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Technology in the educational processes of basic education in Peru

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ABSTRACT

This research project aimed to give a perspective on the implementation of technologies in basic education in Peru. How the automation of basic education processes in Peru helps students, parents, teachers, and administrative staff to reduce time, to have better educational quality, and to obtain indicators for the teacher and student. The methodology of the research is a sequence of activities that allow us to design a framework for process technologies in basic education in Peru. Based on online surveys, it was possible to obtain information from people who want a change in the processes of education, such as: having more reach to information with the help of the internet for which mobile applications or web applications are needed, the delivery of evaluations and enrolment via online, taking advantage of technology for the benefit of the student and teachers, and other processes. The research has a qualitative approach. It is also descriptive in scope with the help of other studies or tests conducted. For the creation of this article, we used surveys, scientific journals, and our own experience as practitioners. If we want to improve education, it is necessary to improve educational processes with the help of technology and the internet.

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1. INTRODUCTION

Education is the key to the development of society. Omar [1] argued how Malaysian public schools have used technological tools for the benefit of students to understand difficult concepts. The study also commented how teachers prefer blended learning combining online teaching and the traditional classroom model. Mansor, Abdullah, and Rahman [2] mentioned the characteristics of e-learning in the education 4.0 environment and how Malaysian governments are promoting this methodology to improve the quality of education. With this, we can understand that technology is of great support in education at any level. The internet that comes with technology is great help in education, as Moradi and Fard [3] argued that the applications are very favorable in English language teaching; not only English language, but also for history, mathematics, language, economics, art, chemistry, and physics, so that the child has more exercises and all the information to perform tasks, practices, and evaluations. In addition, technology is used in educational processes to reduce time and costs for students, parents, and teachers.

Technology is the way companies improve their administrative and academic processes by leveraging technology and organizing their workflows. Technology in basic education and regular continuous education can control several aspects, such as relationships with parents, students, and administrative staff, workflow

analysis, planning, standardization, and development, making them more effective and fruitful. The use of information and communications technology (ICT) in the classroom enhances the learning experience [4]. On the other hand, rapid technological advances provide another compelling argument in unquestionable support for reforming the education system [5]. Technology shapes changes in society and the internet, big data, artificial intelligence, and robotics should be harnessed to assist in the educational and administrative processes of education by applying technology to those processes.

Hieder, Abdullah, and Ali [6] mentioned the growing demand for e-learning education and how technology helps students. If these technologies complement automation in the educational process of regular basic education, the results could be amazing, grades would be calculated immediately, grade records would be online, practice grades and evaluations could be like computer games, and create competitions with students to see who wins and all in real-time without delay or having to wait for the teacher, graded practices and evaluations could be like computer games and create competitions with students to see who wins and all in real-time without delay or having to wait for the teacher to correct the practices, all this and more by making complex information technology (IT) process of using technology and continuous improvement in such educational processes. It can manage tasks, such as system administration, system users, and network troubleshooting, as well as programs to help teachers, parents, and students reduce time and improve the quality of education. With a proper education management system, teachers can save time and an honest regime will be the main key for them to advance through meritocracy in various job positions. Especially in organizations where relationships are important, automation can improve interpersonal interactions and decision-making, while providing real-time transparency.

2. RESEARCH METHOD

In the development of the research, there was a set of sequential activities that allowed the design of the framework for the application of technology in educational processes in basic education in Peru, as shown in Figure 1. Considering a good sequence of activities allows the user to have a better order and develop each activity in a more efficient way. In addition, an "execution, monitoring and control" activity is being considered that is repeated in order to seek continuous improvement in management processes.

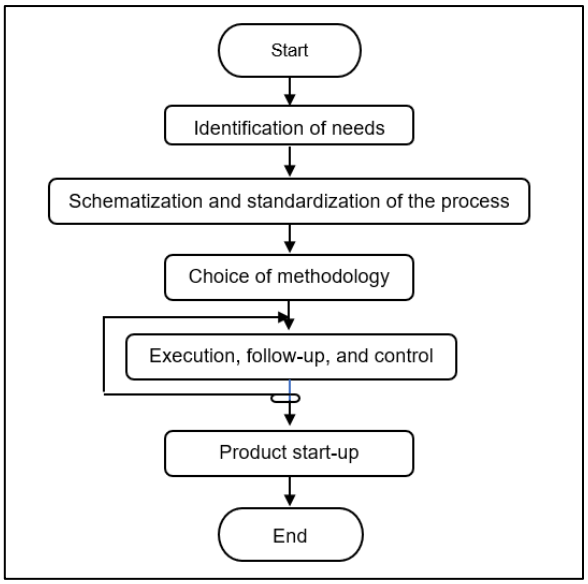

Figure 1. The sequence in the automation of regular basic education in Peru

2.1. Problem identification

In any process of continuous improvement, it is always seeking to identify the needs or problems in the management flows. Table 1 shows the problems that make the educational system less efficient. Likewise, these problems generate, in the users, the loss of time, money, or both, and the objective is to improve the processes of regular basic education with the help of technology.

Table 1. Problems or needs in regular basic education

Number	Problem
1	Problem with registration to find out if there are vacancies
2	Not having an indicator management system in place
3	Not having a learning management system that integrates grades with records
4	Failure to inform parents of student's grades and observations.
5	School air quality to prevent pollution
6	Being unprepared for new challenges in the pandemic.
7	More effective requirements management system

2.2. Outlining and optimizing processes

2.2.1. Problem with the number plate

Parents have to go to schools to see if there are vacancies for their children and waste a lot of time, Figure 2 shows the flow of enrolment process. The flow of the enrolment process is all manual, i.e., the parent has to go in person to see if there is enrolment; if not, the parent would have to look for another school to find out. If there is enrolment, the parent would have to follow a difficult process to enroll the student. Previous research [7] mentioned how artificial intelligence helps in these administrative processes of the teacher, administrative staff, students, and parents are automated through artificial intelligence. The technology not only facilitates learning in the classroom but also helps teachers to perform various administrative tasks related to teaching, online grade tracking, and future improvements in education.

