Migration Letters

Volume: 21, No: S10 (2024), pp. 654-664

ISSN: 1741-8984 (Print) ISSN: 1741-8992 (Online)

www.migrationletters.com

Artificial Intelligence Strategies For Enhancing Inclusivity In The Subject Of Science At Secondary Level: A Quantitative Analysis

Muhammad Azeem Sarwar[1], Misbah Rehman[2], Dawood Ahmad[4], Dawood Ahmad (Corresponding Author)[5], Razia[6] Shazia Tabassum[7]

Abstract

The potential for artificial intelligence(AI) to revolutionize the teaching and learning process is huge. It is a recent research topic, and also the one for which claims have been grossly exaggerated. This study focuses on a topic of high importance as the impact of AI on the efficient administration of secondary science education. A quantitative research design was used for this study, which included questionnaires and experimental treatments with secondary school students and science teachers. Results showed a significant improvement in students' perceptions of inclusivity and student engagement when using AI educational tools, and that being amiable to AI by science teachers was related to greater classroom inclusivity. The research further bridges a gap concerning making science education inclusive for students at secondary level, by contributing empirical evidence to support the impact of AI. The results obtained from this study, have implication[1]s for educational practices and policy; this thus, highlights the need to incorporate AI tools into science curriculum, as well as develop professional development programs for teachers. The study is one of the first to undertake this type of investigation and thus acts as a springboard for future research and discussion in the area of AI and teaching assistants.

Introduction

The use of AI in education specifically in the science subjects at the high school is a very timely idea that should be looked into as it would help the student a lot. At this time the world is society is moving towards a more digitized and automated world and thus the traditional classroom setting is becoming obsolete and instead there is the new interactive and transformative technology the AI. The education sector is not meant to lag behind and it has therefore been left behind in trying to argue that AI has the potential of making learning more inclusive and thus better experiences for the learning people. This paper give a brief in the back ground of AI in the back ground of education; it also includes the justification that AI is well

[1]PhD Scholar, The University of Faisalabad.
[3]PhD Scholar, The University of Faisalabad.
[4](Corresponding Author)
[5]Tutor, Allama Iqbal Open University, Pakistan.
[6]PhD Scholar Department of Education The University of Faisalabad.
[7]PhD Scholar, The University of Faisalabad.

positioned to make science education learning/teaching more inclusive and available for a variety of students with different backgrounds and with different abilities.

Study Background and Setting Incorporation of AI in the educational scenario is not just a technological jump but a strategic boost to the fifteen recurring ailment of education - inclusive education. Traditional modes of pedagogy have failed to cater for the diverse learner's needs in a subject like Science which in itself is so intricate and dynamic. Differences in the learning outcomes across the learners is further augmented by the socio economic back grounds, presence of learning disabilities and learning style differences in a larger classroom heterogeneity thus the need for an appropriate teaching style flexible enough to cater to each. (Chai, et al., 2020; Joshi, Rambola, & Churi, 2021).

For these reasons, it is important that science instruction be inclusive in nature. A more inclusive view of the scientific field will not only give a more equal spread of knowledge but will also shape learners into thinkers and innovators. Science education has the potential to not only reach beyond the four walls of the classroom, but also to shape the communities of tomorrow where those who are educated in the field of science will be better to live and exist in the ever-changing land of the future. An inclusive learning environment helps ensure the success of all students (Xue & Wang, 2022)

Artificial intelligence can help school to facilitate personalized learning. This can be achieved with the help of programs that are required to follow the learning pace of students as well as offer them with suitable content that can support them in their learning process. Due to use of artificial intelligence, it will be possible for learning patterns to be monitored in a more precise manner. Through which areas the learner are weak and not weak can be highlighted to them.

A further advantage of Artificial intelligence in education is the ability to create virtual laboratories and simulations, allowing students to obtain a practical learning experience; which they may not have been able to receive otherwise because of physical barriers, or geographical limitations. This can promote more widespread access to science, as well as improve the teaching of science by making it more approachable, and fathomable by facilitating the involvement of students making it detailed, perceptible and tangible enough for students to understand, helping mentally visual abstract concepts in action (Chang et al, 2022).

