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Presentation of the Content

Issue sixteen, is presented an article *Considerations for digital literacy in rural communities in the context of ITC4D implementation in emerging economies*, by ALONSO-CALPEÑO, Mariela Juana, SANTANDER-CASTILLO, Julieta and RAMÍREZ-CHOCOLATL, Yuridia, with adscription at TECNM - Instituto Tecnológico Superior de Atlixco, in the next article *Evaluation of criteria in mining units through the SMM*, by MARTINEZ-TORRES, Rosa Elia, RIVERA-ACOSTA, Patricia, HUERTA-GONZALEZ, Juana María and ALVARADO-CANO, Juan Antonio, with adscription at Tecnológico Nacional de México - Instituto Tecnológico de San Luis Potosí, in the next section *Trends in multicriteria decision-making models for solar dryers* by HERNÁDEZ-DOMÍNGUEZ, Erick Alejandro, PANTOJA-ENRIQUEZ, Joel, FARRERA-VÁZQUEZ, Nein and RUIZ-SUAREZ, Alison, with adscription at Universidad de Ciencias y Artes de Chiapas, in the next section *Home-habits, app for monitoring the progress of the HabitFun video game to generate hygiene habits*, by LUNA-CARRASCO, Claudia Yadira, LUNA-TREJO, Cupertino and VARGAS-FERRER, Juan, with adscription at Tecnológico Nacional de México - Instituto Tecnológico Superior de Huauchinango.

Content

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Considerations for digital literacy in rural communities in the context of ITC4D implementation in emerging economies

Consideraciones para la alfabetización digital en comunidades rurales en el contexto de la implementación de ITC4D en economías emergentes

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Abstract

This work addresses the problem of the digital divide and social exclusion in the context of technological innovation. The digital divide has become a constituent of social and economic inequality, and there are factors that aggravate it in rural areas, such as technological factors, community literacy in ICT and the government's commitment to its development. The adoption of ICT is essential to prevent rural depopulation and promote the social and economic development of these communities, so it is necessary to address digital literacy and comprehensive actions to consolidate it. This work documents a literature review to investigate the aspects that must be considered to achieve digital literacy in rural areas of emerging economies and the conditions that must prevail for a successful implementation of ICT4D, for which a six-step process is proposed, and emphasis is placed on the authors' proposals to promote digital literacy.

Digital Literacy, ITC4D, Rural Communities

Resumen

El presente trabajo aborda el problema de la brecha digital y la exclusión social en el contexto de la innovación tecnológica. La brecha digital se ha convertido en un constituyente de desigualdad social y económica, y hay factores que la agravan en las zonas rurales, tales como los tecnológicos, la alfabetización comunitaria en TIC y el compromiso del gobierno con su desarrollo. La adopción de las TIC es esencial para prevenir la despoblación rural y promover el desarrollo social y económico de esas comunidades, por lo que es necesario abordar la alfabetización digital y acciones integrales para consolidarla. En este trabajo se documenta una revisión de literatura para investigar los aspectos que deben considerarse para lograr la alfabetización digital en áreas rurales de economías emergentes y las condiciones que deben prevalecer para una implementación exitosa de la TIC4D, para la cual se propone un proceso de seis etapas y se hace énfasis en las propuestas de autores para promover la alfabetización digital.

Alfabetización digital, TIC4D, Comunidades rurales

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Introduction

Technological innovation does not reach everyone at the same time and with it, a new marginalisation and social exclusion arises (Cabero and Ruiz, 2017). The so-called digital divide is a quantitative and comparative expression of the development of specific societies that use digital media in their work. It has become a factor of social and economic inequality among the population, as it divides them into those connected and those not connected to the internet and therefore, users or not, of Information and Communication Technologies (ICT) (Micheli and Valle, 2018), which is why it represents a new situation of vulnerability that significantly affects different groups and profiles, with a special incidence on those who are already in a situation of marginalisation and social exclusion (Gómez, Hernández and Romero, 2017). According to Martínez (2021), the cost of the service is the main constraint for internet connectivity in rural and urban households; in addition, in both contexts, older individuals are more likely not to access and use the internet due to a lack of digital skills, which is related to education. Juditha and Islami (2018) also add that there are at least three factors that cause the digital divide in rural areas: technological factors, the level of community ICT literacy and government commitment to rural development.

Rural areas have been gradually subjected to a natural marginalisation that also includes, among others, poor public infrastructures and little or no investment in the sustainability of productive models, which leads to a whole series of shortcomings (Del Pino and Camarero, 2017). The relevance that ICTs offer as tools for transformation in rural areas is undeniable, enabling not only the revitalisation of their social dynamics, but also business, education and employment, which is why their adoption is considered essential to prevent their depopulation (García et al., 2021). It is therefore urgent that, as technologies advance, governments in all countries support and assist enterprises, including small and medium-sized enterprises (SMEs) and informal and artisanal micro-enterprises in all sectors, to enable the basic use of these technologies and their subsequent adoption in areas such as market research, product development, sourcing, production, sales and after-sales services (UNCTAD, 2023).

It is also undeniable that ICT diffusion has an impact on poverty reduction through access to information, efficiency in communication, skills acquisition, more effective promotion of social programmes, and improved governance and political participation (Tandi & Zozimus, 2019).

In rural areas, farmers can expect benefits from access to ICTs that can range from promoting greater inclusion in the economy, reducing production and transaction costs, increasing production through the use of technological innovations, and boosting linkages with other businesses in the sector with the possibility of generating productive chains (Deichmann, Goyal, & Mishra, 2016). To harness the potential of ICTs by productive sectors and individuals, especially rural ones, access to digital technologies is essential; However, this is not enough, digital literacy must also be provided for an optimal use of them and this must be accompanied by comprehensive actions to consolidate their use and appropriation (Domínguez and Navarro, 2020), since it has been demonstrated that ICTs generate socio-economic changes in rural communities, but only to the extent that their benefits are exploited by those who use them, that is, ICTs alone do not generate changes, but when used, they are re-signified (Lopera Molano, 2022).

The aim of this paper is to investigate, through a literature review, what aspects should be taken into account to achieve digital literacy in the rural sector in emerging economies and what conditions should prevail in order to apply it successfully.

This work is relevant because the issue of digital literacy has been addressed mostly in terms of ICT uses, but this has not allowed for evidence of appropriation or adoption, especially in rural areas. In addition, although these studies reach the generalised conclusion that communities need to be trained or empowered, this stage is not described. Research focused on developing digital skills or capacities in communities is very limited, even though the literature has pointed out that this is the approach most likely to be successful in developing social appropriation processes (Lopera Molano, 2022), so this research paper makes a significant contribution to this under-addressed topic.

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The first part of this document explores the theoretical context corresponding to the central themes of this work, followed by a description of the methodology followed to achieve the stated objective, and then the results obtained are shown in two parts: the first focuses on the considerations for the implementation of ICT for development (ICT4D) in emerging economies and, in the second part, the aspects to be considered according to various studies and interventions carried out for digital literacy in rural communities.

Theoretical context

Digital literacy

Literacy, defined by the Royal Spanish Academy (RAE) as the process of "teaching someone to read and write", no longer refers exclusively to the use of pencil and paper, but now extends to the use of ICTs, requiring that these literacy processes are also oriented towards learning to use, appropriate and understand them to access global information and generate knowledge, currently called digital literacy (George, 2020).

Digital literacy, which was recognised as a competence by the European Commission in 2006 among the eight key competences for lifelong learning for digital citizenship, has gone from being recommended to being essential (Pérez-Escoda et al., 2019). As a result, it is assumed that people who are not able to incorporate ICTs into the world of work, education, social and even personal life are being marginalised, and have fewer possibilities to develop and develop at all social levels (Cabero, 2016).

Digital literacy should be seen as a process of knowledge acquisition that must respond critically to the demands of an increasingly extensive and complex information environment, in which learning about new cognitive mechanisms to search, filter, categorise and use relevant information is required in order to achieve relevant and relevant educational purposes in an accurate and relevant way (George y Avello-Martínez, 2021).

George (2020), categorises digital literacy into four components: use of technology, critical understanding, online collaboration and knowledge creation and socialisation. The first focuses on reading critically and reflectively in digital media, the second on learning to select and analyse information accumulated in virtual media efficiently, the third on sharing information and content to communicate and interact effectively and safely while maintaining a digital identity and, finally, the fourth on writing texts and hypertext and hypermedia content with digital tools. This implies that in order to develop digital literacy programmes, the aim must be to provide knowledge that achieves a favourable conceptualisation of the relationship between ICTs and contemporary citizenship (know what), practical knowledge so that they can develop digital experiences (know how), and to link both knowledge to determine what can be done with technological tools (know how to be). It is also a priority to recognise that rural areas need differential and appropriate strategies for digital inclusion, and therefore a generic approach cannot be applied (Roberts et al., 2017).

ICT4D

ICT for development (ICT4D) is a multidisciplinary area of study concerned with the provision and use of ICTs to advance the progress of developing communities (Thomas et al., 2022). Broadly speaking, ICT4D projects are contextualised in low- and middle-income countries, which, while representing a heterogeneous group, share many common human development challenges (Karanasios, 2014).

Methodology

To meet the objective of this paper, an integrative literature review (Torraco, 2005) was conducted among different authors who have historically made contributions to the theoretical body of the topic, in order to establish a new framework by conceptualising and expanding the theoretical foundations (Snyder, 2019).

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The literature review was conducted using the search and evaluation for inclusion methodology (Xiao and Watson, 2019) as shown in Figure 1, by searching open sources for theories, perspectives and frameworks related to creativity, the factors of which are applicable to the level of work teams in organisational studies as shown in Figure 1.

From the literature review, the components were derived for the proposal of the present work.