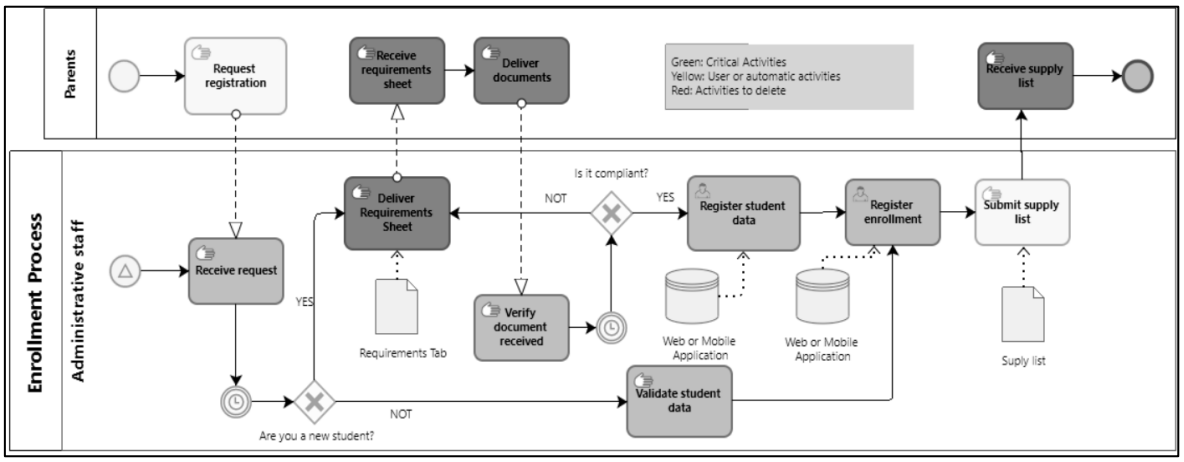

Figure 2. The flow of the enrolment process

2.2.2. Not having an indicator management system

The previous study [8] aimed to propose a system of management indicators to support decision-making in schools. In regular basic education in Peru, teachers do not have key indicators such as punctuality, responsibility, proactivity, daily practices, and reaching out to students. León *et al.* [9] analyzed how many teachers in the Libertad region of Peru are dissatisfied with their low salaries, the poor conditions of the institutions, and other shortcomings. With a biometric system, it would be possible to know if the teachers are punctual to their classes, cameras and audio in the classroom integrated into the education system, indicators, such as responsibility, arrival to the student, proactivity, punctuality and other factors that one wants to measure for the benefit of good teaching could be obtained. In a management system, the class could be uploaded on a day-to-day basis and thus be able to have an indicator of accountability and also of daily practices. Many teachers carry out the management of indicators manually, which involves long days of data collection to obtain indicators. With a digitalized educational management system, the time required to obtain indicators and to be able to measure the efficiency and quality of the teacher and student would be reduced. Figure 3 presents the workflow of the enrolment process with the system.

A study showed how videos help in training teachers and students to memorize content better [10]. The use of technology in education will have the help of many educational videos but also serve to monitor classes and place appropriate indicators to the teacher to know if the teacher performs properly, understood, and motivates the student to learn. The teacher enjoys teaching all these characteristics on video and then reviewed to get a performance indicator. Hopefully it can qualify the teacher for future promotions, but all this must be related to a single education system, thus automating the indicators of the teacher.

