Impact and ethical considerations for software in education

Afonso Boucho 55860, André Matos 55358, Diogo Ramos 55481,
João Palma 55414, Ruben Belo 55967

DI, Nova School of Science and Technology, Portugal.

Contributing authors: a.boucho@campus.fct.unl.pt;
afr.matos@campus.fct.unl.pt; ds.ramos@campus.fct.unl.pt;
jp.palma@campus.fct.unl.pt; rc.belo@campus.fct.unl.pt;

Abstract

It is known that software in education is a very important subject that has gotten more attention recently since it has revolutionized the way we learn and teach. However, it's crucial to consider the ethical implications of using technology in education such as ensuring data privacy, avoiding bias, and promoting digital literacy, to ensure that education remains equitable, accessible, and empowering for all learners.

Keywords: Privacy, Equity, Bias, Pedagogy, Accessibility, Ethic

1 Introduction

In the last years software has become an integral part of modern education especially during the COVID-19 pandemic. When everybody studied online, we could feel all the benefits of using educational software, it changed the way learning takes place and how students engage with course materials.

This type of software is designed to enhance and support learning by providing digital resources, interactive learning activities, and real-time feedback on student progress. However, it is also important to take into account how the use of these technologies can be harmful for the future of education.

This document aims to discuss the impact software can have in education while also taking into account the ethical considerations like: privacy, accessibility, inequality, and the way we structure the educational system.

Along this discussion we will present some different real life scenarios, where we highlight the drawbacks and the advantages of educational software , allowing us to understand how technology will impact education.

2 Software in education

2.1 Pros and Cons

Software has become an increasingly important tool in education, with teachers and administrators turning to technology to enhance student learning experiences. From personalized learning to increased efficiency, the benefits of software in education are numerous. Here are some of the pros of using software in education [1, 2]:

- **Personalized Learning:** Software can adapt to the learning pace and style of individual students, allowing for personalized learning experiences that cater to the specific needs of each student.
- **Enhanced Engagement:** Using interactive technologies to teach can motivate and interest students in the subject matter.
- **Accessibility:** Software can help close the digital gap and improve education for students who might not otherwise have access to resources and materials.
- **Enhanced Efficiency:** Software can automate administrative duties like grading, record-keeping, and lesson planning, giving teachers more time to concentrate on teaching and student involvement.
- **Improved cooperation:** Students can communicate and share ideas with their peers and teachers more easily when using software to facilitate cooperation between students and teachers.

Although software has the potential to enhance education in various ways, there are also potential negative consequences that must be taken into account. Here are some of the disadvantages of using software in education:

- **Over-reliance on Technology:** An over-reliance on software can lead to a lack of human interaction and can limit the development of social skills, such as communication and teamwork.
- **Dependence on Technology:** Technology can fail, and software glitches can disrupt instruction and cause frustration and stress for both teachers and students.
- **Potential for Cheating:** Online tests and quizzes can be vulnerable to cheating, as students can easily access resources and share answers with their peers.
- **Inequality:** The cost of software and technology can create inequalities, as schools with less funding may not have access to the same resources as more affluent schools.
- **Data Privacy and Security:** The use of software can raise concerns about data privacy and security, as student information and data may be vulnerable to hacking or misuse by third parties.

Overall, while software has the potential to enhance the education experience, it is important to be mindful of the potential drawbacks and to use technology in an ethical and responsible manner.

3 Ethical considerations

As software continues to play an increasingly prominent role in education, it is important to consider the ethical implications of its use. Questions related to student privacy, accessibility, equity, pedagogy and biased software designs must be taken into account to ensure that the benefits of software in education do not come at the expense of ethical considerations [3–5].

Software education programs must respect the right to **privacy**, which is a basic human right. Students should be taught the knowledge and skills necessary to protect their privacy online as well as the dangers connected to data collection, storage, and use by educators. This includes imparting knowledge of the ideal procedures for data protection, encryption, and password management.

Another crucial factor in software education is **equity**. Equity in education is severely hampered by the "digital divide," which is the difference between those who have access to technology and those who do not. Software education initiatives should work to guarantee that all students have equitable access to technology and the tools they need to succeed. This could entail giving students who lack them computers or other devices, as well as providing internet connectivity in disadvantaged areas.

