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Management of educational projects applied to information and communication technologies.

Dirección de proyectos educativos aplicados a las tecnologías de la información y la comunicación

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ABSTRACT

This document presents a methodology which can be freely used in the management or direction of educational projects applying information and communication technologies, starting from the general, which is the direction of projects and the life cycle using up to the direction of these.

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In the methodology presented, we work from the incremental life cycle, which allows incorporating new versions, updates and improvements, this process is categorized by the users, the processes where it is reported: the business plan, the pedagogical planning, the incremental life cycle, and the training, we also take into account the channels that are managed and the IT infrastructure used. It is important to highlight that some technologies have been encouraged more than others in education, this is due to the fact that some of them have greater experience in the field, the ability to be linked to different subjects or branches of knowledge, promotion by different publishers or organizations in the education sector, among others. However, some emerging technologies have not yet been fully implemented due to their costs, lack of pedagogical material, hardware devices, licenses, lack of incentives from educational institutions, secretaries of education or companies, and lack of innovation in the educational sector.

Key words: Educational projects, management, methodology, processes and information and communication technologies (ICT).

RESUMEN

En el presente documento se presenta una metodología la cual se puede emplear libremente a la gerencia o dirección de proyectos educativos aplicando las tecnologías de la información y la comunicación partiendo desde lo general, que es la dirección de proyectos y el ciclo de vida empleando hasta la dirección de estos. En la metodología presentada se trabaja a partir de ciclo de vida incremental, el cual permite incorporar nuevas versiones, actualizaciones y mejoras, este proceso está categorizado por los usuarios, los procesos en donde se informa: el plan de negocios, la planeación pedagógica, el ciclo de vida incremental, y la capacitación, tenemos también en cuenta los canales que se manejan y la infraestructura TI empleada. Es importante resaltar que algunas tecnologías se han incentivado más que otras en la educación, esto se debe a que algunas de ellas tienen mayor experiencia en el campo, capacidad de vincularse a diferentes asignaturas o ramas del saber, promoción por diferentes editoriales u organizaciones en el sector educativo, entre otros. Sin embargo, algunas tecnologías emergentes aún no han logrado implementarse completamente debido a sus costos, falta de material pedagógico, dispositivos de hardware, licencias, falta incentivos por parte de instituciones educativas, secretarias de educación o empresas y la falta de innovación en el sector educativo.

Palabras clave: Proyectos educativos, gestión, metodología, procesos y tecnologías de la información y la comunicación (TIC).

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1. Introduction

Since 1910 (Ceolevel, 2016) different academic speakers, universities, companies and organizations have proposed different practices, methodologies or guidelines to define with great accuracy the phases of each one of the projects, a project manager must know or specialize in some of them, since the current world forces us to present and execute projects in one way or another.

Since not all organizations can use the same methodology, this can present variations and adapt according to the sector in which it is working, the objective, the mission, the vision of the company and the same context in which they live, this is a decision on the part of the management government as these strategies can be adapted to meet their objectives and also taking into account the vision of the other members of the institution.

It is also necessary to take into account the time and each of the stakeholders involved in the project, since we must have a global vision of our environment, the users, our suppliers and the people who benefit positively from the project itself.

For which different methodologies have been taken from the design, programming and administration to make proposal in the educational sector, since currently many projects are led in the same but it is not possible to guarantee the continuity of the different projects due to the conditions of its macro-environment and institutional order of each of the organizations, mentioning that this methodology is applicable for education in classroom, virtual and remotely assisted using different platforms.

It is necessary to take into account each of the guidelines mentioned therein and think about how to adapt to the environment and how to guarantee continuity of the same project, carrying out different processes of self-evaluation, consultancy and monitoring by third parties or the participating stakeholders themselves.

Problem

Currently, designing, directing, managing and administering a project around information and communication technologies applied to the educational sector requires special attention from the methodology to be carried out and the activities or processes to be performed.

These projects around information and communication technologies can be seriously compromised because organizations do not think about innovating their own products or services and these can be compromised over time either because it was replaced by a technological device, digital tool, platform or there are new learning models.

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Therefore it is necessary to present a methodology around the management of educational projects using ICT, ensuring the participation of each of the members, taking into account the activities to be performed in a precise and specific way and always linking the end user as the center in educational projects, making use of different strategies around the management of projects and agile methodologies that promote innovation in organizations.

Project management

Directing a project is something we hear very often, however, there are several methodologies proposed: lean Enterprise institute, ITIL (Information, technology infrastructure library), PRINCE2 (Projects in controlled environments), PMI (project management institute), SCRUM, agile, among others, each of these methodologies encourages the fulfillment of phases, collaborative work, presentation of results, permanent innovation in the institution or provides us with guidelines which we can mold according to our needs and of each of the organizations, according to (Vrancken L, 2018): "Modern methodologies have emerged, new versions of previous methodologies or adaptations to different fields, which offer a wide range of possibilities for organizations to successfully carry out their projects".