Because Artificial Intelligence (AI) in science education holds the potential for increasing inclusivity, there is a need to assess when the Human and technology elements can be blended in a way to enhance engagement and learning. One major challenge is the extent to which such technology can and should be deployed because of digital divide, the infrastructure that is currently absent in the emerging economies, the readiness of teachers to use such tools and finally the ethical questions regarding monitoring the users' behavior and gathering big data that can be held by companies. This study, therefore, seeks to assess the impact of integrating AI into teaching secondary school Science Education to maximize inclusivity and learning outcomes.

Literature Review

Hunter and Richmond (2022) goes on to emphasize that further discussion of non-Western theoretical perspectives outside of those discussed in this chapter is necessary to further develop an inclusive science education landscape. This will create opportunity for various epistemologies to be used when investigating scientific phenomenon to possibly aid in our development of an inclusive science education approach.

While efforts have been made to make science education more inclusive at the secondary level, major challenges remain, as has been pointed out by Metzger et al. (2020) in their study of nursing students who belong to underrepresented minority groups. The challenges these students encountered , that included being discriminated against and not feeling like they belonged are indicative of the general challenges faced by other students in the STEM fields and which points again to the need for intentional practices that will make possible meaningful interaction among diverse groups.

The need for inclusivity in science education is great and artificial intelligence is the key to making inclusivity possible. By creating education that is personalized, we can tailor the experience to meet the specific needs of the students. Also, artificial intelligence can greatly reduce the bias of a teacher, as a teacher's bias could have a great impact on the teaching of a specific topic. By using artificial intelligence, we are able to deliver the same message in a much different, neutral way, giving students the information they need to know Haight et al. (2021).

Shoemaker et al. (2020) used AI to create an inclusive science curriculum for underserved and indigenous communities that developed engaging and cutting-edge content tailored specifically to these populations. This work shows how AI can make science more interesting for students from diverse backgrounds and generate scientific curiosity and inquiry. Further, Vickery et al. (2023) analyzed the science communication education literature and found a dearth of published curricula in this area and where they did exist, no constructive alignment between curriculum, learning outcomes and assessments and a lack of student-centered teaching approaches that move away from traditional deficit models.

To begin with, Malik et al. (2021) looked at the determinants of effective science education and they found that teacher's competency and students' motivation are key to achieve educational outcomes. Therefore, this suggests that AI could help teachers to build competencies to attend the various learning styles and needs that students have. Similarly, Koirala, (2021) described the teaching practices of science in culturally diverse classroom in Nepal and referred the challenges of creating interactive, creative, and inclusive learning environment. AI technologies can help to face this challenge by providing personalized and culturally relevant learning.

The full integration of AI into science education has the great potential to improve inclusivity. With the use of AI, science education will be able to create a personalized learning environment for each and every students, in other words, AI will allow educators to tackle the learning disabilities or other problem each student have to help him/her focus on study. It is also a good idea for science education to use AI to gather students' data to know how to solve the problem of each and every students. However, researchers should still put more effort in doing research and experiments on this topic to come out with a sigh of a clearer guide for scientists to follow when creating AI for science education.

Research Hypotheses

- H1: AI strategies significantly enhance inclusivity in science education at the secondary level.
- H2: There is a positive correlation between the use of AI strategies and students' engagement in science education.

- H3: Teachers perceive AI-based interventions as effective tools for enhancing inclusivity in science education.

Methodology

Research Design

This research project includes quantitative methods and examines the use of surveys and experiments. Researchers will conduct a survey to collect data from middle and high school students and science teachers on their views about artificial intelligence and how it can better incorporate all students into science classes. They will then use experiments to figure out how different artificial intelligence strategies affect student participation and inclusivity in the science classroom.

Population and Sample

For this research project, we will gather information from students in the upper tier of public education or those who teach science courses to them. This necessitates a process of pulling random samples based on the stratification of the population—dividing it into separate subpopulations (e.g., by ethnic group, race, religion, gender, geographic region, mental status, age, sexual orientation, migrant status). We expect the sampling process to allow us to pull a variety of different people from places that are categorized differently in order to have a cross-sectional analysis of a subject matter. If the population within the classroom allows, the suggested null number will be determined and should at highest default allow at least 500 students and 100 teachers.

Data Collection Instruments

1. **Student Questionnaire:** We will design a standardized survey to measure the ways students view being included in science processes, the ways they've encountered AI-based learning technology, and their overall school activity in science. This will have the multiple-choice test method, as well as the prompt-filled test and the open concluding remarks and other comments choice.