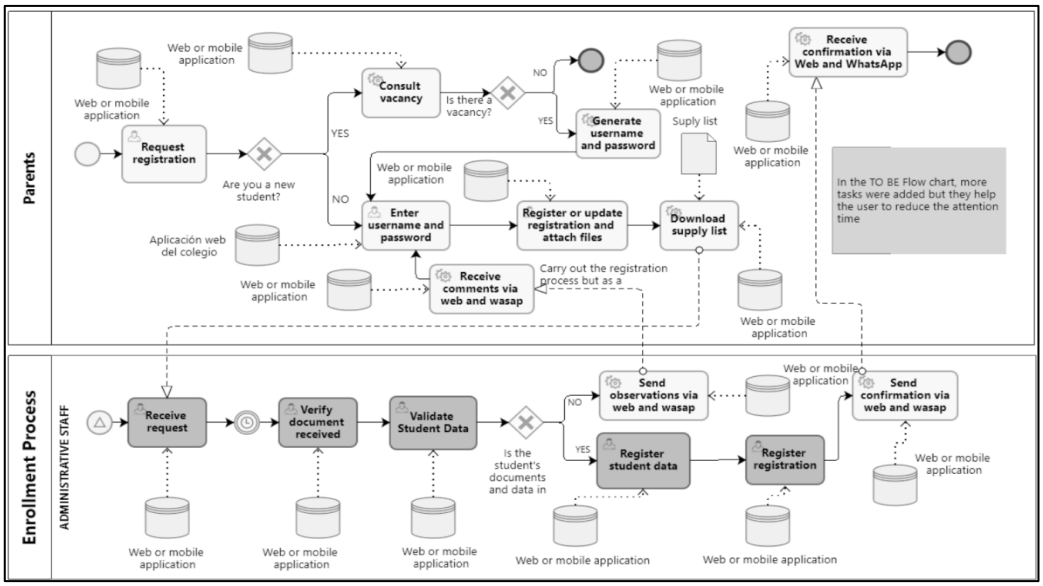

Figure 3. Workflow of the enrolment process with the system

2.2.3. Not having a learning management system, integrating grades with minutes

In basic education, the practices are taken on paper, then the teacher has to correct them and record in an Excel or paper record. After each period the average is done manually, at the end of the year everything has to be averaged to then coordinate with the parents and pass the marks on to the final report card. Figure 4 shows an evaluation process carried out manually by the teacher. This process is lengthy and time-consuming. A change is needed with the use of technology. A very important part of the automation of processes in regular basic education are the aforementioned practices or exams. However, these are currently not automated and a very appropriate way is for practices to be like online games where we have lives, pass levels, and share with classmates. Several recent studies [11]–[13] use technologies to help with learning, such as mother tongues, social sciences, mathematics, history, natural disaster preparedness, and other sciences. Most importantly, we can collect information from digital media to automate the process in order to have performance indicators from the student and teacher knowing in real time what is being taught to the student, what grades student are getting, what can be improved, and how to help the student to learn better.

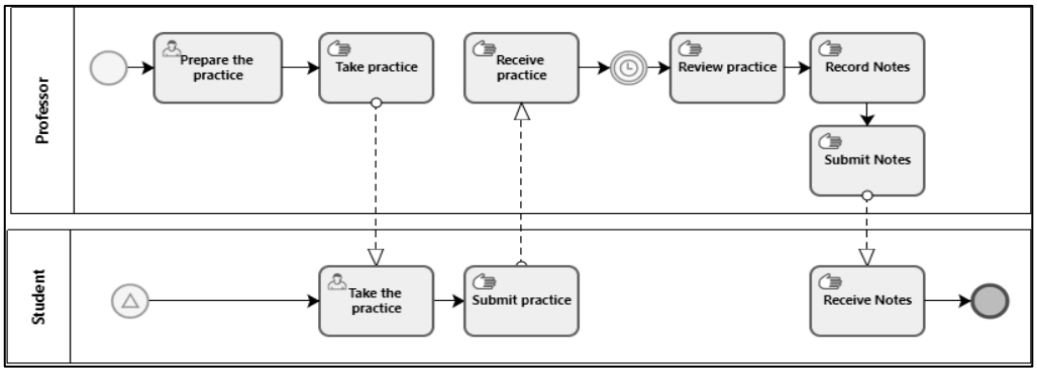

Figure 4. Workflow of the student assessment process

Avanthey and Beaudoin [14] showed how a game allows better structuring of information and a good vision of what classroom evaluations could be like if everything were digitized and automated. Figure 5 shows a flow of an educational management system that could save time, effort, and be much more efficient. It is automated through a web or Android application or programs that is always connected to a database and then can have performance indicators for the teacher and student.

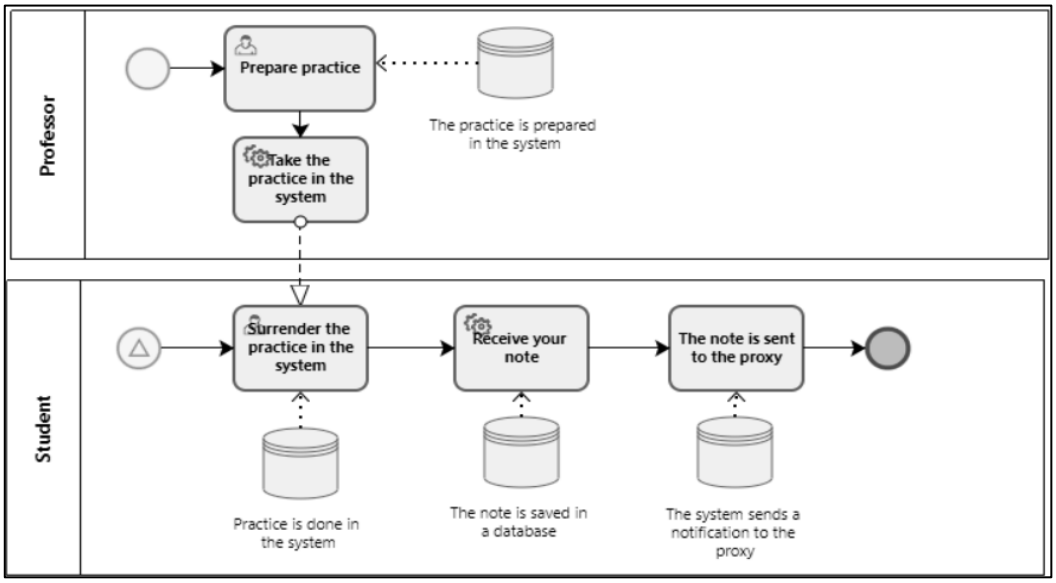

Figure 5. Workflow of the student assessment process with the system

In order to have an online grading system, it is necessary that each student has a computer, laptop, or tablet. Cleary *et al.* [15] showed how smartwatches help to implement and automate the use of retrieval as a study tool outside of the classroom contexts. Therefore, smartwatch cues can be strategically applied to automate the reinforcement of learning outside the classroom. According to Cui *et al.* [16], human-robot interaction in education helps predict student engagement and can enhance learning outcomes by improving student learning performance. This would be one more example of how technology can be leveraged as long as educational systems are automated and digitized. In Figure 5, we observe how students perform their evaluations in a digitized system, with the intention of having the grades online and that the teacher does not correct the evaluation but a system does it. It is also appropriate that the student can develop within the classroom and a better way with a smart classroom system. Kaur, Bhatia, and Stea [17] investigated rapid implementation to improve educational systems, resulting in greater participation and empowerment of students, educators, and administrators. Kulik, Chukhray, and Havrylenko [18] saw another example of how technology is aiding education with online courses being used by students.