We should also look at **bias** in software education. If they are not carefully built and put to the test, machine learning algorithms and other types of AI may perpetuate biases and injustices. Students should be taught about potential biases in software, how to spot them, and how to lessen their impact.

Software development and programming teaching approaches and techniques are referred to as **pedagogy**. Inclusive, accessible, and engaging instruction is ideal. Teachers should offer pupils a variety of learning and understanding-demonstrating opportunities, such as practical projects, group learning, and individualized instruction.

The importance of **accessibility** in software education cannot be overstated. Software must be created with accessibility for users with disabilities, such as those who are visually impaired or have limited mobility, in mind. Teachers should instruct students on accessibility guidelines and how to create user-inclusive, accessible software.

Finally, it should be noted that ethical issues including **privacy**, **equity**, **bias**, **pedagogy**, and **accessibility** are crucial parts of software education. Teachers should make an effort to incorporate these factors into their curricula and provide students the information and abilities required to create moral software that is advantageous to all users. We may develop a more equal and inclusive technology ecosystem by giving these moral considerations top priority."We need to be sure that our work is of both the highest standards of research and the highest standards of ethics."(McLaren)[6].

4 Real-life Scenarios

- **In 2014, a controversy arose when it was discovered that a school district in Florida had been using software to monitor students social media accounts [7–9].**

  The debate surrounding a Florida school district's usage of "Snaptrends" software brings to light crucial ethical issues and potential privacy violations in the use of technology in education. The possibility of invasive surveillance and the usage of social media monitoring technologies create serious concerns about students' privacy. The school district may be able to gain sensitive information about students' private lives, political views, and extracurricular activities by monitoring their social media accounts. Additionally, this information might be used to unfairly single out particular students for disciplinary action or other penalties, especially those who are members of marginalized communities.

  Due to societal biases and historical and current discrimination, students from marginalized groups may be more likely to have their data exploited against them or to be exposed to harm. This means that the school system must actively work to identify and mitigate any potential negative repercussions that may disproportionately affect marginalized communities in addition to taking actions to protect the data of all children. From an ethical perspective, educators and schools have a duty to put students' protection and privacy first. The use of social media monitoring software must be carefully thought out, with an emphasis on striking a balance between the risks and potential harm to kids and the potential benefits of the technology.

  The school district should put into place clear and open policies and procedures around data collection, storage, and use to guarantee that all students have an equal level of protection and control over their information. This may entail getting the parents' and students' informed consent, outlining precisely what data is being collected and why, and giving students and families the option to refuse data collection if they choose to do so. The district should also regularly review and update these policies to make sure they are in line with best practices and evolving legal requirements.

  Furthermore, the district should ask students, families, and community members for feedback to make sure their concerns are heard and taken seriously. The school district can ensure that all students have an equal chance to profit from the use of educational software while minimizing any potential negative effects by taking equity into consideration. Schools should make sure that they have adequate privacy and data protection policies and procedures in place, and they should be open and honest with students and parents about how they utilize such technologies. Forging a relationship of trust and ensuring the moral application of technology in the classroom, open dialogue and transparency with children and their families are essential to protect their privacy and rights.

It raises questions about how to strike a balance between monitoring for safety and protection and infringing on students' rights to privacy and autonomy. While using software to monitor students' social media accounts may be done with the intention of promoting a safe and secure learning environment, this can be seen as a form of surveillance. Although it is unclear whether this strategy is an effective means of preventing bullying, harassment, or other negative student behaviors, it may deter students from speaking out freely when they have the freedom to do so without concern for monitoring or censorship.

- **In 2020, a study found that an algorithm used by a popular online math program was biased against students from low-income backgrounds and those with certain learning disabilities [10].**

  The algorithm in question was used by an online math program to provide personalized recommendations to students. However, the study found that the algorithm was biased against students from low-income backgrounds and those with certain learning disabilities, as it tended to recommend easier content to these students, while recommending more challenging content to students from higher-income backgrounds.