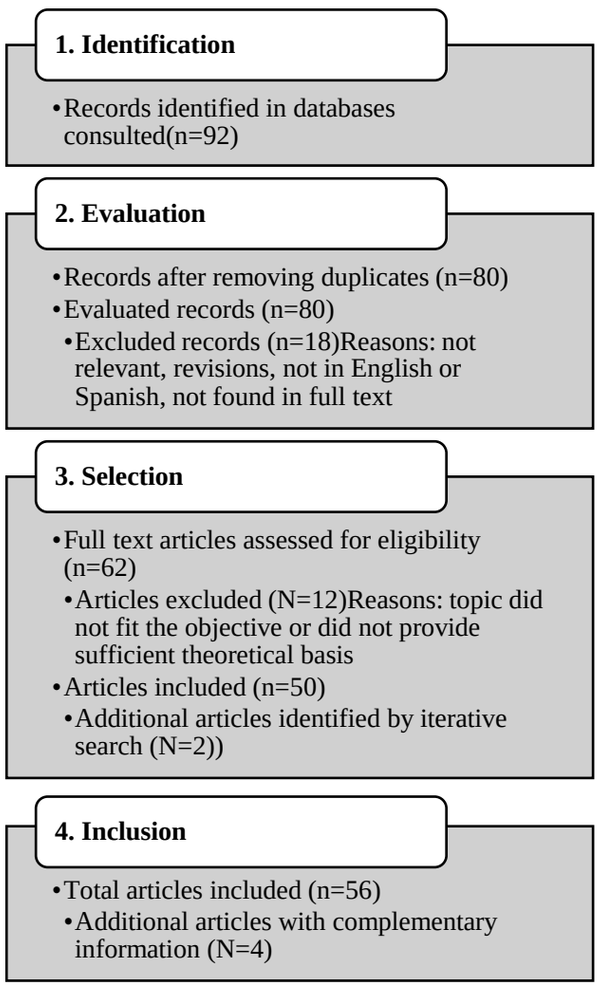

Figure 1 Methodology
Source: Adapted from (Torraco, 2005; Snyder, 2019; Xiao and Watson, 019)

Results

Stratton and Nemer (2020) highlight in their research the paucity of studies on Information Technologies for Development (ICT4D) in Latin America and recommend that researchers broaden their scope to other countries in the region to look for new contexts and environments.

This can lead to the development of theories and interventions that benefit the lives of people living in the most extreme conditions and achieve social justice for the most marginalised and persecuted groups.

Implementing ITC4D in emerging economies can be a complex process that requires careful planning and strategic execution (Woetzel et al., 2018) for which different authors propose different actions that have been categorised under the following six headings that can be configured into steps of an overall process:

1. Identify needs and challenges.
2. Develop an implementation strategy.
3. Invest in technological infrastructure.
4. Training and education.
5. Encourage innovation and research.
6. Implement and evaluate.

Step 1: Identifying needs and challenges

Identifying ICT4D needs and challenges in developing countries requires drawing on multiple theoretical streams, firstly, fundamental theories on technology, context and socio-economic development (Thapa and Omland, 2018). Secondly, middle-range theories can shed light on specific issues of ICT-related phenomena in the context of developing countries (Avgerou, 2017). It is also suggested to conduct field research with disadvantaged communities in developing countries that can help identify common factors and challenges associated with ICT4D projects (Potnis, 2016). It is also crucial to manage the scope, time, costs, quality, human resources, communication and risks to address these challenges (Estevez and Montoya, 2015). The absorptive capacity of different societies needs to be understood and human and institutional capacities need to be developed to harness the potential of ICT4D in developing countries (Omland and Thapa, 2017).

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Other studies suggest that identifying the needs and challenges for ICT4D in developing countries involves addressing issues such as tradition, experience, contextually appropriate technologies and long-term viability, using a multidisciplinary and mixed-methods research approach (Bezuidenhout et al., 2022; Sebbane, 2022; Yim and Gomez, 2021; Lee and Primi 2020, Sinha and Alvarado, 2020).

Step 2: Develop an implementation strategy:

To develop an implementation strategy for ICT4D in developing countries, it is important to understand the underlying mechanisms that link ICT and development (Thapa and Omland, 2018). This requires investigating how and why ICTs work in the specific contexts of developing countries. A four-step methodological approach based on critical realism can be used to identify these mechanisms (Kwabiah, 2019). In addition, it is crucial to focus on empowering people and enabling widespread multi-stakeholder participation and collaboration. (Malik y Khan, 2021). Lessons learned from previous phases of implementation should also be incorporated into the strategy (Botha and Herselman, 2015). The strategy should also consider the specific needs and challenges of the target country, including policies, processes, technology and business models (Dahan and Hammer, 2015), while still taking into account the most appropriate approach (Dahan and Hammer, 2015).

Furthermore, ICT4D implementation strategies in developing countries can be carried out through project management standards (Cidav et al., 2020; Kühn, 2021), and also the capability approach can help to design ICT4D interventions considering users' capabilities, such as prior knowledge and financial incapacity, to maximise their impact on socio-economic and human development (Hoque, 2020).

Step three: Invest in technological infrastructure

Investing in technological infrastructure to implement ICT4D in developing countries requires consideration of several factors. First, it is important to identify genuine local needs and ensure local ownership of projects, where governments take the leading role (Mozelius et al., 2009; Wynn and Jones, 2020).

Realistic constraints and a competent network of people must also be taken into account (Estache et al., 2015; Pérez-García, 2021). A communication strategy and a planning horizon are crucial for successful implementation (Gurara et al., 2018). The documentation of measurable results and the availability of resources for sustainability are also important aspects to consider (da Silva and Fernandez, 2013; Silva and Fernandez, 2020). Furthermore, ensuring fun and motivation in projects can contribute to their success (Heeks and Alemayehu, 2009). It is also necessary to adapt funding schemes to the institutional constraints present in each specific context in order to target them appropriately and achieve a positive impact (Chatterjee, 2020).

Step four: Training and education

ICT4D training and education in developing countries can be implemented by prioritising computer science education, despite challenges such as limited internet bandwidth and shortages of academic staff that affect student motivation and teacher performance (Bissyandé et al., 2015). Universities can play a crucial role in supporting ICT4D projects by providing resources and expertise (López et al., 2012). Each country must develop its own solutions based on local conditions and strategic priorities; developing states may face financial, human and other resource constraints, so in-depth analysis of local conditions and strategic planning can help overcome these challenges (Mozelius, 2014). Measurable, sustainable and scalable design solutions are essential to achieve the UN Sustainable Development Goals in ICT4D (Wagner, 2018).

Step 5: Fostering innovation and research

It is possible to foster innovation and research for ICT4D in developing countries through several strategies. First, there is a need to promote collaboration and entrepreneurship between different disciplines, as this can create alternative local products and contribute positively to the developing economy through networking and institutional anchoring (Seifu et al., 2020; Pandey et al., 2021; Nyerhovwo, 2022). Second, it is important to focus on digital innovation and the impact of digital technologies in developing countries, as this area has been largely overlooked in current research (Al-Zaroog and Baqir, 2020; Saweo, 2023).

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Furthermore, fostering innovation ecosystems with the help of Artificial Intelligence (AI) can also play an important role in promoting ICT4D in developing countries (Nielsen, 2017). Also, it is crucial to conduct critical research in ICT4D, focusing on transformation and change, and to engage in closer collaboration between researchers and practitioners to ensure policy impact (Cortés et al., 2021; De et al., 2018; El-Ferik and Al-Naser, 2021; Harris, n.d;). Innovation and research for ICT4D in developing countries can also be fostered through the adoption of sound policies and investments that support education, research spending and market development. (Al-Zaroog y Baqir, 2020; Mohamed et al., 2022; Tantanee et al., 2019).

Step six: Implement and evaluate.

To implement and measure ICT4D in developing countries, it is important to consider the underlying mechanisms that link ICTs and development (Namo et al., 2020). This can be achieved through a four-step methodological approach based on critical realism, which involves identifying the mechanisms that explain how and why ICTs lead to development (Thapa and Omland, 2018). In addition, governments should allocate a significant part of their budgets to factors that improve technological capacity, science education, as well as gross enrolment in education and internet connectivity (Heeks, 2017). Policies that promote national prizes for scientists and researchers, develop international relationships, modify school curricula to emphasise creativity and spontaneity, and relax corporate taxes for environmentally friendly and economically viable innovations are also recommended (Khayyat and Lee, 2015; Pandey et al, 2021). Furthermore, it is crucial to understand that ICTs alone cannot improve people's lives, but must be integrated into broader strategies designed to make the most of these tools and techniques for human development (Hamel, 2010).

Now, in terms of aspects to consider according to various studies and interventions carried out for digital literacy in rural communities, the following was found: Juditha and Islami (2018), identify three critical success factors for ICT empowerment in rural areas:

1) There must be commitment from all stakeholders.

2) A socialisation programme must be generated to increase public awareness and education (literacy) to accelerate ICT adoption in rural communities with infrastructure development.

3) The development of an ICT ecosystem should be integrated by a network of participating villages or communities to share knowledge.

For its part, (Nedugandi et al., 2018) proposes a framework that includes seven stages to achieve digital literacy. These stages refer to:

1. identifying vulnerable populations in rural areas that require digital literacy support.

2. Developing an integrated curriculum that addresses multiple literacy topics such as, health, financial literacy and e-safety for low-literate students in low-resource settings.

3. Adaptation of mobile technology for remote areas.

4. Creation of a context-based curriculum that is tailored to the specific needs and challenges of learners in rural areas.

5. Implementation of flexible learning schedules to accommodate the constraints of learners in remote environments, such as intermittent electricity and limited internet bandwidth.

6. To provide digital literacy and awareness, the involvement of existing civil societies, schools and governmental organisations is important.

7. Conducting examinations directly in tribal settlements to reduce barriers to assessment in remote areas.

Madaio et al. (2020), found that: 1) it is critical to consider the nature of digital literacy skills needed and to quantify how widespread these skills might be over time; 2) it proposes using educational technologies as a solution to support education in low-resource rural contexts where formal schooling is insufficient to foster widespread literacy; 3) it proposes using educational technologies as a solution to support education in low-resource rural contexts where formal schooling is insufficient to foster widespread literacy.

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4) it proposes using educational technologies as a solution to support education in low-resource rural contexts where formal schooling is insufficient to foster widespread literacy.

Kurniawan et al. (2021), indicates that universities can help rural communities to become empowered in the use of ICTs. He suggests emphasising the use of email and software for writing texts.