2.2.4. School air quality to prevent pollution

Indoor air quality plays a decisive role in human health, especially for children and young people, due to its presence for long periods of time in school classrooms. They tend to be more susceptible to develop chronic diseases such as asthma, allergies, and respiratory problems or have these problems aggravated. In these circumstances, to prevent the occurrence of these specific diseases, it is essential to improve the school environment, i.e. the quality of indoor air in classrooms [19].

2.2.5. Being unprepared for new challenges in the pandemic

Basic education in Peru before, during, and after the pandemic was not prepared for online teaching as other countries had to learn on the fly. The study by Shen and Guo [20] in times of the COVID-19 pandemic has brought about drastic changes in teaching as it has moved to online mode during the pandemic. However, there are many problems in the effective implementation of the teaching process, leading to the inability to achieve better results in the quality and efficiency of teaching and effective learning of students' practical application ability. Other research by Lee *et al.* [21] provided suggestions on how to effectively implement synchronous online reverse learning in teacher training programs during COVID-19, which can be leveraged in regular basic education in Peru as long as the education system is digitized. Also in the research conducted by Al-Hajri *et al.* [22] aimed to discover the key factors influencing the acceptance and use of cloud computing systems in the education sector, with special emphasis on the outbreak of COVID-19. The findings revealed that the intention to use cloud computing in this context depends significantly on its perceived ease of use, usefulness, perceived reliability, and responsiveness. As such, it provides significant contributions in the area of technology adoption. Sigh and Meena [23] examined the major challenges faced by teachers and students in the virtual classroom during the time of the COVID-19 pandemic.

Due to national confinement and lack of funding, basic education in Peru similarly faces the same problems. In the study conducted by Celik *et al.* [24] seeks to better understand the responses of learning analytics tools or systems to the online learning challenges faced by students, teachers, and educational institutions during the pandemic. In addition, it provides key cases where learning analytics tools or systems have been effectively implemented for various purposes during the pandemic in the context of education. Several challenges are uncovered. For example, learners needed timely support and interaction and experienced difficulties in time management. Teachers lacked pedagogical skills for online teaching. Educational institutions have not been prepared for digital transformation and online teaching. In response to these challenges, learning analytics tools or systems offer solutions to the needs, obstacles, and expectations related to the COVID-19 pandemic in education.

2.3. Choice of methodology

Of the many methodologies that exist, SCRUM was chosen, which consists of delivering short, adaptable sprints that are adaptable to change. Among the roles we have: Product Owner is responsible for the project; the Scrum Master is responsible for the team to work smoothly fulfilling the methodology; and the Team is made up of programmers, testers, designers, and architects. Among others, the concepts to be taken into account in SCRUM are: The "Product Backlog" is a list of requirements established by the Product Owner and the "Sprint Backlog" is the list of tasks belonging to the Product Backlog that are to be performed in a sprint. The main difficulties encountered in this process, include: lack of communication among the staff; lack of knowledge of the accreditation process; and inexperience.

2.4. Implementation, monitoring, and control

At this stage, they used some good practices for the execution, monitoring, and control of the project, such as the framework of the SCRUM methodology, and the good practices of the Project Management Body of Knowledge (PMBOK) of the Project Management Institute. For implementation, we would have to look for software with all the integrated features which are: i) Enrolment manager; ii) Internship and grades manager; iii) Assignment manager; iv) Camera and audio manager; and v) Teacher indicators manager. If there is no web or Android application, depending on the technical specifications of the equipment, a start should be made with the development of a web or Android application. Monitoring and control help us to know how good or bad the software was and how it helps in the management of regular basic education in Peru.

2.5. Commissioning

For the implementation of the technology in regular basic education processes, the operational application must be tested and delivered with the respective training of the teaching staff. In addition, continuous improvement in educational processes that help achieve the objectives of improvement in the quality of regular basic education in Peru should be considered. With this, it will be possible to have indicators for the student, the teacher, and the institution for the development of the country.

3. RESULTS AND DISCUSSION

Figure 6 shows that many people already know some benefits of the internet and how day by day more and more people get other benefits, such as: for business, as a distraction, or both. As can be seen in Figure 7, many people think that the internet in school would be very beneficial because we can search for information for homework or research. However, not only searching for information can be done with the internet, but also building interactive applications, and recreational games that can help in education at any level.