Since 1910, different companies, institutions and non-profit organizations have proposed different methodologies when managing a certain project (Ceolevel, 2016).

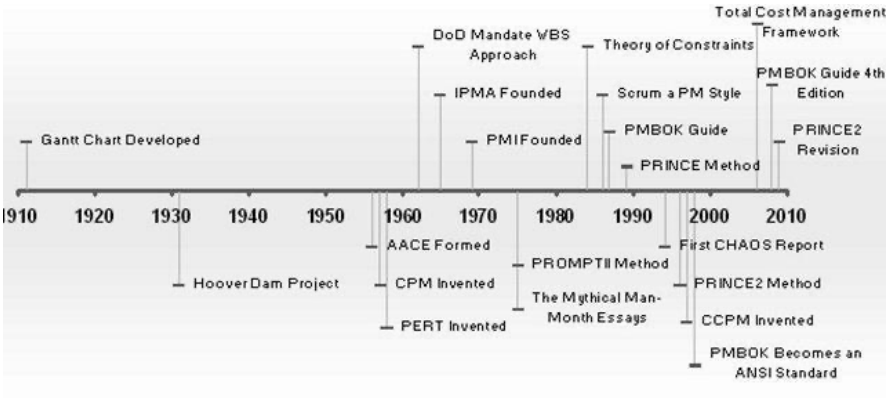

Illustration 1 Timeline 1950 - 2010 Project Management

source: Ceolevel

Each of these methodologies are focused on one or more sectors of the industry, some are used more for software development, structuring a business plan, incorporating new

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features, tracking a product or providing a service, as managers or directors we must ensure success in the institutions we lead, thinking, proposing and executing each of our ideas.

Once the methodology has been selected and according to (Palacio J, 2013) it is important to define the concepts under which we are going to work (Development, work and knowledge) and additionally take into account the management models (predictive and evolutionary), it should be clarified that this methodology is aimed at software development, as we find it in the following image, however, in this document we adapt it, according to the needs in the management of educational projects by evaluating the relevance of each of these concepts and including new ones.

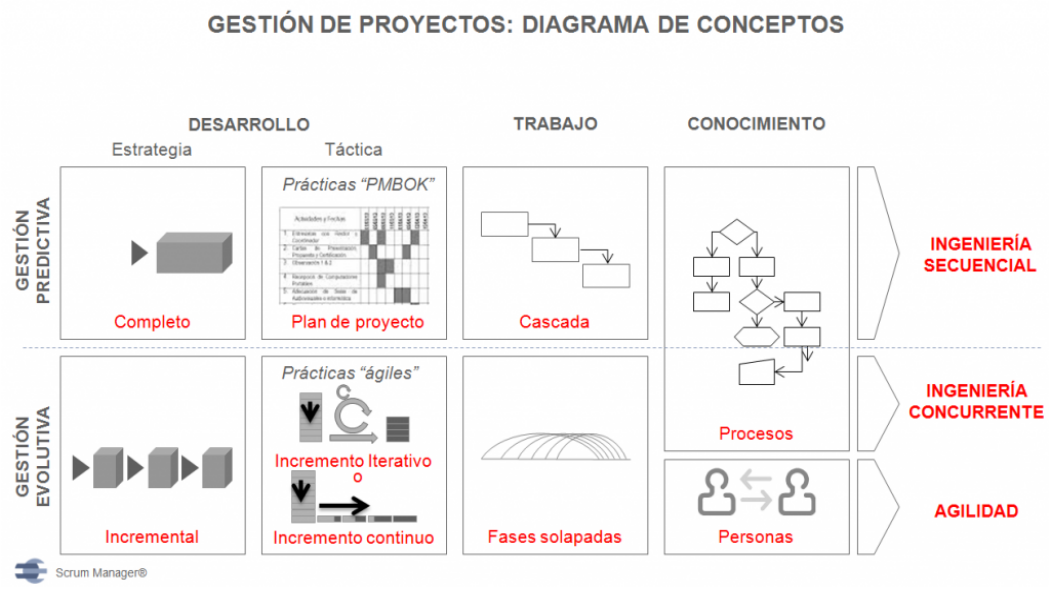

Illustration 2 Concept diagram, source: Scrummanager

In illustration 2 we visualize predictive and evolutionary management, which in any project refers to how the leaders of different educational projects make use of each of the guidelines, suggestions or methodologies in project management, taking into account the strategic vision and the tactical vision, which leads us to talk about the life cycle of a project, ensuring its continuity and evolution over time.