On the other hand, Lopera Molano (2022) mentions that in order to achieve a successful outcome in the digital literacy process in rural areas, it is important to study the daily life routines of the actors involved, to introduce technology into them and not only focus on productivity. And also to carry out a situated literacy and mainly qualitative approach, where the priority is not infrastructure.

Furthermore, Norhasni et al. (2022) indicate that one should:

1. generate partnership programmes between the community and institutions to promote digital literacy skills to increase awareness and knowledge on this topic;

2. Promote virtual volunteering by professionals. Many professional employees can volunteer as virtual volunteers to enlist as teachers, mentors, and strategists, among others;

3. Engaging activities and learning modules of digital literacy programmes should be developed;

4. The role of a community leader is important as this will achieve effective results.

Tomczyk et. al. (2023), recommends combining teaching with the realisation of everyday life activities, as well as paying attention to match the pace of people's learning in order to help overcome resistance to technological innovations, and finally, highlighting the benefits of ICT implementation by demonstrating the results achieved in the development of their own activities.

Finally, Fernandez (2023) in an intervention process carried out the following activities:

1. as a starting point he contacted local councils, in order for them to contact citizens by disseminating posters and setting a date to hold an information meeting.

2. After the information meeting, the interested citizens carried out their online assessments. One to identify the level of digital competences and one to identify the digital literacy courses to be offered.

3. The training courses were focused on the stages of initiation, building new skills and others focused on the working environment such as marketing or economics.

4. The training process of these competences was facilitated and monitored by a specialised person.

5. The courses offered were: introduction to computers with Windows, introduction to office, and introduction to the internet.

6. To close the courses, another meeting was held so that the participants could self-evaluate their achievement of digital competences in order to register differences with respect to the initial evaluation.

7. Finally, they propose to evaluate the digital skills training courses in order to identify opportunities for improvement.

Conclusions

With regard to the implementation of ICT4D in emerging economies, it can be concluded that multidisciplinary and mixed methods approaches with a critical realism-based approach can be used to identify the underlying mechanisms that explain how and why ICTs lead to development in specific contexts in order to identify the needs and challenges of ICT4D.

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Also, that developing an ICT4D implementation strategy in developing countries requires fostering convergence between disparate sectoral and national ownership initiatives to achieve a more effective approach to ICT4D implementation.

Closing infrastructure gaps may require improving the efficiency of public spending, mobilising domestic resources and seeking support from development partners. Overall, a comprehensive approach that addresses these aspects is essential for successful investment in technology infrastructure for ICT4D in developing countries.

It is important to emphasise that by implementing collaborative strategies across different sectors, and with local and international partners; and, by adopting appropriate policies and sufficient investment that supports education and research spending, technology development and market development, developing countries can effectively foster innovation and research for ICT4D, and consider that once the technology is in place, it will be important to monitor and evaluate its impact, although this may involve collecting data, conducting surveys and assessing the impact of the technology on identified goals and objectives.

In terms of considerations for carrying out a digital literacy process, the authors agree that it will be easier if it is related to the activities that the participants carry out on a daily basis and highlighting the results they get from doing so. It is also emphasised that leadership in the rural community is important as well as engaging stakeholders in this process. It is essential to make a literacy plan that integrates the contents that each community needs, in which its implementation is followed up through a project management methodology. It must also be evaluated by the participants in order to improve it continuously, and there is no doubt that social, academic and governmental organisations can become volunteers to support this process, which will undoubtedly boost rural communities and in the future could reduce the digital divide that exists with respect to the urban sector.

This research also corroborates that digital literacy is addressed in the studies, although very little is said about how to implement it systematically in rural communities.

As future work, it is proposed to carry out the digital literacy exercise in a rural community and implement one of the models included in the literature, but considering the findings identified in this work as relevant factors in the process.

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Evaluation of criteria in mining units through the SMM

Valoración de criterios en unidad minera a través del MGS

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Abstract

A Sustainable Management Model is created, which in its implementation seeks to generate evidence of alignment of current environmental practices with four Sustainable Development Goals in the country's mining units. The implementation process closely follows the stages of a diagnosis, the result of which is documented in a Sustainable Technical Report that emanates mainly from the records issued by the database called MGS and that allows the assessment of criteria that denote the enablement or insufficiency of compliance with observed SDGs. This document presents the development of the implementation of the model, the recording of the information in the database and the valuation methodology; The Sustainable Technical Report is the product that the mining unit obtains and is subject to issuance by both internal and external authorities, intending as a scope, to be a means of information for the government agencies that formally follow up.

Sustainable management model, SMM database, Sustainable technical report

Resumen

Se crea un Modelo de Gestión Sustentable, el cual en su implantación busca generar evidencia de alineación de prácticas medio-ambientales vigentes con cuatro Objetivos de Desarrollo Sustentable en las unidades mineras del país. El proceso de implementación, sigue de cerca las etapas de un diagnóstico, del cual, el resultado se documenta en un Informe Técnico Sustentable que emana principalmente de los registros que emite la base de datos denominada MGS y que permite valorar criterios que denotan la habilitación o insuficiencia del cumplimiento de ODS´s observados. Este documento presenta el desarrollo de la implantación del modelo, el regsitro de la información en la base de datos y, la metodología de valoración; el Informe Técnico Sustentable es el producto que la unidad minera obtiene y es sujeto de emisión para autoridades tanto internas como externas, pretendiendo como alcance, ser un medio de información para los organismos gubernamentales que dan seguimiento formalmente.

Modelo de gestión sustentable, Base de datos MGS, Informe técnico sustentable

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Introduction

In search of the development of nations that flows in an economic, environmental and social balance, Sustainability can operate as a business strategy, in which the priority is interpreted as a balance that allows supplying and generating wealth through the system that operates, with commitment and responsibility to care for the environment and the social environment, simultaneously with the search for economic sustainability. For its part, the government designs regulations that allow for Sustainable Development, optimising social and economic well-being and environmental care (Velázquez and Vargas, 2012).

These regulations allow for the collection of the information that is generated and that results from this search to create prosperity and capitalisation of new resources. Traditionally, the objective of maximising economic gains, obviating social and environmental elements, provided the opportunity for sustainable strategies and programmes to be presented, obtaining credibility and permanence as a benefit. Timely sustainability analyses, presented in reports, allow organisations to demonstrate their commitment and the essence of what is expressed in the reports is considered as normative monitoring (Aplanet, n.d.).

The Sustainable Management Model is in itself a methodology for handling diagnostic information within the strategic planning of mining units in Mexico; in its implementation, which is recorded digitally through the MGS database created specifically for this purpose, it is observed that there is the technological possibility of creating a format of ordered elements that suggest the structure of a Sustainable Technical Report, a valid and reliable document for authorities of the unit of analysis or even governmental bodies (Martínez et al., 2023).

The resulting diagnosis concentrates collected information and interpretations of experts in the field, and places the authorities in a position to make decisions in favour of the environment. The recording of observations in the MGS, during the implementation of the model, generates quantifiable sections that, together with the interpretation of experts, allow the structuring of the report that provides the valuation of the unit of analysis.

Theoretical basis

Sustainable management model

Created for the mining industry, it meets international efforts through Sustainable Development Goals and complies with the requirements of the country's Mining Law through observable and evidentiary legislative parameters (Martínez et al., 2020).

It is a model that, due to its foundation, adheres to the strategic plans of Mexican mining units to strengthen their Environmental Management. The conservation of a safe, clean, healthy and sustainable environment is vital for the well-being of human beings and the guarantees offered by the right to enjoy them. This model contemplates in its construction two main axes:

1. Four Sustainable Development Goals assessed in the fieldwork, taken from the 2030 Agenda (ECLAC, 2018): SDG 9- *Industry, innovation and infrastructure*, SDG 11- *Sustainable cities and communities*, SDG 12- *Responsible production and consumption and* SDG 13- *Life of terrestrial ecosystems.*.

2. 16 legislative parameters are observed, which are documented in the Environmental Impact Manifest (MIA), in which companies are obliged to describe in the greatest detail how they will carry out the requested activities in terms of care for the environment. (SEMARNAT, 2002): *lifetime, technical manager, nature of the project, dimensions, land use, development of the area, site preparation, construction of works, operation and maintenance, abandonment, use of explosives, waste generation and management, waste management and disposal infrastructure, abiotic aspects, biotic aspects and landscape.*

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Database MGS

A database called MGS is designed and programmed, which involves field work to collect information. It was created specifically for the Mexican company Minera Tierra Adentro, S.A. de C.V. -MTA, which has been providing management, operational and environmental consultancy services to the mining and construction sector since 2012, the MGS database serves as a sustainable diagnosis, since, based on the Sustainable Management Model, it monitors SDGs and legislative parameters through the practices of the units analysed, thus exposing the reality, effectiveness and proposing recommendations generated by the firm.It consists of two modules, which systematically provide a work organisation to achieve the scope of the Sustainable Management Model to be implemented in the mining sector of the country; once there is a mining unit that accepts the diagnosis, the registration of the information obtained from the field, by means of the logarithms created, provides the structure of a technical report, which due to its approach, is called Sustainable Technical Report.

The MGS database is also a technological project in which the scope is integral in terms of environmental assessment; a third module is being analysed to involve monitoring of the units in terms of Circular Economy.

Sustainable technical report

Technical reports are characterised by the physical structure reflecting the planning and operation of companies, in which programmes and strategies that determine objectives and targets set in relation to the analysis of measurable and verifiable factors operating in key processes are interpreted and prepared to execute action plans for organisational improvements. They are based on scientific research or studies, and therefore, they must follow conceptual methods that cover stages of planning, development and conclusions, in order to carry out an analysis to understand the parts or elements through specialised techniques for their reordering and interpretation (Pazos, 2017).

The denotation of descriptions of business observations and strategic proposals must be supported by measurements that express the reality of the companies and project it over time for its effectiveness. To support the validity of the criteria or key elements, the measurement of indicators is recommended, which allow visualising through their value, whether or not the proposed objectives are met (Portugal, 2017; Aplanet, n.d.).