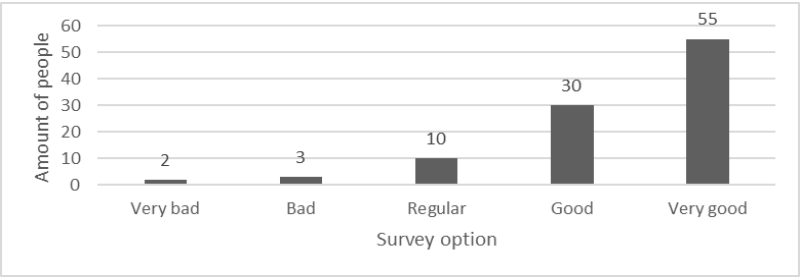

Figure 6. The perspective of users regarding the internet

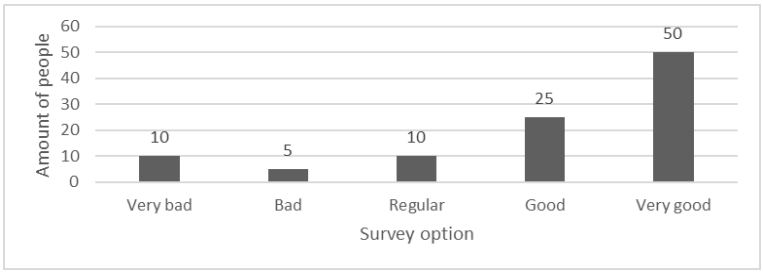

Figure 7. The perspective of users regarding using the internet at school

Figure 8 shows that online enrolment would be very helpful for basic education as nowadays a lot of time is wasted to avoid queues or crowds of people and to avoid the spread of COVID-19. From Figure 9, many people think that assessments should be taken via the internet in regular basic education and automate the process for the delivery of grades to parents. Imagine how a parent could receive via email, WhatsApp, or other digital means their child's grade in real-time. As presented in Figure 10, many people believe that basic education should be with the use of technology, i.e., the enrolment process, practice, indicators for teacher and student, for homework, games, and other school activities.

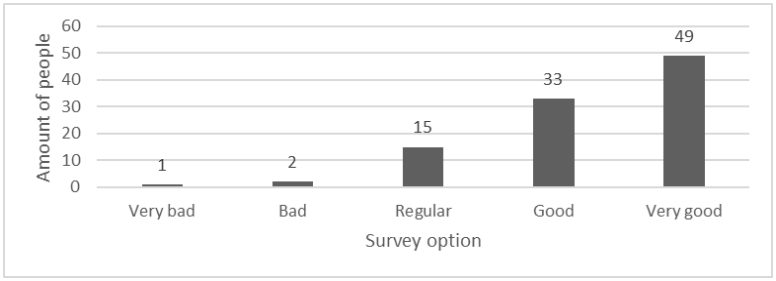

Figure 8. People's point of view regarding having an online registration process

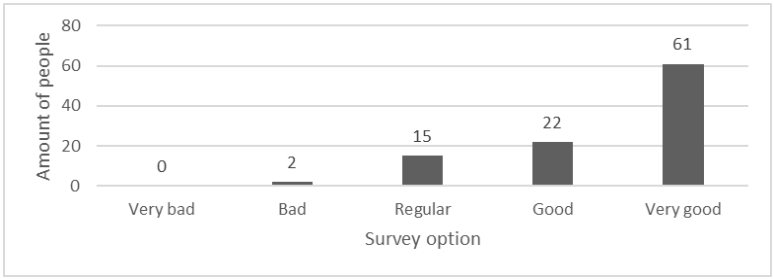

Figure 9. Users' point of view about taking exams through the internet in schools

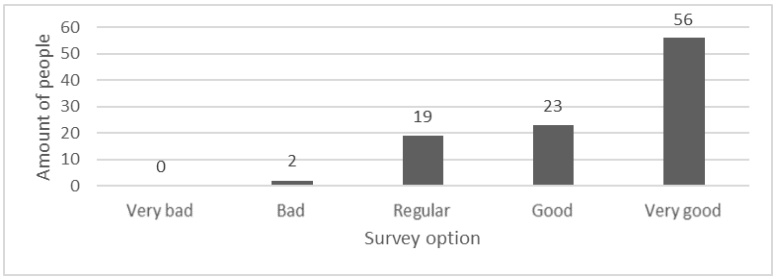

Figure 10. The users' point of view about having an application for the management of activities in regular basic education

The development of technology and automation in the field of regular basic education is progressively taking place but it is still unknown what impact it would have on the management of regular basic education in Peru. However, we could mention that technology and proper automation could provide the following benefits: i) By using technology and automating educational processes in basic education in Peru, there would be indicators for teachers such as punctuality, educational quality, dedication, and whether the teacher reaches the student; ii) Less workload for the teacher and higher quality education for the pupil; iii) Technology will allow schools to adapt to the needs of students and provide more individualized teaching, allowing students of different ability levels to work together in the same classroom; iv) With technology constantly monitoring student progress and learning patterns, automation will be able to help teachers identify and address gaps in their teaching. Customer Relationship Management (CRM) with a mobile application created for a school that will allow interaction between the student and the teacher [25]; v) Assessments could be like playing a computer game and have the grade at the end of the class. Students could compete in real-time and have their grade at the end of the class; vi) Having smart classrooms, knowing virtual reality could provide a new vision for students in a globalized world; vii) Technological tools such as video calls, web pages, web applications, and chatbot, help students in their studies, not only in their studies but these same technological tools are used to include people with disabilities. Mateos-Sanchez *et al*. [26] mentioned how the chatbot, as an educational and inclusive tool for people with disabilities. In addition, Kirupainayagam and Sutha [27] showed how technology facilitates inclusive learning in educational institutions.

The study conducted by Saaludin *et al.* [28] had the objective of improving the evaluation of teachers through the analytical hierarchy process (AHP). In the same way, the AHP can be implemented in regular basic education in order to improve the evaluation score of teachers, always bearing in mind that the quality of regular basic education in Peru is determined by skills, experience, and many other academic competencies. New methods for the calculation of teacher qualifications should always be implemented in regular basic education in Peru in order to be able to pinpoint the best teacher performance. This would be more effective if the educational process were automated.