Project management life cycles

In the management of projects applied to the educational sector and making use of information and communication technologies, tends to change constantly, so it is necessary to talk about the life cycle, in the industry there are several types such as the linear life cycle, waterfall, spiral, iterative and incremental.

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The life cycle that has greater compatibility with the educational sector is the incremental one since this (Usr.code, n. f.): "It is built by modules that fulfill the different functions of the system. This allows to gradually increase the capabilities of the software", i.e. from the educational point of view as from certain updates and improvements we can include a greater number of didactic materials, ICT tools, functionalities or pedagogical models in order to present an excellent academic proposal in the teaching-learning process.

Management of educational projects using ICT

One of the biggest concerns when carrying out information technology (IT) projects, supported by hardware or software, is the programmed obsolescence of each of these technological elements, which is why it is necessary to be in a constant updating process as presented by the incremental life cycle.

It is important to innovate in our teaching and learning process (Agerrondo, Lugo, Rossi, 1999): "Schools are transformed when deficiencies are detected, when imperfections and backwardness are detected, and when decisions are made to overcome them with a proactive attitude", for which reason the following methodology is proposed in the management of educational projects:

From the beginning, keep in mind that this methodology will have an incremental life cycle, i.e. (Sáez, P., Rodríguez, V., Villanueva, J. & Cueto, M, 2014): "It focuses on the delivery of an operational product with each increment. The first increments are incomplete versions of the final product, but they provide the user with the functionality he/she needs and also a platform for evaluation" and seen from the point of view of the student and/or learner, who will be at the beginning and end of each phase presented.

Due to the large number of categories that participate in this process we will explain one by one and who they are, ending with a graphic of this and a brief explanation of how this would work at the time of executing each one of them.

Users

1) End users: Each student/learner at all educational levels, carrying out their learning processes in a face-to-face, virtual or remotely assisted manner.

2) Teachers: They impart knowledge to each of the students making of different didactic and digital tools, at the same time is who carries out a teaching process, (Gonzalez I, 2015): "In which a certain knowledge about a subject is communicated, and to learning as the acquisition or instruction of a new knowledge, skill or ability".

In this methodology they have an additional task and that is to evaluate each of the proposals presented and/or pedagogical models to be managed, since these must be in a constant process of improvement, updating and incorporation of new functionalities.

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3) Academics: They are experts in the subject and have a great experience from the experience and/or applicability of different concepts to be developed in the subject, others may call them as the sources of knowledge or the theoretical framework under which they are going to be developed.

4) Managers: For this position it is necessary to recognize different agile methodologies and carry out a management process among clients, institutions or academies and in the management of the team of teachers, collecting the improvements that each one of them can offer to the educational methodology used.

If the team is large, a team of coordinators is needed, who will be in charge of verifying and increasing the current versions by adding functionalities and incorporating new needs to the educational proposal.

Processes

1) Business plan: It is a document in which all aspects of the company are found, its corporate name, mission, vision, financing model, catalog among others, the business plan is, (CEASE, 2011): "A management tool of the company that serves as a guide for the entrepreneur or businessman to implement a business. That is, the business plan is a planning tool that allows communicating a business idea to manage its financing", this plan is totally different from pedagogical planning.

2) Pedagogical planning: it is a document that allows educators to execute their teaching processes in a structured way, reflecting the objectives of each session, class or meeting, it also allows us (OEI, 2018): "Building work proposals in advance allows us to propose processes that respond to the characteristics, needs and particular interests of all those who meet in the modality".

3) Training: Both students and teachers must be in a constant process of learning and training, in order to keep up with new methodologies, improvements in the teaching process, the incorporation of another program or the usability of a new application.

4) Incremental life cycle: It is one of the most used methodologies in project management in software development, and it can be successfully applied to the educational sector, however, we must be very attentive and willing to learn, because we run a great risk in the implementation of these methodologies, since they can become obsolete over time.

It is made from modules (Usr.code, n. f.): "That fulfill different functions of the system. This allows to gradually increase the capabilities... It facilitates the development task by allowing each member of the team to develop a particular module".

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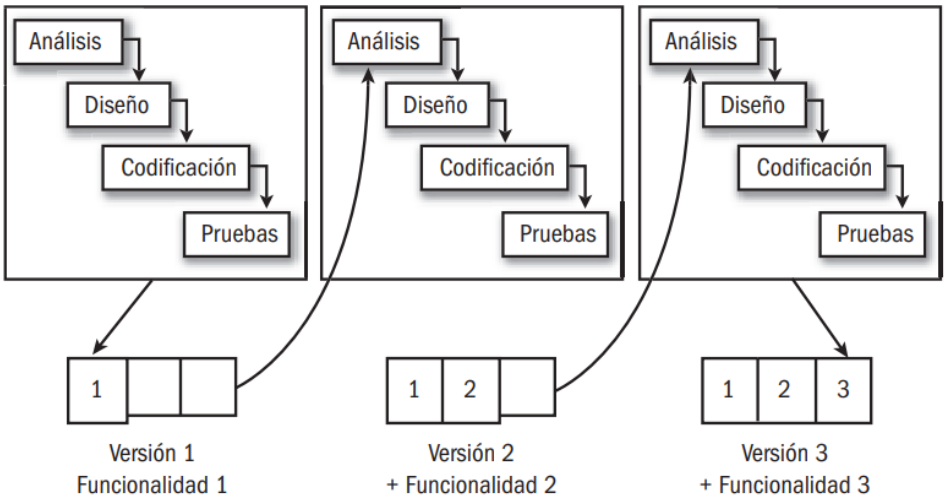