Therefore, a sustainable technical report should contain the analysis with a scientific approach based on current environmental practices, facilitating the communication of findings of deviations or adherence to sustainable development guidelines and the proposals for action derived from them.

Methodological basis

This document presents the process of implementing the Sustainable Management Model, the registration format in the MGS database and the formalisation of this work in a Sustainable Technical Report. By its nature, it is a diagnostic research study, with a mixed approach to information processing and transversal in continuity, since the comprehensive research, which consists of theoretical and methodological bases that determine the creation of the Sustainable Management Model dates from 2018 and is formalised in 2020; its implementation and extension have been constant and executed by researchers of the Academic Body 07 belonging to the San Luis Potosí Technological Institute in agreement with the company Minera Tierra Adentro.

The objective is therefore to provide value to the criteria that form part of the sustainable measurement carried out at mining units, considering the implementation of the model and using the MGS database, to structure a deliverable result in the format of a Sustainable Technical Report.

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Development of the implementation of the Sustainable Management Model

Module 1 MGS

Called the qualitative selection module of mining units, it is based on the applicability that today's technological advances have, via web or mobile, forming part of a new paradigm, in which time and the effectiveness of evidence reveal updating and credibility. In its execution, it considers the selection of units based on criteria defined by convenience (Hernández, 2018), which, when integrated, offer information on the units suitable for managing the request for implementation of the model, allowing it to be systematic in the country's mining sector.

The interface resulting from the modelling of the database suggests the registration of general information on mining units, which corresponds to the criteria defined to fulfil two purposes: first, to create a catalogue for MTA, which can be accessed at any time for consultation; second, to prioritise the units so that MTA can make a formal proposal for the implementation of the model and have options, if they are not to be accepted in the first instance.

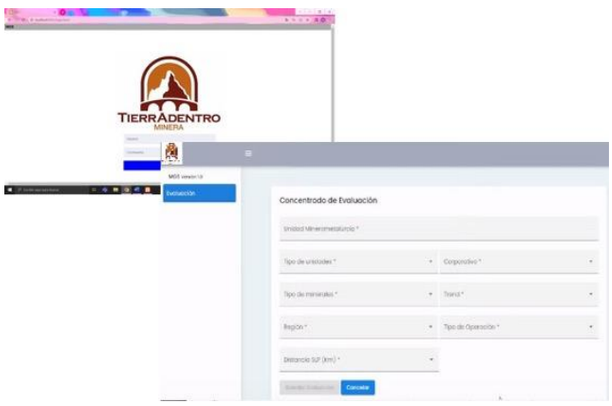

Figure 1 MGS Module 1 interface
Source: Own elaboration

Module 2 MGS

Once contact has been established with the unit that delivers module 1 as optimal, MTA staff approach the management and propose that the model be implemented; if it is accepted, a working agreement is established under an established programme.

The following is a summary of the registration form for the implementation of the MGS. The images show the interface designed for the database and the format for registering information on the legislative parameters that represent the MIA; the tab that indicates this interface is pointed out, the file of the unit analysed is generated and the information is registered. This process is repeated 16 times, corresponding to the selected parameters.

Figure 2 Legislative Parameters Registration Interface - MGS Module 2
Source: Own elaboration

Once the information obtained in the field of the 16 legislative parameters has been recorded, the database allows the export of this information to WORD, in which, as it is an editable file, the findings can be described with expert interpretations, in which it is also possible to detail, add and formalise the information.

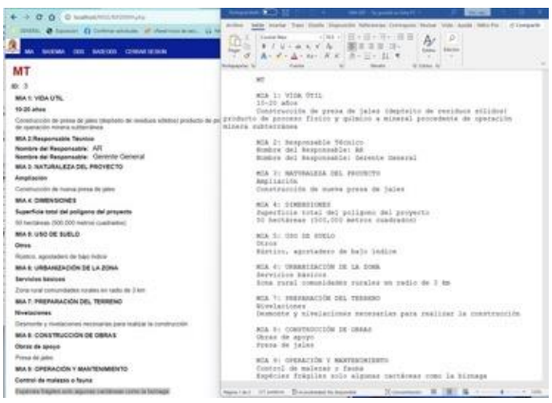

Figure 3 Summary interface of recorded information and word view - MGS module 2
Source: Own elaboration

The recording of SDG indicators has a quantitative format, in which the information collected involves field review - where it is generated -, confirmation of documents, verification with operational and administrative staff, review of national reports of agencies and calculations of economic factors; the export is made to an EXCEL spreadsheet where it is also possible to perform other operations or create representative graphs.

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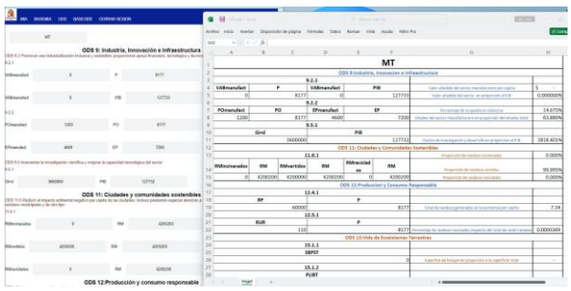

Figure 4 ODS data recording interface and excel view - MGS module 2.
Source: Own elaboration

Assessment of sustainable criteria of the units analysed

Indicators that reflect representative estimates of the SDGs are considered. Corresponds to the quantitative information recorded in the database. This quantification is required to know the degree of scope in the measurement of the criteria established in relation to the effectiveness of the actions carried out.

Interpretations are generated for each SDG evaluated, as well as for each legislative parameter, based on each origin, quantitative and qualitative cut-off respectively. In turn, recommendations are generated that are expressed globally, so that an improvement action programme can be integrated or, if necessary, a claim action programme can be integrated; the calculations issued by the base, are focused on a base technique that centralises the assessment in a range defined by MTA based on the results of the calculations made from the information in the database.

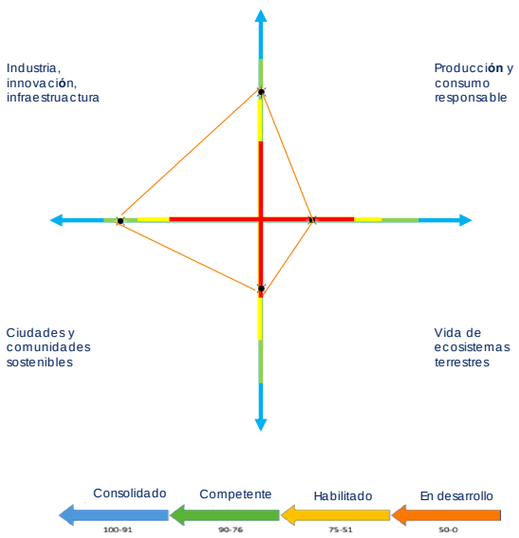

Figure 5 Assessment of the SDGs
Source: Own elaboration

The degree of measurement of the SDGs is based on a simple numerical scale, assessed by MTA staff; it is represented in a diagram with nomenclature related to colours and range of values:

- Blue-consolidated.
- Green-competent.
- Yellow-enabled.
- Red-developing.

The format in which the database sequence is arranged and thus how it presents the partial results offers the opportunity for MTA to write up findings and interpretations of the analysed unit and deliver the Sustainable Technical Report.

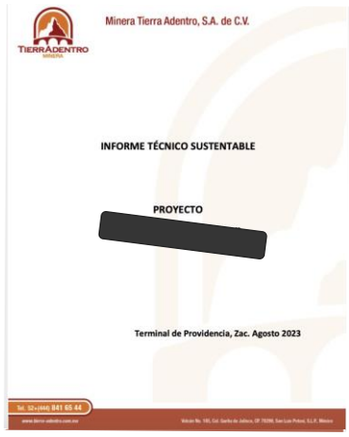

Figure 6 Sustainable Technical Report, front page
Source: Own elaboration

Conclusions

The scope of this document formalises the implementation of the Sustainable Management Model, the application of the MGS database, concluding that the assessment of the criteria can be fulfilled by systematically following this procedure, and can even be considered a sustainability methodology.

In addition to the process of a diagnosis, the stages proposed by Portugal (2017) are fulfilled and are linked to the recording of quantitative and qualitative information collected in the field within the units analysed.

The recording of the information collected in the field is done directly in the database, integrating the findings, the specific interpretations of the experts, and documenting them in the structure of a Sustainable Technical Report and thus being able to visualise the SDGs measured in a more objective way.

The stages fulfil the intention and promote the implementation of the activities involved, so that the observations and recommendations derived from it can be relied upon. The use of the database as a tool for collecting, ordering and structuring the results is satisfactory with opportunities for improvement; the final measurement complements the exercise in a practical way that is easy to understand and interpret.

General descriptions, particular interpretations, organisation of observations and findings, operational calculations, criteria measurements and interventions of the personnel of each unit, as well as of the managers of the implementation of the model, are recorded in the Sustainable Technical Report, a confidential file that MTA delivers to the mining unit analysed.

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Trends in multicriteria decision-making models for solar dryers

Tendencias en los modelos de toma de decisiones multicriterio para secadores solares

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Abstract

This research provides an overview of multi-criteria decision-making models, as well as the most commonly used criteria for the development of solar dryers. Mathematical models for decision making based on the selection of multiple criteria have been part of technological developments for years in various sectors of the industry. Solar dryers have been extensively analyzed, developed and classified by several authors, within these classifications we find the hybrid solar dryers (SDH) which provide more stable temperature inside the drying chamber due to an alternate source of energy that may or may not be renewable. Through a bibliographic study we determined which are the most used methods, as well as the classification criteria used in groups to know which is the trend in the use of these. This study allows an understanding and will provide a vision of the most currently used criteria, making clear which are the areas of criteria for possible research and development.