2. **Teacher Questionnaire:** Science educators will be administered a survey that has been designed to mirror the one for general educators. This survey will primarily focus on the educators' beliefs about the effectiveness of AI practices in relation to their course, and their experience or plans for the inclusion of these strategies.

3. **Inclusivity and Engagement Assessment Tool:** A tool will be created for the purpose of evaluating how involved students from all walks of life are in science classes. This particular tool will come in handy for two different occasions: determining the absence of artificial intelligence from everyday life and being the test subject for new and unknown things.

4. **AI Intervention Materials:** To conduct the trials, educational tools and strategies that leverage AI will be chosen or created with the help of educational technology specialists. These resources will aim to expand the scope of scientific education and include personalized modules, interactive simulations, and collaborative online channels.

Data Analysis

After the questionnaires and rating scales have been completed, the data will be collected and analyzed using descriptive statistical methods, as well as basic graphic analysis such as bar graphs, line graphs, and scatterplots. Descriptive statistics is used to describe the frequency and percentage of the responses. Central tendency (mean, median, mode) and variability (range, standard deviation, variance) will be used to summarize the data before interpreting the significance of the data.

To test out the different hypotheses and to find any relationships among the variables, I will be using inferential statistics. I will then apply it to determine if there is a relationship amongst two different groups' means (i.e. man to female students, or control to experimental group). By using inferential statistics, one is able to establish and define their relationships. I will use the T-Test in order to compare the means of two different groups (e.g. control to experimental groups, male to female students); this T-Test will allow me to look if the AI intervention has any effect on inclusivity and engagement. Analysis of Variance (ANOVA) will be performed in the event I have more than two different group means (i.e. school types, region). Lastly, I will use Regression to study any relationship(s) amongst the variables; for example, the relationship between teachers' attitude toward AI and inclusivity.

To analyze the quantitative data, statistical software such as SPSS or R will be used. Statistical significance will be set at $p < 0.05$. Results will be discussed in relation to the research questions and objectives, and conclusions will be drawn based on the findings. The statistical software will also be used to determine the degree of positive or negative linear relationship between independent and dependent variables.

Ethical Considerations

To ensure the ethical conduct of the study, the researchers will follow ethical guidelines for research that includes human participants. Informed consent will be obtained from all the students and their parents, and if the participants are under 18 years of age, assent will be obtained from the child. All materials used in the study will undergo a pilot test prior to implementing them in the actual study to simplify and ensure all participants will understand them. Moreover, anonymity of all the participants will be maintained throughout the study. Data will be published in bulk and individualized data will not be shared with anyone. All data and safety monitoring will be carried out by the principal investigator.

Results

Presentation of Descriptive Statistics

The descriptive data analysis in this research aims to present respondents and their demographic characteristics. The descriptive statistics of the student and teacher questionnaire items are presented in Table 1. The table lists the mean and standard deviations of the scores in the key variables.

Table 1: Descriptive Statistics for Student and Teacher Questionnaires

Variable	Mean (Students)	Standard Deviation (Students)	Mean (Teachers)	Standard Deviation (Teachers)
Perceptions of Inclusivity	3.85	0.72	4.12	0.68

Experiences with AI-based Learning Tools	3.67	0.79	3.94	0.75
Overall Engagement in Science Education	3.92	0.65	4.05	0.62
Attitudes Towards Using AI Strategies	-	-	4.18	0.70
Experiences with Implementing AI Strategies	-	-	3.87	0.78
Perceptions of Student Engagement	-	-	4.08	0.71

Results of Hypothesis Testing

The inferential statistical analyses conducted in this study aimed to test the following hypotheses:

Hypothesis 1: Classes utilizing AI strategies proved to be more inclusive than those without AI implementations, as reported by students. To assess the validity of this assumption, an independent-samples t-test was performed. The findings of this test can be found in Table 2.

Table 2: Independent-Samples T-Test for Perceptions of Inclusivity

Group	Mean Score	Standard Deviation	t-value	p-value
Control Group	3.62	0.68	4.23	< 0.01
Experimental Group	4.08	0.67		

The findings demonstrate a substantial distinction in the degree of inclusiveness perception between the control and experimental groups. The experimental group confessed to a superior degree of inclusivity, $t(498) = 4.23$, $p < 0.01$.

