: You're welcome! I'm glad I could contribute to the conversation and help others understand the nuances of remote learning.

The main findings of the survey are as follows the advantages of remote learning including flexibility in scheduling, ability to work at one's own pace, access to education for students in remote areas or with health concerns, and opportunities for collaboration and professional development.

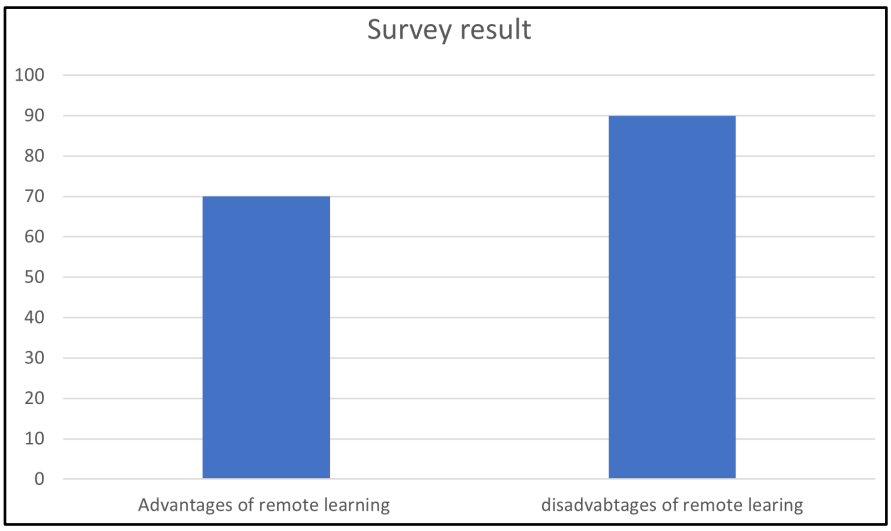

Figure 3. Advantages and disadvantages of remote learning.

As the disadvantages of remote learning, difficulty in maintaining student engagement and motivation, feelings of isolation and lack of social interaction, challenges in providing individualized attention to students, unequal access to technology and internet connectivity, not suitable for hands-on learning or group collaboration, and decreasing productivity. The bar chart in Figure 3 shows the ratio of advantages and disadvantages of remote learning:

Overall, the participants acknowledged both the advantages and disadvantages of remote learning. They emphasized that remote learning can be beneficial for some students, but it is not suitable for everyone. A blended approach that combines the best aspects of remote and in-person learning could be the ideal solution for many students, providing flexibility and opportunities for interaction and collaboration.

8. Conclusion

In conclusion, remote learning has significantly impacted the educational landscape, particularly during and after the COVID-19 pandemic. The COVID-19 pandemic led to a rapid rise in remote learning as schools and colleges closed globally. This shift presented both opportunities and challenges, with increased accessibility and innovative teaching methods but also highlighted the digital divide. Remote learning saw significant growth in enrollment, reaching 189 million, and gained global acceptance. The pandemic revealed the benefits of remote learning, leading many institutions to integrate it into their long-term plans. It has presented both advantages and challenges, such as increased flexibility, access to resources, and opportunities for global collaboration, as well as concerns about the digital divide, decreased social interaction, and the impact on student-teacher communication and academic performance. As we move forward, it is essential to strike a balance between remote and in-person learning, leveraging the potential of technology and online platforms while addressing the challenges and disparities they present. A blended approach that combines the best aspects of both remote and traditional learning could lead to more inclusive, adaptive, and effective education systems, better preparing students for a rapidly changing world. The overall impact of remote learning on student grades compared to traditional face-to-face learning is multifaceted and depends on various factors. Some students may benefit from the flexibility and accessibility of remote learning, leading to improved grades. However, others might struggle with the lack of in-person interaction, time management challenges, and limited access to resources, resulting in lower academic performance. The effectiveness of remote learning for individual students often depends on their learning style, self-discipline, and access to necessary technology and support systems. The rise of remote learning has transformed the educational landscape, offering new opportunities and challenges for students and educators alike. Data from various articles and studies suggest that while remote learning can be effective in improving student performance and increasing access to education, it also high-

lights the need for addressing issues related to student engagement and digital inequalities. As remote learning continues to evolve, further research is needed to ensure that its potential benefits are maximized, and its challenges are effectively addressed.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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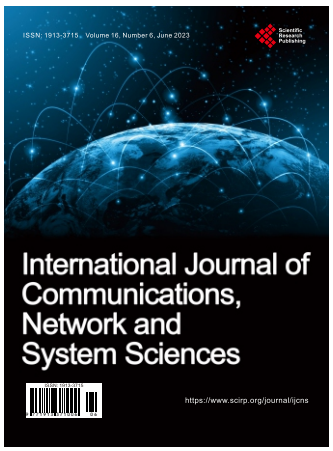

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We are also interested in short papers (letters) that clearly address a specific problem, and short survey or position papers that sketch the results or problems on a specific topic. Authors of selected short papers would be invited to write a regular paper on the same topic for future issues of the IJCNS.

Notes for Intending Authors

Submitted papers should not have been previously published nor be currently under consideration for publication elsewhere. Paper submission will be handled electronically through the website. All papers are refereed through a peer review process. For more details about the submissions, please access the website.

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