MCDM, Solar hybrid dryer, Sustainable

Resumen

Esta investigación otorga un panorama general de los modelos multicriterio para la toma de decisiones, así como los criterios más usando para el desarrollo de secadores solares, Los modelos matemáticos para la toma de decisión basados en la selección de múltiples criterios han formado parte de los desarrollos tecnológicos desde hace años en diversos sectores de la industria. los secadores solares han sido analizados, desarrollados y clasificados ampliamente por diversos autores, dentro de estas clasificaciones encontramos a los secadores solares híbridos (SDH) los cuales proporcionan temperatura más estable dentro de la cámara de secado debido a una fuente alterna de energía que puede ser o no renovable. Mediante un estudio bibliográfico se determinaron cuáles son los métodos más usados, así como la clasificación los criterios utilizados en grupos para conocer cuál es la tendencia del uso de estos. Este estudio permite una comprensión y proporcionará una visión de los criterios más utilizados actualmente dejando en claro cuáles son las áreas de criterios de posible investigación y desarrollo.

MCDM, Solar Hybrid Dryer, Sustainable

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† Researcher contributing first author.

Introduction

In this section found the generalities about solar dryers the importance and classification and show a technological general perspective, besides talk about of multi-criteria decision making (MCDM) which is the relance and show general process follow the models for this technic.

A lot of research has been done on the use of drying technology to extend the shelf life of agricultural products. However, the extremely energy-intensive thermal dryers used in the food processing sectors use heat from conventional energy sources like coal, liquid fuel, etc., or electricity. According to estimates, the agri-food processing chain alone accounts for 20% of global greenhouse gas emissions and up to 30% of the world's energy consumption (Mujtaba, 2017).

Open sun drying is a common, practical, and affordable technique used in underdeveloped nations for the drying and preservation of agricultural, food, and numerous other items. However, the drying air flow rate, temperature, moisture levels, heat input, and other external drying parameters are uncontrollable, which leads to an unfavorable drying rate or a longer drying period. The deterioration of product quality caused by wind, trash, rain, insects, and animals is one of the open suns drying method's additional disadvantages (Midilli, 2001).

Everitt and Stanley came up with the original concept for a solar dryer (SD) in 1976. It was a housing unit in the shape of a box with a clear sun cover. This invention's primary goal was to offer a fresh approach that helped address the shortcomings of open sun drying (United States Patent). Decades later, a number of distinguished researchers advanced solar drying technology by utilizing forced and natural circulation as well as auxiliary source heating (such as electricity and fossil fuels) to produce the desired drying characteristics (O.V Ekechukwu, 1999).

Depending on the needs, many kinds of solar dryers are available in a range of sizes and designs. Solar dryers are generally categorized according to the type of product to be dried, air movement mode, solar contributions, air direction movements, and assembly insulation as seen in figure 1 (Mahesh Kumar, 2016).

In a hybrid solar dryer, drying is accomplished during the hours when the sun isn't shining through the use of backup or storage heat energy. This prevents the product from potentially deteriorating due to microbial infestation (B.K. Bala, 1994).

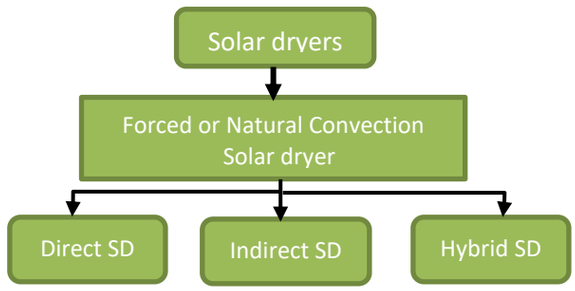

Figure 1 Solar dryer classification
Source: Own elaboration

Using well-built and/or planned devices that can capture solar radiation and maximize its effective usage to dry materials—typically agricultural products—is known as solar drying (Sharma, 2017).

Only in the study of tiny systems can traditional single-objective decision making, which essentially focuses on the maximum or reduction of a certain aspect, remain advantageous. Achieving a system that is perceived as sustainable is more challenging in the current energy planning environment due to the numerous objectives, definitions, and criteria. Thus, in order to combat the growing energy demand while pursuing a vision of sustainable development, an appropriate planning framework that takes into account relevant political, social, economic, and environmental considerations is important (Abhishek Kumar, 2017).

Multi criteria decision making (MCDM) has been shown to be one of the finest tools for effective energy planning in order to tackle such complicated issues pertaining to energy planning. MCDA mostly emerged from operations research, which uses a variety of approaches as show in figure 2 (Murat Köksalan, 2011)

One may see multicriteria decision making (MCDM) as a dynamic, intricate process that involves both administrative and engineering levels of analysis (Serafim Opricovic, 2004)

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These models are basically utility based models and include methods like MAUT, AHP, Weighted Sum Method, and Weighted Product Method, these are mostly preferred for ranking energy technologies like application of energy storage devices in the field of renewable energy (Tzeng Gwo-Hshiung, 1992).

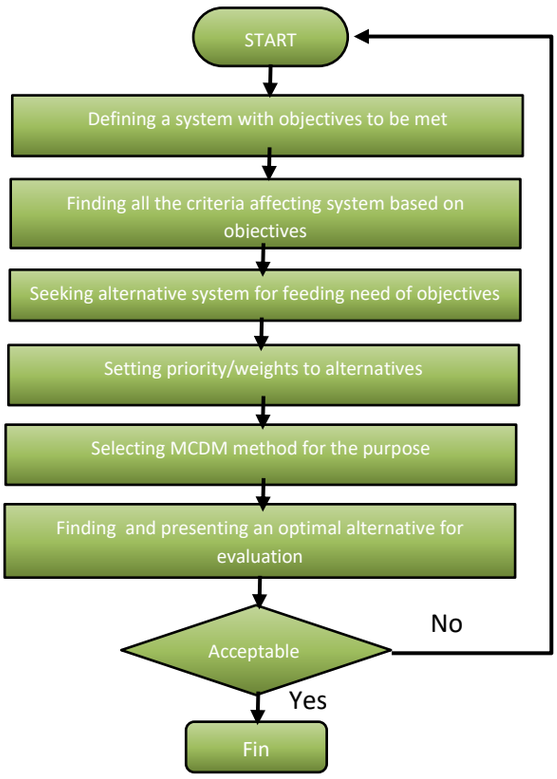

Figure 2 Procedure for MCDM analysis
Source: Own elaboration

Methodology

In this section, we delineate the key words topics and procedural steps that constitute the foundation of this research. We delve into the research process, interpret the systematic methodology employed to gather and analyze data. Furthermore, we elaborate on the tools and methodologies utilized in this study, providing a comprehensive framework.

This section highlights the methods used to prioritize alternatives for solar systems. A detailed explanation of the criteria employed is provided, specifically concerning thermal solar systems, offering a more comprehensive understanding of the factors considered in the evaluation. Additionally, the numerical algorithms associated with the selected MCDM methods are emphasized, providing a fuller comprehension of the analytical tools utilized in the decision-making process within the realm of thermal solar systems.

To reach an objective choice regarding which alternative is best, criteria must be used. Thus, clear and acceptable selection judgments may be achieved by thoroughly thought out and developed selection criteria. To assess how well the alternatives performed, the research used four criteria—social, economic, technological, and environmental. Several criteria were determined and chosen in order to assess the options from a certain angle. The most important stage of the MCDM strategy is this one, which should be selected in consultation with the decision-makers.

The steps to obtain of frame of reference have a next points

1) Use keywords in the principal science data base.

2) Chose de relevance whit the topic.

3) Analyze the paper or book.

4) Select the MCDM and criteria.

5) Administration of data.

After this process we watch general panorama from the studies in this topic as seen in the figure 3.

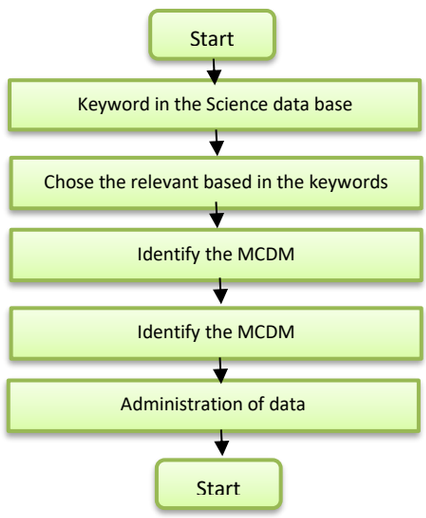

Figure 3 Procedure for MCDM analysis
Source: Own elaboration

This process is followed until no more relevant data is found in the data base.

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Results

In this section shows the results obtained from the process of the mythology highlighting which were the mains Methods in MCDM and the principal criteria.

For the search use the next keyword: "MCDM DRY", "SOLAR THERMAL MCDM" and "MCDM SOLAR DRYER" the search show as around 1120 documents, but only 15 have the relevance as show in table 1.

ID	Author	Title
1	(Ashutosh Chauhan, 2021)	Optimization of pineapple drying based on energy consumption, nutrient retention, and drying time through multi-criteria decision-making
2	(Jorge Meza-Jiménez, 2009)	Low-Cost Solar Thermodynamic Drying System for the Dehydration of Roselle (Hibiscus sabdarifa L.)
3	(Ali Mostafaeipour1, 2020)	A Model Identifying Factors Affecting the Sustainable Use of Solar Dryers: A Case Study
4	(Shweta Singh, 2022)	Analysis of mango drying methods and effect of blanching process based on energy consumption, drying time using multi-criteria decision-making,
5	(Rohit Khargotra R. K., 2023)	Design and performance optimization of solar water heating system with perforated obstacle using hybrid multi-criteria decision-making approach
6	(Huiru Zhao, 2014)	Selecting Green Supplier of Thermal Power Equipment by Using a Hybrid MCDM Method for Sustainability
7	(Rohit Khargotra R. K., 2023)	Optimal thermochemical material selection for a hybrid thermal energy storage system for low temperature applications using multi criteria optimization technique
8	(Jinying Zhang, 2019)	Decision framework for ocean thermal energy plant site selection from a sustainability perspective: The case of China,
9	(Xiaoyan Qian, 2021)	Fuzzy Technique Application in Selecting Photovoltaic Energy and Solar Thermal Energy Production in Belt and Road Countries,
10	(Audrius Ruzgys, 2014)	Integrated evaluation of external wall insulation in residential buildings using SWARA-TODIM MCDM method
11	(Wang, 2022)	Comparative Study of the Thermal Enhancement for Spacecraft PCM Thermal Energy Storage Units
12	(Frattini, 2021)	Fibre-Reinforced Geopolymer Concretes for Sensible Heat Thermal Energy Storage: Simulations and Environmental Impact
13	(Yeliz Simsek, 2018)	Sustainability evaluation of Concentrated Solar Power (CSP) projects under Clean Development Mechanism (CDM) by using Multi Criteria Decision Method (MCDM)
14	(Cavallaro, 2010)	Fuzzy TOPSIS approach for assessing thermal-energy storage in concentrated solar power (CSP) systems
15	(Wenye Lin, 2019)	Multi-objective optimisation of thermal energy storage using phase change materials for solar air systems

Table 1 Highlights papers for dryers or thermal process
Source: Own elaboration

The methods used for solar dryers and thermal processes used by the authors of table 1, TOPSIS, MOORA and AHP are the most used methods as seen in figure 4.