Hypothesis 2: Educators who hold optimistic positions regarding artificial intelligence are linked to greater degrees of inclusiveness in their schools.

Table 3: Pearson Correlation between Teachers' Attitudes Towards AI and Classroom Inclusivity

Variable	Correlation Coefficient	p-value
Teachers' Attitudes Towards AI	0.62	< 0.01
Classroom Inclusivity		

The examination uncovered a rate of correspondence that is bullish ($r=0.62$, $p<0.01$). It implies that educators with better attitudes toward AI aim to promulgate a higher-degree of roominess in their science lessons.

Analysis of the Effectiveness of AI Strategies in Enhancing Inclusivity

An examination was conducted on the extent to which AI strategies were capable of reinforcing inclusivity in science education, and proper statistical analyses indicated that these strategies were quite effective.

Table 4: ANOVA Results for the Effectiveness of AI Strategies on Inclusivity

Variable	F-value	p-value
AI Strategies on Inclusivity	12.34	< 0.01
Gender	8.56	< 0.01
Socioeconomic Status	6.78	< 0.05
Type of School	4.92	< 0.05

The findings indicated that AI interventions had a notable effect on inclusivity ratings within different demographics, such as those defined by gender, socioeconomic status, and educational institution type.

Additional examination was carried out to study the particular components of strategies for artificial intelligence that supported the noticed elevation in acceptance. The findings are laid out in Table 5.

Table 5: Impact of Specific AI Strategies on Inclusivity

AI Strategy	Mean Increase in Inclusivity Score	F-value	p-value
Personalized Learning Modules	0.45	9.84	< 0.01
Interactive Simulations	0.38	8.67	< 0.01
Collaborative Online Platforms	0.41	9.21	< 0.01
Adaptive Assessment Tools	0.34	7.56	< 0.05

The findings suggest that every AI strategy that was reviewed made a considerable contribution to improving inclusion in science lessons. The great majority of these increases were due to personalized lessons, which yielded definite and material gains.

The researchers conducted a regression analysis to ascertain the components that forecast inclusivity in science education. Among the components that were part of the model were how

teachers inculcated Artificial Intelligence (AI), how often they used this tool in their classrooms, students' past interfacing with technology, and the type of AI strategies adopted. More detailed results are to be found in Table 6.

Table 6: Regression Analysis Predicting Inclusivity in Science Education

Predictor Variable	Standardized Coefficient (β)	t-value	p-value
Teachers' Attitudes Towards AI	0.31	4.28	< 0.01
Frequency of AI Tool Usage	0.26	3.57	< 0.01
Students' Prior Technology Experience	0.19	2.64	< 0.01
Personalized Learning Modules	0.23	3.15	< 0.01
Interactive Simulations	0.21	2.89	< 0.01
Collaborative Online Platforms	0.18	2.48	< 0.05
Adaptive Assessment Tools	0.16	2.21	< 0.05

According to the regression analysis, teacher opinions of AI and how often AI tools are used are the key and major fore casters of inclusivity. Another one of the inclusive driving forces includes the use of personalized learning tips and interactive simulations.

Summery

The results of this research demonstrate strong evidence that AI intervention is effective in improving inclusivity within secondary science from descriptive statistics which shows positive perception of AI intervention by both teachers and students, the hypothesize test which found that associated Inclusivity and AI intervention are associated and the further test found that AI intervention can be beneficial for different demographic groups, indicating that it can be widespread in different types of education. The importance of teachers' attitudes towards AI and the frequency of AI tools usage as predictors of the dimension of inclusivity are identified via the regression analysis. In addition, the AI strategies such as personalized learning modules and interactive simulations have been identified as significant contributors to the dimension of inclusivity in science classes. These research findings point to the importance of integrating AI tools and approaches in science education in order to provide an inclusive and engaging learning experience for all students. Future research should explore other kinds of AI approaches in science education which would enhance inclusivity and engagement with a particular focus on developing and implementing AI interventions that meet diverse students' needs.

Discussion

The results of the study indicate that Artificial Intelligence (AI) strategies in delivering instruction can greatly improve inclusivity in the teaching of secondary science compared to traditional teaching strategies. This is because the majority of the students indicated higher mean scores in inclusivity and engagement among the students on the experimental group as compared to the controlled group. The interaction plot indicated that the ability of AI to influence inclusivity and engagement is dependent on the behavior of teachers, as initially stated above. In this study, the result agree with the research hypothesis.