  This bias is particularly concerning because it perpetuates existing inequalities in education. Students from low-income backgrounds and those with disabilities already face numerous challenges in accessing high-quality educational opportunities, and biased algorithms only serve to further disadvantage these students.
  Students who are recommended easier problems may not be challenged enough and may not receive the same quality of education as their peers. This can result in a lack of preparedness for more advanced topics and potential negative long-term consequences, such as lower grades, fewer opportunities for advanced coursework, and reduced career prospects.

  Therefore, it is important for the program developers to recognize and address the bias in the algorithm, ensuring that all students receive the same quality of education and opportunities to succeed, regardless of their background or ability. By taking equity into consideration, the developers can ensure that their program is not contributing to systemic disadvantages and is instead promoting educational equity and social justice.

  Additionally, before implementing any technology in education, the informed agreement of both pupils and their parents or legal guardians must be obtained. Technology should be utilized for specific purposes that are made clear, including how it will assist learning and teaching goals and how it will be made available to all students. Overall, the use of technology in education ought to be consistent with the pedagogical ideals of equity, inclusion, and justice.

  Accessibility plays a crucial rule here in ensuring that all students receive the same quality of education and opportunities to succeed, regardless of their background

or ability. This biased algorithm perpetuated existing inequalities in education by recommending easier content to students from low-income backgrounds and those with certain learning disabilities, while recommending more challenging content to students from higher-income backgrounds.

Besides recognizing the bias in the algorithm, the developers need to make sure that the algorithm is more accessible to students with disabilities, such as those who require assistive technology to access content.

It is also important that this type of educational software is accessible to students with low-income so program developers must ensure that their algorithm provides personalized recommendations that meet the learning needs of all students, regardless of their background or income level. For example, they can ensure that their program is compatible with a range of devices and internet speeds, including older or slower devices that may be more common among low-income households. They can also provide resources and support to help students from low-income backgrounds access the technology and use it effectively.

In this way by making the algorithm more accessible to all students, regardless of their background or ability, can help to reduce bias by ensuring that all students receive personalized recommendations that meet their learning needs and leveling up the playing field to ensure that all students have the chance to reach their full potential.

- **In the New York City breach, a hacker gained access to student names, birthdates, and data on such characteristics as special education, English-language learner, and free or reduced-price meal status on platforms operated by Illuminate Education [11].**

  The New York City breach highlights the importance of privacy and security in education software. When sensitive information such as student names, birthdates, and personal characteristics are compromised, it can have significant consequences for students, their families, and the educational institutions that collect and store this data.

  The impact of this breach on student privacy cannot be overstated. With access to this information, malicious actors can potentially use it for identity theft, financial fraud, or other criminal activities. Additionally, the release of personal information can have serious emotional consequences for students who may feel violated or unsafe as a result of the breach.
  From an ethical perspective, software providers have a responsibility to ensure that their products protect the privacy and security of the data they collect. Education software providers in particular must be mindful of the sensitive nature of the information they handle and take steps to secure it appropriately. This includes implementing robust security protocols, regularly testing for vulnerabilities, and promptly addressing any security issues that arise.

Moreover, education software providers have an ethical responsibility to be transparent about the data they collect and how it is used. This means clearly communicating to users what data is being collected, why it is being collected, and how it will be used. Users should also have the ability to opt-out of data collection and be able to delete their data if they choose.

We can also look at this case from an accessibility in software education perspective, it shows us that it can be dangerous if not implemented properly. For instance, accessibility features may unintentionally create security vulnerabilities that could be exploited by hackers to gain access to sensitive data. It is therefore essential for software developers and providers to carefully evaluate and test the security implications of accessibility features before implementing them.

In conclusion, the New York City breach underscores the need for education software providers to prioritize privacy and security in their products. Providers must not only ensure the confidentiality of personal information, but also be transparent about data collection practices and give users control over their data. Ultimately, this will help build trust between software providers, educators, and students, and support the ethical use of technology in education.

- **In 2016, a study was published that examined the use of gamification techniques in educational software [8, 9, 12].**

  The study found that while gamification can be effective in motivating students and increasing engagement, it can also raise ethical concerns around pedagogy. For example, gamification techniques may prioritize extrinsic rewards over genuine learning, which could lead to shallow or superficial learning experiences. Additionally, gamification techniques may not be effective for all students, particularly those with disabilities or other learning challenges.