On the other hand, the criteria shown in Figure 5 are grouped because they have specific sub-criteria for each decision making, with the technical criteria being the most important according to the average made by the authors of Table 1.

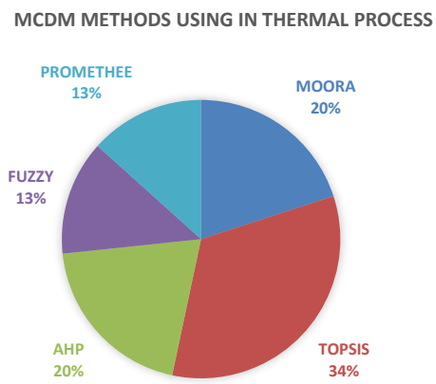

Figure 4 MCDM using in thermal process
Source: Own elaboration

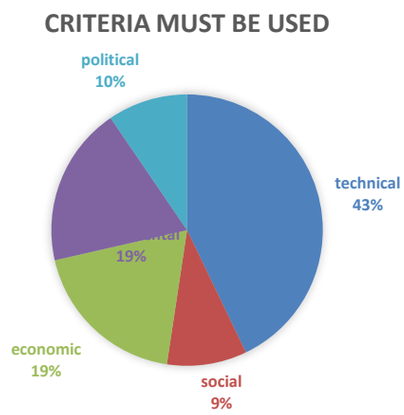

Figure 5 Criteria used by author of table 1
Source: Own elaboration

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Conclusion

According to the research, solar thermal systems have been poorly evaluated with MCDM due to the low evaluation, articles on thermal processes were selected to have a more representative sample, although various MCDM studies for electrification, solar dryers have an area of opportunity for optimization through the MCDM process.

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Home-habits, app for monitoring the progress of the HabitFun video game to generate hygiene habits

Home-habits, app para monitoreo del progreso del videojuego HabitFun para generación de hábitos de higiene

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Abstract

The Home-Habits app allows you to monitor the progress of the HabitFun video game, which was developed as a support tool for the generation of good hygiene habits in elementary school children, in the range of 6 to 8 years. Home-Habits allows parents or guardians to monitor their children, which essentially consists of the analysis of recovered data such as the times of the day when the video game was opened, mini-games played, playing time, scores obtained, and with all the data to make a progress history, in addition to having the ability to provide feedback to each report generated, this with the intention of being able to track the child's daily behavior and relate it to the progress within the game.

App, Monitoring, Hygiene habits

Resumen

La app Home-Habits permite el monitoreo del progreso del videojuego HabitFun que fue desarrollado como herramienta de apoyo a la generación de buenos hábitos de higiene en niños de primaria, en el rango de 6 a 8 años. Home-Habits permite a los padres o tutores el monitoreo de sus hijos, que consiste esencialmente en el análisis de datos recuperados como los momentos del día en que se abrió el videojuego, minijuegos jugados, tiempo de juego, puntajes obtenidos, y con todos los datos hacer un historial del progreso, además de tener la capacidad de poder brindar una retroalimentación a cada reporte generado, esto con la intención de poder hacer un seguimiento del comportamiento en el día a día del niño y relacionarlo con el progreso dentro del juego.

App, Monitoreo, Hábitos de Higiene

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Introduction

According to UNICEF, health, as a necessity and fundamental right of citizens, is closely linked to school performance, quality of life and economic productivity. In this sense, one of the aspects that must be attended to, encouraged and promoted from home, school, health establishments and other organizations, is the development of hygiene habits in the personal, social and environmental order, which lead to the health care, maintenance and prevention. (Unicef, 2005).

Therefore, it is necessary to develop knowledge and skills on this important topic in the family, at school and in the community, to promote attitudes for compliance and promotion of hygiene habits, with the participation of all actors in society in dissemination and promotion campaigns to promote positive change in all areas of life.

Unicef also believes that good hygiene is essential to prevent the spread of infectious diseases and help children lead a long and healthy life. It also prevents them from missing school, which leads to improved learning outcomes (Unicef, 2017).

For a family, having good hygiene habits also means avoiding illnesses and thus being able to spend less on medical care. In some cases, it can also reinforce the family's social status and help people maintain self-confidence. The practice of personal hygiene in childhood is a matter of individual responsibility that is acquired through an educational process and is essential to prevent diseases and promote an adequate state of health. From the school environment, children should be encouraged to achieve certain objectives (Pinto Yépez, 2014).

One of the situations to face is that children tend to give little importance to personal hygiene activities, and for them they tend to be repetitive and tedious activities, and parents tend to approach this learning in a rigid way and this in many of the Sometimes it causes rejection.

The main strategies aimed at creating better health conditions include interventions aimed at the school-age children's population, since in childhood the attitudes and behavioral patterns that regulate life in adulthood are acquired (Piaget, 1977).

Unicef focuses on key behaviors that help children and their families maintain adequate hygiene, washing hands with soap, daily showers or baths, safe handling and storage of drinking water, safe disposal of faeces, etc (Unicef, 2017).

Good personal hygiene habits are directly related to less illness and better health. However, poor personal hygiene habits can lead to some minor side effects, such as body odor and oily skin. They can also lead to more serious or even severe problems (Holland, 2018).

In addition to the above, poor hygiene habits can lead to self-esteem problems, looking good and feeling presentable can give a boost of confidence and a sense of pride in one's appearance.

Hygiene is about measures to prevent and maintain good health. The practice of hygiene rules, over time, becomes a habit. Hence the inseparable relationship of Hygiene Habits. It is convenient for the learning, practice and assessment of hygiene habits that adults set an example for children and young people with the daily practice of adequate hygiene habits, so that conceptual, attitudinal and procedural knowledge about hygiene is consolidated. Issue (Unicef, 2005).

In 2018, Unicef México launched a program called Water, Hygiene and Sanitation, which highlights that children and adolescents have the right to live in a clean environment and with access to drinking water (Unicef México, 2018).

In this program, solutions are presented to the aforementioned problems, emphasizing drinking water, but also complementing these actions, various teaching materials were developed that allow people to have information to create healthy environments, with access to drinking water and good hygiene practices. Among the materials presented, there is an activity booklet, guides for teachers, guides for healthy environments committees, etc (Unicef México, 2018).

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Technology plays a leading role in society today, which is why it is intended to be used as a support tool to make the acquisition of good habits more fun. Video games are great learning motivators, through them, children, they can develop good habits with a less routine and, above all, less authoritarian environment, which allows the psychosocial development of the student, that is, by living their own experiences, they build their own knowledge, articulate the cognitive, with the affective and emotional, to achieve development. integral in an attractive and different way, all this within a child's own innate social expressions, thus seeing play as a learning tool that generates interest, motivation, desire to learn and to put into practice what has been learned, since only that the child is interested in is significant and continues in his desire to know much more, in addition to making it clear that activities such as leaving the room clean not only have to do with one's own hygiene but with environmental hygiene, which also benefits , to the people who live with the child (Pinto Yépez, 2014).

In addition, we must teach children to take care of themselves, not to depend on someone to clean the space they have just used.

Nowadays, technology becomes relevant, especially after the pandemic experienced in recent years, and that is why the HabitFun video game was developed as a support tool for the generation of hygiene habits focused on primary school children, in the range of 6 to 8 year old. However, if we only have a child play a video game, how do we know, especially when we are not present, how long he plays, what levels he has reached, etc.

Multiple studies have been carried out on the benefits and harms of video games in people's lives, and there are still detractors of them even when their main focus is educational use, since they consider, among other things, that they can generate violence in the community. personality of the player, confusion of reality, etc (Estela, Yeray, Rafael, 2020).

Due to the above, and considering that this can provide some relief or peace of mind to parents who are not yet convinced of the benefits of video games in their children's education, Home-Habits was developed, an application for mobile devices. which allows monitoring the progress of the HabitFun video game, and in this way parents can not only be attentive to the time their little ones spend playing the video game, but they can also verify or analyze if the video game is having a positive impact on hygiene habits. of their children.

Analysis

Below, some of the products made in some of the developed stages will be described.

Among other things, at this stage the functional and non-functional requirements for the development of the Home-Habits App were established.

In Table 1, the functional requirements are listed, while in Table 2, the non-functional requirements are shown.

CLUE	NAME	DESCRIPTION
ReqF01	Create Account	The guardian user of the infant may create a new account.
ReqF02	Login	The tutor user will be able to log in.
ReqF03	Sign off	The tutor user will be able to close a session started.
ReqF04	See information	The tutor user will be able to see their registered information.
ReqF05	List of player users	The tutor user will be able to see the list of player users he/she supervises.
ReqF06	List reports for each session	The tutor user will be able to see the reports of each game that the player user registers.
ReqF07	Report information	The tutor user, once a session report has been selected, will be able to see a complete description of the session that the player user registered.
ReqF08	Change Password	The tutor user may change his or her password.
ReqF09	Account Sync Token	The tutor user will be able to see the account synchronization token to register player users.
ReqF10	Clipboard	The tutor user will be able to access the account synchronization token through the clipboard.

Table 1 Functional requirements
Source: Own elaboration

CLUE	NAME	DESCRIPTION
ReqNF01	Design	The interface design must be using material design.
ReqNF02	View Centralization	All views will focus on a main menu.
ReqNF03	Loading view	Have a loading screen.