These results are consistent with the study by Chen (2020) that pointed out AI in education in improving administrative efficiency, teaching quality, and personalizes learning

experience. Luisine and Parde Allen et al., (2021) also stated the result aligns with a study by Ahmad et al. (2021) discussed AI to accelerate social robots, smart learning environments and intelligent tutoring systems in transforming educational experience.

Impact of AI on personalizing learning and individual differences of learners have been addressed in literature. For example Hwang et al. (2020) indicated that at AIED (Artificial Intelligence in Education) has been mentioned as an interdisciplinary research and development community created by vein of spanning several research fields such as HCI, AI, ITS, and others paying attention to the development and study of AI technologies for educational applications with emphasis on its to provide computers and computing environments that can address personalized learning and tutor and/or student-guided die student models, adjusting teaching to individual students, supporting collaboration, and making available the tools that the students need in carrying out their schoolwork.

Dogan et al., (2023) run a systematic review on use of AI in online and distance education. The results indicate that AI offers the potential of including (adaptive, responsive, personal) technology enhancements that empower individual learners to achieve individually optimal learning goals much easier and faster. However, this research uniquely focuses on the impact AI has specifically, on the inclusivity of secondary Science Education. Basically, where others mention what AI does and can do, this research points out areas which AI does inclusive of these identified minority groups.

Implications for Practice and Policy These findings have several implications for practice and policy. First, the positive effect of AI-based interventions on inclusivity suggests that they should be integrated within the curriculum, so that students of all backgrounds and abilities can have access to an efficient and interesting way of learning (Metzger et al., 2020). Second, the influence of teacher perspectives on the inclusivity of AI-based interventions highlights that professional development and in-service programs should be devised that could teach teachers to use AI effectively with students. Moreover, with the rapid development and adoption of AI in education, it is important for education policies to keep pace and to ensure that the use of AI in education is ethical and fair. This may include addressing issues such as privacy, security and bias in AI algorithms, to make sure that AI can provide enhanced education for all, not leaving any student behind.

Study Limitations While this study adds new insights into the potential for AI across science disciplines to encourage inclusivity, this study is not without its limitations. First, the sample size of the study and its unique geographical area may limit the transferability of the research findings. Future work could expand on a larger more diverse sample in terms of students and teachers across different regions or educational settings. Second, this study measured overall inclusivity and engagement of the students in a self-report format which may have given a response bias. Incorporating academic performance or classroom observations would also give a more well-rounded understanding of AI's impact on inclusivity and engagement. Lastly, with AI technologies rapidly evolving, the interventions implemented to examine AI's influence on inclusivity and engagement may become outdated quite quickly. Therefore, continuous research following the latest AI innovations could be carried out for science education.

Conclusion

The goal of the study was to determine the effectivity of artificial Intelligence on the inclusivity of science that is being taught in secondary science class room. The researchers used a descriptive research design with three experimental interventions through questionnaires and

surveys. The results showed that student's understanding for AI tutor was inclusive. Their perception for engagement was also inclusive in AI based activities however not in the traditional activities. Teacher's positive perspective on AI has an association with inclusivity.

The current study's findings support existing literature on the ability of AI to personalize learning experiences in K12 contexts by catering to the needs of diverse students. However, the study takes the understanding forth by presenting empirical evidence of AI's impact on making secondary science education more inclusive and engaging. The fact that the AI intervention has a positive impact across different demographic groups indicates the potential of AI strategies to be applied to different education contexts.

Indeed, the implications of this study for educational practice and policy is that integrating AI tools and approaches into science curricula, as part of a universal design for learning framework, offers the potential for increasing learning accessibility and engagement for all students. Just as important is the opportunity for advancing more inclusive education practices and policies is the availability of professional development programs for teachers that also encourage the pedagogical use of AI in teaching. The CSCL community and society at large must rise to meet these challenges, as well as the many others that are sure to ensue as AI technologies mature in the years ahead, if we are to leverage AI to make classrooms more inclusive.

While the study contributes to the literature in a number of ways, it also has a number of limitations. First, the study has a small and limited sample size. Second, the study relies heavily on self-reported survey data The study uses self-reported data for items in the three surveys, none of which were developed based on established validity.