Flores-Cáceres *et al.* [29] showed the performance of teachers with respect to virtual education, from which we can draw many very encouraging conclusions regarding the performance of teachers and how they face challenges. The use of digital technology in the teaching-learning process has multiplied in recent years. New teaching methods, applications, and online educational resources are appearing every day. This fact makes its study within the educational sciences quite necessary. Through automated analysis procedures, it is possible to monitor and establish baselines and levels of competence acquisition. This makes it possible to strengthen personal education at school and to address educational diversity in the classroom in a useful and effective way, as reflected in the different groups established by the competency levels of students [30]. Any process that used to be manual and can now be carried out automatically [31] would lead to some people losing their jobs in the future because their work is now done by a system in a more efficient and less costly way, this always happens when processes are automated. Virtual reality can be used in any training [32]. This is something that is not being taken advantage of in basic education in Peru, and even less is it being integrated, for the correct use of technology in educational processes. In these times, technological changes have caused people to have doubts about virtual education, but we have realized that it is very useful for education and that other countries are taking advantage of it in academic and administrative development [33], [34]. The right automations in the educational processes are being implemented.

With the introduction of computer science (CS) into curricula around the world, it has been investigated whether CS could be introduced transversally, in support of other disciplines. The findings indicated that CS activities could be harnessed for mathematics and spelling, but require validation on a larger scale. We believe that the depth gained from discussing student and teacher perspectives is beneficial and can become a more general method for assessing the classroom learning experience [35]. A good pedagogical style of teachers largely determines students' satisfaction with learning. The pedagogical competence of a good teacher, in the eyes of students, should include preparation for teaching. Teachers should moderate positive conditions in the classroom, use of media and technology in the classroom, providing feedback so that students can develop skills, and conducting an objective assessment of learning [36].

In any system, whether business, industrial, educational, or others, processes are always being improved [37] shows how to improve a manufacturing process in the preparation of clayey sand for the preparation of ceramic tiles. With this simple example, we can understand that one of the keys to improvement is to automate processes. Virtual education helps in any sector [38], [39], but it is better when the whole institution applies the technology in a single management system. People who develop an educational system must have a holistic view of education in order to implement the best automation of the educational process by integrating science, technology, reading, art, and mathematics into a computer system. [40]. Previous research [41] showed how m-learning technology helps students to learn and acquire knowledge using the internet and cloud computing technologies.

4. CONCLUSION

The cost of implementing the education management system is high but the quality of education is of very good quality. Bureaucratic or paperwork processes are reduced to a minimum. From the results of the surveys, people agree that changes should be made in the management of basic education in Peru in order to automate administrative and academic management. It should also be noted that many industries have sought to automate their processes in order to reduce costs. Technology in the education sector makes students' educational lives much easier, more interesting, and more fun. Educational process technology allows teachers to fulfill their primary duty, which is to provide quality education while saving time and effort. Educational process technology allows for indicators that can be used for decision-making. By implementing the development of software for the automation of educational management, many of its manual paperwork routines can be eliminated, such as: the evaluation of practices, exams, filling out minutes, flyers, and leaflets. Thus, the teacher can become more productive and acquire new technological skills as well as students. With the support of virtual education, virtual classrooms, online practice, online assignments, and research using digital media, the student would have more skills, new opportunities, and a better view of the globalized world.

As a final result of the technology in Peru's educational process, it would be possible to have information on how students are progressing with their courses and be able to improve the quality of education every year and reward teachers and students for their good performance since the information will be online. The change from traditional basic education to digitalized basic education with technological processes implies changes in the mentality of students and especially teachers who are used to not being monitored with performance indicators. However, this is beneficial for the development of students.

REFERENCES

[1] S. F. Omar, H. S. A. Nawi, R. W. M. Mee, L. S. Pek, T. S. T. Shahdan, and A. Woo, "Readiness in using online interactive platforms for remote teaching," *Indonesian Journal of Electrical Engineering and Computer Science (IJEECS)*, vol. 24, no. 2, pp. 1047–1053, Nov. 2021, doi: 10.11591/ijeecs.v24.i2.pp1047-1053.

[2] N. A. Mansor, N. Abdullah, and H. A. Rahman, "Towards electronic learning features in education 4.0 environment: Literature study," *Indonesian Journal of Electrical Engineering and Computer Science (IJEECS)*, vol. 19, no. 1, pp. 442–450, 2020, doi: 10.11591/ijeecs.v19.i1.pp442-450.

[3] M. Moradi and K. R. Fard, "An english-language teaching plan for children in the internet of things environment," *Indonesian Journal of Electrical Engineering and Computer Science (IJEECS)*, vol. 13, no. 3, pp. 927–932, Mar. 2019, doi: 10.11591/ijeecs.v13.i3.pp927-932.

[4] I. Arocena, A. Huegun-Burgos, and I. Rekalde-Rodriguez, "Robotics and education: a systematic review," *TEM Journal*, vol. 11, no. 1, pp. 379–387, Feb. 2022, doi: 10.18421/TEM111-48.

[5] J. Alvarez-Cedillo, M. Aguilar-Fernandez, R. Sandoval-Gomez, and T. Alvarez-Sanchez, "Actions to be taken in mexico towards education 4.0 and society 5.0," *International Journal of Evaluation and Research in Education (IJERE)*, vol. 8, no. 4, pp. 693–698, Dec. 2019, doi: 10.11591/ijere.v8i4.20278.

[6] I. A. Hieder, S. M. Abdullah, and R. A. Ali, "Utilizing the ATM technology in E-distance learning," *Indonesian Journal of Electrical Engineering and Computer Science (IJEECS)*, vol. 20, no. 2, pp. 1016–1029, Nov. 2020, doi: 10.11591/ijeecs.v20.i2.pp1016-1029.

[7] S. F. Ahmad, M. M. Alam, M. K. Rahmat, M. S. Mubarik, and S. I. Hyder, "Academic and administrative role of artificial intelligence in education," *Sustainability (Switzerland)*, vol. 14, no. 3, p. 1101, Jan. 2022, doi: 10.3390/su14031101.