Table 2 Non-functional Requirements
Source: Own elaboration

Development

Once all the interfaces had been designed, the project and the architecture that it would follow were structured, creating the necessary data layers.

The Home-Habits App was created organized under the concept of "Clean Architecture" which consists of structuring all content in four main layers, these layers are: Core, Data, Domain and UI.

General-purpose elements were placed in the Core layer (figure 1). The Data layer contains the classes necessary to obtain data (figure 2).

Within the Data layer we find the Model package that contains the data models that correspond to the backend responses, the entities of the Home-Habits App and the data transfer objects or Dto (figure 3).

At the same level as Model, we find the Network folder, in which the necessary logic is carried out to connect the app to the API and link each of the endpoints (figure 4).

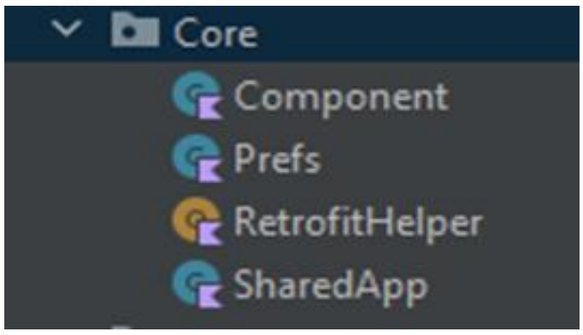


Figure 1 Structure of the Core layer
Source: Own elaboration

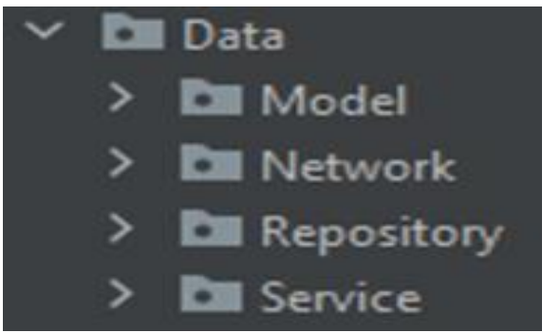


Figure 2 Structure of the Data layer
Source: Own elaboration

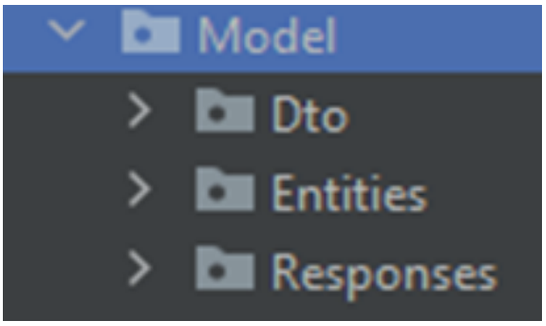


Figure 3 Model Structure
Source: Own elaboration

In the same way as Model and Network there are the service and repository layers (Service and Repository), the first will make the corresponding calls to the network layer according to the information requested and the second will call the functions established in the service and it will process the information to provide clean data and not the answers that the backend gives in response (figure 2).

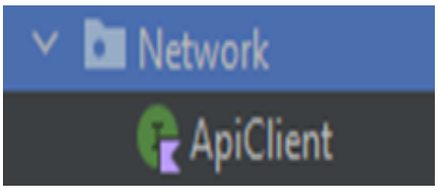


Figure 4 Network Structure
Source: Own elaboration

At the height of the Data layer is the Domain layer, and in it the functions of all the use cases that correspond to the functional requirements are stored (figure 5).

The last layer is the UI, in which the folders are separated by views, which are organized according to the number of activities they have, as shown in figure 6.

Implementation

The implementation stage encompasses the entire process of taking the previously made design to code. As a first instance, the views are laid out within the UI layer, separating and designing each element, fragments, activities and dialog windows. Within this first implementation stage, the own design pattern is implemented to link the data between the interface and what is obtained from the domain layer. For this software, the MVVM pattern will be implemented.

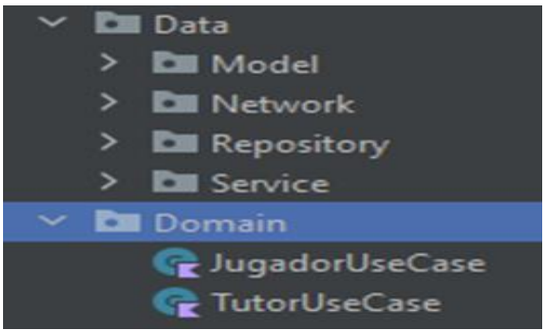


Figure 5 Domain Structure
Source: Own elaboration

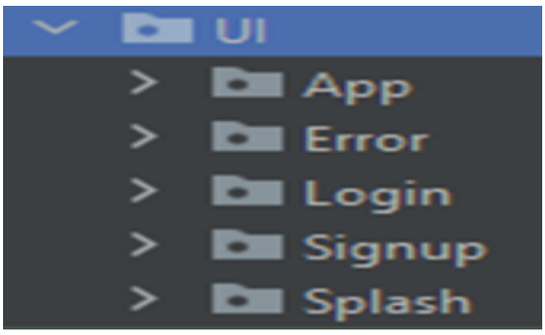


Figure 6 UI structure
Source: Own elaboration

We can see in Figure 7, an example of the general structure of the UI layer showing the login activity. The objective of using MVVM is to be able to bind the view to the data automatically and to be able to observe whenever a change is made, update the data within the ViewModel, but without having any type of business logic within the interface.
Within the view file, only two actions are performed, the call to the ViewModel function to authenticate the user and the observable that is waiting for the response whether it is registered or not (figure 8).

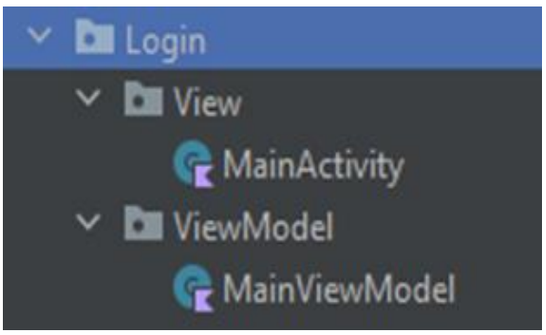
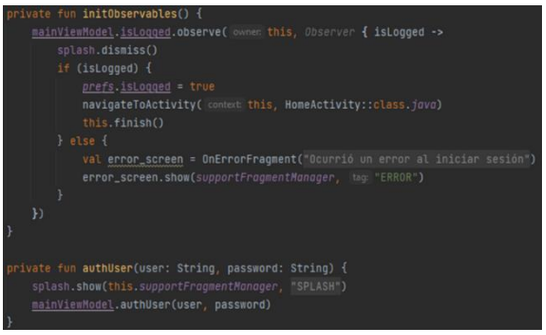


Figure 7 Login Structure
Source: Own elaboration

Now, within the ViewModel the call is made to the domain layer to be able to assign a value to the observable that needs to know if it is registered (figure 9).

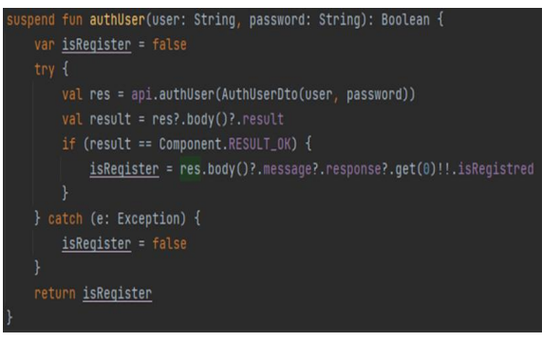


```
private fun initObservables() {
    mainViewModel.isLogged.observe( owner: this, Observer { isLogged ->
        splash.dismiss()
        if (isLogged) {
            prefs.isLogged = true
            navigateToActivity( context: this, HomeActivity::class.java)
            this.finish()
        } else {
            val error_screen = OnErrorFragment("Ocurrió un error al iniciar sesión")
            error_screen.show(supportFragmentManager,  tag: "ERROR")
        }
    })
}

private fun authUser(user: String, password: String) {
    splash.show(this.supportFragmentManager, "SPLASH")
    mainViewModel.authUser(user, password)
}
```

Figure 8 View File
Source: Own elaboration

```
class MainViewModel : ViewModel() {
    var tutorUseCase = TutorUseCase()
    var isLogged = MutableLiveData<Boolean>()

    fun authUser(user: String, password: String) {
        viewModelScope.launch (Dispatchers.IO){  this: CoroutineScope
            if(tutorUseCase.authUser(user, password)){
                isLogged.postValue( value: true)
            }else{
                isLogged.postValue( value: false)
            }
        }
    }
}
```

Figure 9 ViewModel
Source: Own elaboration



```
suspend fun authUser(user: String, password: String): Boolean {
    var isRegister = false
    try {
        val res = api.authUser(AuthUserDto(user, password))
        val result = res?.body()?.result
        if (result == Component.RESULT_OK) {
            isRegister = res.body()?.message?.response?.get(0)!!.isRegistred
        }
    } catch (e: Exception) {
        isRegister = false
    }
    return isRegister
}
```

Figure 10 Repository
Source: Own elaboration

The domain layer in this project performs the role of intermediary, requesting data from the repository and delivering data to the ViewModel. The repository in turn works with the data that the service provides, which is to receive the responses from the backend and process them to deliver only the requested data to the domain layer (figure 10).

In the service layer, functions that qualify as intermediaries are performed, calls are made to each endpoint of the backend and responses are obtained directly from the server to send them to the repository (Figure 11).

```
suspend fun authUser(body:AuthUserDto): Response<AuthResponse>? {
    return withContext(Dispatchers.IO){ this: CoroutineScope
        var response:Response<AuthResponse>?
        try{
            response = api.authUser(body)
            val response_info = api.getTutorId(body).body()?.message?.response
            prefs.tutorId=response_info?.get(0)?.idTutor
            prefs.tutorToken=response_info?.get(0)?.authTokenTutor
            response ^withContext
        }catch(e:Exception){
            response= null
            response ^withContext
        } ^withContext
    }
}
```

Figure 11 ViewModel
Source: Own elaboration

At this point we reach the point where the data transfer leaves our project in Android Studio and the calls are made to the backend using, in this case, retrofit, and we describe the type of response that is expected from the backend (figure 12).