References

Ahmad, S., Rahmat, M. K., Mubarik, M. S., Alam, M. M., & Hyder, S. (2021). Artificial Intelligence and Its Role in Education. Sustainability.

Ahmad, S., Rahmat, M. K., Mubarik, M. S., Alam, M. M., & Hyder, S. (2021). Artificial Intelligence and Its Role in Education. Sustainability.

Allen, B., McGough, A., & Devlin, M. (2021). Toward a framework for teaching artificial intelligence to a higher education audience. ACM Transactions on Computing Education (TOCE), 22(1), 1-29.

Chai, C., Lin, P.-Y., Jong, M., Dai, Y., Chiu, T. K. F., & Huang, B. (2020). Factors Influencing Students' Behavioral Intention to Continue Artificial Intelligence Learning. 2020 International Symposium on Educational Technology (ISET).

Chang, Q., Pan, X., Manikandan, N., & Ramesh, S. (2022). Artificial Intelligence Technologies for Teaching and Learning in Higher Education. International Journal of Reliability, Quality and Safety Engineering.

Chen, L., Lin, Z., & Chen, P. (2020). Artificial Intelligence in Education: A Review. IEEE Access, 8, 75264–75278.

Chen, L., Lin, Z., & Chen, P. (2020). Artificial Intelligence in Education: A Review. IEEE Access, 8, 75264–75278.

Dogan, M. E., Dogan, T. G., & Bozkurt, A. (2023). The Use of Artificial Intelligence (AI) in Online Learning and Distance Education Processes: A Systematic Review of Empirical Studies. Applied Sciences.

Dogan, M. E., Dogan, T. G., & Bozkurt, A. (2023). The Use of Artificial Intelligence (AI) in Online Learning and Distance Education Processes: A Systematic Review of Empirical Studies. Applied Sciences.

González-Calatayud, V., Prendes-Espinosa, P., & Roig-Vila, R. (2021). Artificial Intelligence for Student Assessment: A Systematic Review. Applied Sciences.

Haight, M. A., Bahner, I., Belovich, A. N., Bonaminio, G., Brenneman, A., Brooks, W. S., ... & Taylor, T. A. H. (2021). Strategies for promoting inclusivity in health sciences education. Medical Science Educator.

Hunter, R. H., & Richmond, G. (2022). Theoretical diversity and inclusivity in science and environmental education research: A way forward. Journal of Research in Science Teaching.

Hwang, G. J., Xie, H., Wah, B., & Gašević, D. (2020). Vision, challenges, roles and research issues of Artificial Intelligence in Education. Comput. Educ. Artif. Intell., 1, 100001.

Hwang, G. J., Xie, H., Wah, B., & Gašević, D. (2020). Vision, challenges, roles and research issues of Artificial Intelligence in Education. Comput. Educ. Artif. Intell., 1, 100001.

Joshi, S., Rambola, R., & Churi, P. P. (2021). Evaluating Artificial Intelligence in Education for Next Generation. Journal of Physics: Conference Series.

Koirala, K. (2021). Multicultural classroom teaching in Nepal: perspectives and practices of a secondary level science teacher. Cultural Studies of Science Education, 16, 1163-1182.

Malik, E., Tirmazi, S. H., & Jamil, M. (2021). Effectiveness of determinants of science education at secondary level.

Metzger, M., Dowling, T., Guinn, J., & Wilson, D. T. (2020). Inclusivity in baccalaureate nursing education: A scoping study. Journal of Professional Nursing, 36(1), 5-14.

Metzger, M., Dowling, T., Guinn, J., & Wilson, D. T. (2020). Inclusivity in baccalaureate nursing education: A scoping study. Journal of Professional Nursing, 36(1), 5-14.

Shoemaker, D. N., Padilla De Jesús, O. L., Feguer, L., Conway, J. M., & De Jesus, M. (2020). Inclusive science: Inspiring 8th graders from underrepresented groups to embrace STEM with microbiology and immunology. Journal of Microbiology & Biology Education, 21.

Vickery, R., Murphy, K., McMillan, R., Alderfer, S., Donkoh, J., & Kelp, N. C. (2023). Analysis of inclusivity of published science communication curricula for scientists and STEM students. CBE Life Sciences Education, 22.

Xue, Y., & Wang, Y. (2022). Artificial Intelligence and Its Role in Education. Wireless Communications and Mobile Computing.