[8] F. Eizerik, Â. D. M. F. Danilevicz, and I. C. De Paula, "System of management indicators for multidisciplinary educational projects," *Education Policy Analysis Archives*, vol. 28, pp. 1–46, 2020, doi: 10.14507/epaa.28.4980.

[9] H. C. R. León, E. R. Navarro, L. V. Meléndez, T. del Rosario Merino Salazar, N. R. C. Yuncor, and E. M. M. María, "Job satisfaction factors in secondary school teachers, public and private institutions in a Peruvian Region," *Cypriot Journal of Educational Sciences*, vol. 16, no. 6, pp. 3317–3328, Dec. 2021, doi: 10.18844/cjes.v16i6.6566.

[10] M. R. Bin Husin, H. Bin Ahmad, and M. Bin Hamzah, "Video application to accommodate students' learning style for moral education in teacher education institutes," *Indonesian Journal of Electrical Engineering and Computer Science (IJEECS)*, vol. 16, no. 1, pp. 349–354, Oct. 2019, doi: 10.11591/ijeecs.v16.i1.pp349-354.

[11] M. F. L. Ruiz, R. I. Esclada, J. H. Balderama, A. A. I. Aguirre, M. N. I. Cutin, and R. M. Lozada, "WISE game: wireless interactive software educational game," *Indonesian Journal of Electrical Engineering and Computer Science (IJEECS)*, vol. 23, no. 3, pp. 1357–1365, Sep. 2021, doi: 10.11591/ijeecs.v23.i3.pp1357-1365.

[12] G. M. B. Catedrilla, J. L. Lerios, S. B. Sapin, M. C. Lanuang, and C. A. C. Buama, "An android-based mobile educational game for disaster preparedness: an input to risk reduction management," *Indonesian Journal of Electrical Engineering and Computer Science (IJEECS)*, vol. 22, no. 2, p. 936, May 2021, doi: 10.11591/ijeecs.v22.i2.pp936-943.

[13] R. J. P. Siosan, J. R. Lavilla, M. A. C. V. Dequilla, and J. T. de Castro, "Android interactive word game in mother tongue for early childhood learners," *Indonesian Journal of Electrical Engineering and Computer Science (IJEECS)*, vol. 22, no. 3, pp. 1787–1795, Jun. 2021, doi: 10.11591/ijeecs.v22.i3.pp1787-1795.

[14] L. Avanthey and L. Beaudoin, "How to boost close-range remote sensing courses using a serious game: uncover in a fun way the complexity and transversality of multi-domain field acquisitions," *Remote Sensing*, vol. 14, no. 4, p. 817, Feb. 2022, doi: 10.3390/rs14040817.

[15] A. M. Cleary *et al.*, "Wearable technology for automatizing science-based study strategies: reinforcing learning through intermittent smartwatch prompting," *Journal of Applied Research in Memory and Cognition*, vol. 10, no. 3, pp. 444–457, Sep. 2021, doi: 10.1016/j.jarmac.2021.01.001.

[16] Y. Cui, X. Song, Q. Hu, Y. Li, P. Sharma, and S. Khapre, "Human-robot interaction in higher education for predicting student engagement," *Computers and Electrical Engineering*, vol. 99, p. 107827, Apr. 2022, doi: 10.1016/j.compeleceng.2022.107827.

[17] A. Kaur, M. Bhatia, and G. Stea, "A Survey of smart classroom literature," *Education Sciences*, vol. 12, no. 2, p. 86, Jan. 2022, doi: 10.3390/educsci12020086.