This is the entire flow of the data journey and is the same path that all use cases follow to be implemented. This is the entire flow of the data journey and is the same path that all use cases follow to be implemented.

```
@POST("auth/tutor")
suspend fun authUser(@Body authUserDto:
```

Figure 12 API
Source: Own elaboration

Methodology to be developed

Home-Habits is an application for monitoring the progress of a child in the HabitFun video game, and it was decided to use the Android Studio platform for its development.

For the planning and development of the Home-Habits application, it was decided to use the agile Scrum software development methodology, considering the general stages of the software life cycle, this because the size of the software is not extensive (Schwaber, Sutherland, 2020).

Results

Once all the development shown in the previous sections has been completed, part of the Home-Habits App is presented below.

In the first instance, and as established in the functional requirements, there is a login interface shown in Figure 13, but also, if a user is not registered, they can register through the interface shown. in figure 14.

Once the account is created, the Home-Habits App redirects you to the login interface (figure 13), and this allows you to log in to enjoy all the functionality. Once authentication is completed, if there is still no synchronized player to monitor their progress, a synchronization token will be displayed (figure 15) so that a tutor user does not review the progress of any player user. The sync token must be used in the HabitFun video game and this will complete the sync.

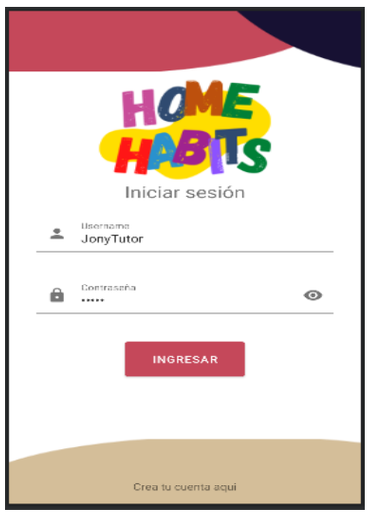


Figure 13 Login interface
Source: Own elaboration

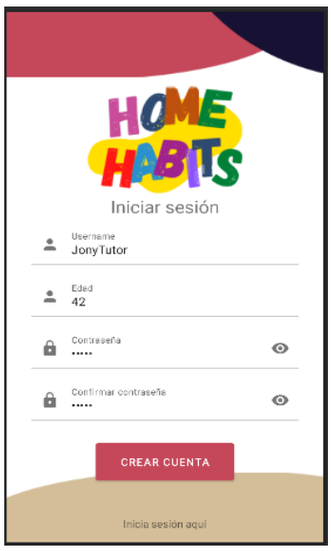


Figure 14 Account creation interface
Source: Own elaboration

Figure 15 Interface with sync token
Source: Own elaboration

If you already have synchronized player users, a list of them will be displayed, as shown in figure 16. If a player is selected to monitor, the navigation system of the Home-Habits App is based on a tab-style menu, since at the top the information from the reports, sessions and personal information of the player are separated into different fragments. profile.

In the reports section (figure 17), a summary of data is displayed for each report generated by each minigame completed by the synchronized player, and if one of them in particular is selected, the complete information of the player is displayed along with statistics of advance of the corresponding level (figure 18).

In the sessions section (figure 19), a list of the sessions created by the player is displayed and a list of reports generated in that session can also be displayed along with the score obtained with reference to the maximum total possible points. reach.

Finally, in the My Information section (figure 20), in addition to viewing general profile information, you can access the synchronization token to monitor more than one player, along with the possibility of changing the password if you wish.

Figure 16 Interface with list of synchronized players
Source: Own elaboration

Figure 17 Reporting interface
Source: Own elaboration

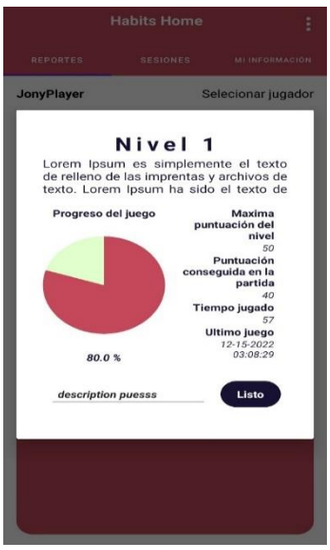


Figure 18 Report detail interface
Source: Own elaboration

Figure 19 Interfaz sesiones
Source: Own elaboration

Figure 20 My information interface
Source: Own elaboration

Gratitude

Express gratitude to the academic body of Intelligent Computing (ITESHUAU-CA-3) of the Instituto Tecnológico Superior de Huauchinango for the facilities provided for the development of this project.

Conclusions

An app called Home-Habits was developed to monitor the progress of the HabitFun video game to generate hygiene habits, specifically children between 6 and 8 years old, with an intuitive, minimalist and appropriate interface for guardians or parents.

The information presented is clear, concise and in simple language so that parents or guardians can understand it.

The Home-Habits App is visually pleasant and simple so that the parent or guardian can use it without so many complications.

Home-Habits is an innovative application that integrates with the HabitFun video game to effectively promote and monitor hygiene habits. Both tools combined mix fun and gamification with personalized monitoring and this allows them to be effective tools for developing and maintaining healthy hygiene habits in your daily life.

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Home-Habits allows while children enjoy the playful experience of the HabitFun video game and work on improving their personal hygiene, Home-Habits offers an interactive approach to behavior change progress, encouraging consistency.

Additionally, progress monitoring through the Home-Habits app allows guardian or parent users to have a clear view of children's achievement as well as areas for improvement, encouraging greater awareness in parents or parents. tutors on hygiene habits. By receiving feedback, users, parents or guardians, feel encouraged to stay committed to the children's long-term goals.

Home-Habits is an innovative and effective app that harnesses the power of gamification and personalized tracking to help children develop and maintain healthy hygiene habits in a fun and sustainable way and parents or guardians to monitor progress. By promoting hygiene as an interactive game, Home-Habits and the HabitsFun video game have proven to be promising tools in improving the quality of life and general well-being of elementary school children aged 6 to 8 years.

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Keywords (In Spanish)

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Citation: Surname (IN UPPERCASE), Name 1st Author†*, Surname (IN UPPERCASE), Name 1st Coauthor, Surname (IN UPPERCASE), Name 2nd Coauthor and Surname (IN UPPERCASE), Name 3rd Coauthor. Paper Title. ECORFAN Journal-Republic of Peru. Year 1-1: 1-11 [Times New Roman No.10]

* Correspondence to Author (example@example.org)
† Researcher contributing as first author.

Introduction

Text in Times New Roman No.12, single space.

General explanation of the subject and explain why it is important.

What is your added value with respect to other techniques?

Clearly focus each of its features

Clearly explain the problem to be solved and the central hypothesis.

Explanation of sections Article.

Development of headings and subheadings of the article with subsequent numbers

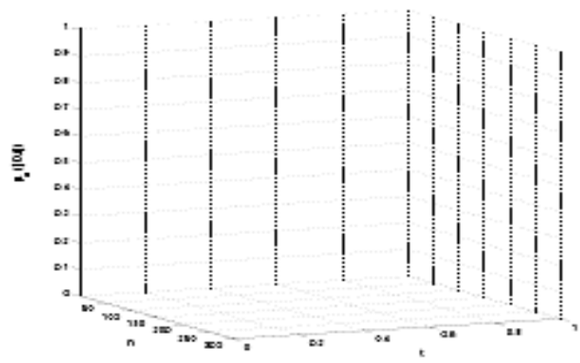
[Title No.12 in Times New Roman, single spaced and bold]

Products in development No.12 Times New Roman, single spaced.

Including graphs, figures and tables-Editable

In the article content any graphic, table and figure should be editable formats that can change size, type and number of letter, for the purposes of edition, these must be high quality, not pixelated and should be noticeable even reducing image scale.

[Indicating the title at the bottom with No.10 and Times New Roman Bold]



Graphic 1 Title and *Source (in italics)*

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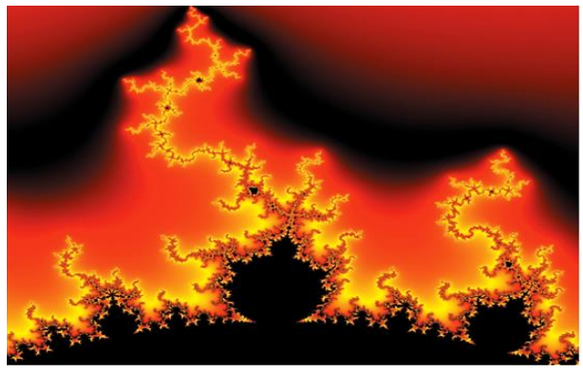

Figure 1 Title and *Source (in italics)*

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Table 1 Title and *Source (in italics)*

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Each article shall present separately in **3 folders**: a) Figures, b) Charts and c) Tables in .JPG format, indicating the number and sequential Bold Title.

For the use of equations, noted as follows:

$$Y_{ij} = \alpha + \sum_{h=1}^{r} \beta_h X_{hij} + u_j + e_{ij} \quad (1)$$

Must be editable and number aligned on the right side.

Methodology

Develop give the meaning of the variables in linear writing and important is the comparison of the used criteria.

Results

The results shall be by section of the article.

Annexes

Tables and adequate sources

Thanks

Indicate if they were financed by any institution, University or company.

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Conclusions

Explain clearly the results and possibilities of improvement.

References

Use APA system. Should not be numbered, nor with bullets, however if necessary numbering will be because reference or mention is made somewhere in the Article.

Use Roman Alphabet, all references you have used must be in the Roman Alphabet, even if you have quoted an Article, book in any of the official languages of the United Nations (English, French, German, Chinese, Russian, Portuguese, Italian, Spanish, Arabic), you must write the reference in Roman script and not in any of the official languages.

Technical Specifications

Each article must submit your dates into a Word document (.docx):

Journal Name
Article title
Abstract
Keywords
Article sections, for example:

1. Introduction
2. Description of the method
3. Analysis from the regression demand curve
4. Results
5. Thanks
6. Conclusions
7. References

Author Name (s)
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