  First and foremost, educational software should adhere to solid pedagogical principles and uphold its intended instructional objectives. Second, the commercialization of educational software shouldn't compromise the quality of instruction, and the software should put students' educational needs above the urge to make as much money as possible. The use of gamification tactics in educational software should be openly disclosed to students and their parents/guardians, with the opportunity for them to opt out if they so choose. In general, these factors are crucial for making sure that educational software is used ethically and for safeguarding student privacy and educational needs.

  Other thing to consider when doing these types of techniques is how bias can manifest through the use of game mechanics that may inadvertently privilege certain students over others. For example, a game mechanic that rewards students who are able to complete tasks quickly or who accumulate points over time may disadvantage students who require more time or who may not be as proficient in certain subject

areas. This could result in unequal learning opportunities and outcomes for different students, particularly those from underrepresented or disadvantaged backgrounds.

It is also important to consider that in the case of gamification techniques in educational software, accessibility is important to ensure that all students, including those with disabilities or other learning challenges, can fully participate and benefit from these techniques.

By designing educational software with accessibility in mind, developers can help to mitigate any potential bias or disadvantage that may arise from the use of game mechanics that favor certain students over others. Ultimately, accessibility in gamification techniques can help promote equity and inclusion in education contributing to a more just and equitable society.

- **The National Federation of the Blind filed a lawsuit against edX in 2019 for failing to provide accessible content for blind students, violating the Americans with Disabilities Act [8, 9, 13].**

  In 2019, the National Federation of the Blind (NFB) filed a lawsuit against the online learning platform, edX, for failing to make its content accessible to blind students. The NFB argued that the platform's use of inaccessible technology, such as certain video players and other multimedia, violated the Americans with Disabilities Act (ADA) and prevented blind students from fully participating in courses. The lawsuit was settled in 2020, with edX agreeing to make significant accessibility improvements to its platform.

  Pedagogical effectiveness, inclusive design, accessible material, and informed consent are all crucial ethical factors to take into account when deciding how to employ technology in education. All students' requirements, including those of students with disabilities, should be taken into account when designing technology, and its efficiency in achieving teaching and learning goals should be frequently assessed. For fairness and openness to be guaranteed, informed consent from students' parents or legal guardians is also essential. Educators may make sure that technology is used in a way that supports equity, inclusivity, and effective pedagogy by addressing these ethical issues.

  This case shows us that accessibility is something very important and that we must think about this when we talk about software in education. It's crucial to ensure that all students can fully participate in courses and achieve their learning goals.

  By incorporating inclusive design and accessibility features, developers can create software that is accessible to everyone, including those with disabilities. Examples of some accessibility features that can be implemented into software include alt-text for images, captions for videos, and keyboard shortcuts for users who have difficulty using a mouse, designers must also consider the color contrast and font size to ensure that the text is legible for everyone, including individuals with visual impairments.

It's true that education technologies are making learning more accessible, but we must build these education software tools in a way that we ensure that all students, regardless of their abilities, have equal access to the educational materials. It will not only benefit students with disabilities but also promote diversity and inclusivity in the classroom, creating a better learning environment for all students.

5 Conclusion

The way we teach and learn has changed as a result of the integration of educational software into modern education in recent years.We have witnessed the advantages of adopting educational software, which enables remote learning and gives students more flexibility. Educational software can improve and support education by offering digital materials, interactive learning activities, and real-time feedback on student progress.

But it's crucial to take the ethical consequences of employing instructional software into account. As we have seen, privacy issues have been brought up in relation to the gathering and use of student data. To guarantee that all students, regardless of aptitude or socioeconomic situation, have equitable access to educational software, accessibility issues must also be addressed. Additionally, there is a chance that instructional software will be employed in place of effective instruction, which could diminish the importance of human connection in learning.

It's also critical to understand that although educational software has numerous advantages, it does not provide a comprehensive answer to all educational problems. There are some facets of education that cannot be substituted by technology because they demand human interaction. To ensure that instructional software is used successfully and morally, we must therefore approach its use with a critical eye.

Educational software has the power to change the way students learn and improve education as a whole. However, we must be aware of any potential negative effects and moral issues related to its application. We can build a more equal and inclusive educational system that better prepares kids for the future by balancing the advantages and possible risks of educational software.

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