[18] A. S. Kulik, A. G. Chukhray, and O. V. Havrylenko, "Information technology for creating intelligent computer programs for training in algorithmic tasks. Part 1: mathematical foundations," *System Research and Information Technologies*, vol. 2022, no. 4, pp. 27–41, Dec. 2022, doi: 10.20535/SRIT.2308-8893.2021.4.02.
[19] A. Abreu, S. I. Lopes, V. Manso, and A. Curado, "Low-Cost LoRa-Based IoT Edge Device for Indoor Air Quality Management in Schools," *Lecture Notes of the Institute for Computer Sciences, Social-Informatics and Telecommunications Engineering, LNICST*, vol. 372, pp. 246–258, 2021, doi: 10.1007/978-3-030-76063-2_18.
[20] Y. Shen and H. Guo, "New breakthroughs and innovation modes in english education in post-pandemic era," *Frontiers in Psychology*, vol. 13, p. 122, Feb. 2022, doi: 10.3389/fpsyg.2022.839440.
[21] Y. J. Lee, R. Davis, and Y. Li, "Implementing synchronous online flipped learning for pre-service teachers during COVID-19," *European Journal of Educational Research*, vol. 11, no. 2, pp. 653–661, Apr. 2022, doi: 10.12973/eu-jer.11.2.653.
[22] S. Al-Hajri, A. Echchabi, A. M. Ayedh, and M. M. S. Omar, "The cloud computing systems' adoption in the higher education sector in Oman in light of the COVID-19 pandemic," *International Journal of Evaluation and Research in Education (IJERE)*, vol. 10, no. 3, pp. 930–937, Sep. 2021, doi: 10.11591/ijere.v10i3.21671.
[23] A. K. Singh and M. K. Meena, "Challenges of virtual classroom during COVID-19 pandemic: An empirical analysis of Indian higher education," *International Journal of Evaluation and Research in Education (IJERE)*, vol. 11, no. 1, pp. 207–212, Mar. 2022, doi: 10.11591/ijere.v11i1.21712.
[24] I. Celik, E. Gedrimiene, A. Silvola, and H. Muukkonen, "Response of learning analytics to the online education challenges during pandemic: Opportunities and key examples in higher education," *Policy Futures in Education*, 2022, doi: 10.1177/14782103221078401.
[25] N. I. Cheboksarova, T. A. Vakaliuk, and I. M. Iefremov, "Development of CRM system with a mobile application for a school," *CEUR Workshop Proceedings*, vol. 3077, pp. 44–65, 2022.
[26] M. Mateos-Sanchez, A. C. Melo, L. S. Blanco, and A. M. F. García, "Chatbot, as Educational and Inclusive Tool for People with Intellectual Disabilities," *Sustainability (Switzerland)*, vol. 14, no. 3, p. 1520, Jan. 2022, doi: 10.3390/su14031520.
[27] D. S. Kirupainayagam and J. Sutha, "Technology facilitation on inclusive learning; higher education institutions in Sri Lanka," *International Journal of Educational Management*, vol. 36, no. 4, pp. 441–469, Apr. 2022, doi: 10.1108/IJEM-02-2020-0048.
[28] N. Saaludin, M. H. Ismail, B. C. Mat, and S. Harun, "Improving lecturers' evaluation score by using analytic hierarchy process (AHP): A case at Universiti Kuala Lumpur," *Indonesian Journal of Electrical Engineering and Computer Science (IJEECS)*, vol. 15, no. 1, pp. 391–398, Jul. 2019, doi: 10.11591/ijeecs.v15.i1.pp391-398.
[29] R. Flores-Cáceres *et al.*, "Virtual education and student perception of teacher performance in the distance learning environment," *Indonesian Journal of Electrical Engineering and Computer Science (IJEECS)*, vol. 24, no. 3, pp. 1638–1646, Dec. 2021, doi: 10.11591/ijeecs.v24.i3.pp1638-1646.
[30] M. J. Espigares-Pinazo, J. M. Bautista-Vallejo, and M. García-Carmona, "Evaluations in the Moodle-Mediated Music Teaching-Learning Environment," *Technology, Knowledge and Learning*, vol. 27, no. 1, pp. 17–31, Sep. 2022, doi: 10.1007/s10758-020-09468-0.
[31] G. Lordan and D. Neumark, "People versus machines: The impact of minimum wages on automatable jobs," *Labour Economics*, vol. 52, pp. 40–53, Jun. 2018, doi: 10.1016/j.labeco.2018.03.006.
[32] X. Yan, T. Li, and Y. Zhou, "Virtual Reality's Influence on Construction Workers' Willingness to Participate in Safety Education and Training in China," *Journal of Management in Engineering*, vol. 38, no. 2, Mar. 2022, doi: 10.1061/(asce)me.1943-5479.0001002.
[33] Q. F. Yesmin and M. E. I. Khan, "Virtual learning of the tribal students in Bangladesh: Constrictions and propositions," *International Journal of Evaluation and Research in Education (IJERE)*, vol. 10, no. 3, pp. 1038–1046, Sep. 2021, doi: 10.11591/ijere.v10i3.21315.
[34] G. Morales Romero *et al.*, "Perception of teaching performance in the virtual learning environment," *International Journal of Evaluation and Research in Education (IJERE)*, vol. 10, no. 4, pp. 1221–1228, Dec. 2021, doi: 10.11591/ijere.v10i4.22056.
[35] L. El-Hamamsy, B. Bruno, H. Kovacs, M. Chevalier, J. D. Zufferey, and F. Mondada, "A case for co-construction with teachers in curricular reform: Introducing computer science in primary school," *ACM International Conference Proceeding Series*, pp. 56–65, 2022, doi: 10.1145/3511861.3511883.
[36] H. Herwin *et al.*, "Evaluation of structural and measurement models of student satisfaction in online learning," *International Journal of Evaluation and Research in Education (IJERE)*, vol. 11, no. 1, pp. 152–160, Mar. 2022, doi: 10.11591/ijere.v11i1.22115.
[37] G. Morales-Romero *et al.*, "Automatic control of the sand granulation process to improve homogeneity in the manufacture of ceramic tiles," *Indonesian Journal of Electrical Engineering and Computer Science (IJEECS)*, vol. 24, no. 2, pp. 762–770, Nov. 2021, doi: 10.11591/ijeecs.v24.i2.pp762-770.
[38] C. Wang, Y. Tang, M. A. Kassem, H. Li, and B. Hua, "Application of VR technology in civil engineering education," *Computer Applications in Engineering Education*, vol. 30, no. 2, pp. 335–348, Mar. 2022, doi: 10.1002/cae.22458.
[39] M. Zhang, L. Shu, X. Luo, M. Yuan, and X. Zheng, "Virtual reality technology in construction safety training: Extended technology acceptance model," *Automation in Construction*, vol. 135, p. 104113, Mar. 2022, doi: 10.1016/J.AUTCON.2021.104113.
[40] P. Nuangchalerm, V. Prachagool, T. Prommaboon, J. Juhji, I. Imroatun, and K. Khaeroni, "Views of primary Thai teachers toward STREAM education," *International Journal of Evaluation and Research in Education (IJERE)*, vol. 9, no. 4, pp. 987–992, Dec. 2020, doi: 10.11591/IJERE.V9I4.20595.
[41] K. Sekaran, M. S. Khan, R. Patan, A. H. Gandomi, P. V. Krishna, and S. Kallam, "Improving the response time of M-learning and cloud computing environments using a dominant firefly approach," *IEEE Access*, vol. 7, pp. 30203–30212, 2019, doi: 10.1109/ACCESS.2019.2896253.

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