***Illustration** 3* Incremental life cycle, source: Implementation and debugging - Chapter 1

Therefore, this methodology is proposed to be used in the development of educational projects, in which we will have a constant process of innovation and constant improvement, where students and teachers will be active members and will have the ability to propose or incorporate new versions.

This life cycle is worked from (Amejiade L, 2016): "An organization needs to manage changing objectives and scopes, to reduce the complexity of a project or when partial delivery of a product benefits and generates value for one or more stakeholder groups without affecting the final deliverable or set of deliverables".

Channels

1) Means of communication: Means through which the marketing, sales and contracting process will be carried out.

2) Social networks: This is optional as it can be used to increase marketing strategies and generate greater traction.

3) Electronic Media: Development of print, multimedia, digital or software proposals

Initial investment

The initial investment in the realization, constitution and creation of different projects in the educational sector are essential, no matter if the organization or the group of people who lead it will work for profit, if it is a public entity or a foundation, an initial

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investment in it must be guaranteed and achieve the duration of this and that in a period of time that investment returns to the benefit of the entity.

Information technology infrastructure

Today there are several ways of learning, in a traditional way, from experience, formal education, non-formal education, carrying out a self-taught process, online learning, among others, therefore ICT plays an important role in education today (Cañete M, 2015): "It produced a great challenge and impact for education, especially for the teacher... It has a significant impact on the development of students' learning and strengthening their competencies for life" (Cañete M, 2015).

1) Hardware: Refers to all physical elements, elements or devices used during the development of the pedagogical proposal.

2) Software: Virtual elements incorporated into the planning of the educational project.

3) Pedagogical material: These can be presented in physical form in a book, a primer, a guide, among others, or presented digitally, a tutorial, a PDF, a virtual learning object, in short and according to (González I, 2015): "It favors the teaching and learning process and facilitates the interpretation of content that the teacher has to teach".

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Illustration 4. Life cycle, source: Own elaboration adapting the incremental process

Agile methodologies

Agile methodologies (Amejiade L, 2016): "They are a series of techniques for project management. They emerged in the field of software development, but have also been exported to other types of projects", the purpose of these is to strengthen business processes, design, programming among others, in a graphical, effective, safe and efficient way.

Such agile methodologies are generally employed in agile software development, where (Amejiade L, 2016):

"These are based on iterative and incremental development, where requirements and solutions that evolve over time according to the need of the project. The work is done through the collaboration of self-organized and multidisciplinary teams."

At this point, the agile methodologies and the proposed incremental life cycle generate synergy between each of them, thanks to the fact that the life cycle is one of the necessary processes to carry out the implementation of ICT in the educational sector

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from constant updates linked to design thinking, one of the methodologies proposed in this section.

In the management, administration and design of the strategy of an educational project it is necessary to take into account high time pressure and the opinions of various participants or stakeholders involved in our project, so it is necessary to use different agile methodologies that promote the development of the project and its continuity.

As an institution or entity, it is necessary to generate spaces for dialogue and exchange of acquired knowledge, to take into account the explicit and tacit knowledge of each of the participants and to collect the position of each of them in order to guarantee the continuity of the project itself, since when we work with IT, as mentioned above, these tend to become obsolete and the life cycle of the project itself can be seriously compromised.

In the following space several agile methodologies that will achieve the collection of information and each of the positions to perform each of the increments (improvements) in our life cycle, these must be adapted according to the project and the context of the same company are propitiated.

Lean startup:

This can be appropriated only once and it is at the beginning of the construction of the theoretical framework of the project, i.e. based on theory, technological advances to date, the experience of the team members and the initial perspectives of the users (Prim A, 2020): "The objective is to reduce the risk in the launching of new products and services. Learning from the customer (Customer Development) is the key and the faster and cheaper the better".

Such methodology focuses on three steps (Llamas F., Fernández J, 2017)**: "**The Lean Startup methodology focuses on a three-step circuit that must be traversed in the shortest possible time and with the minimum investment. You start by creating a product, measure the results, and learn".

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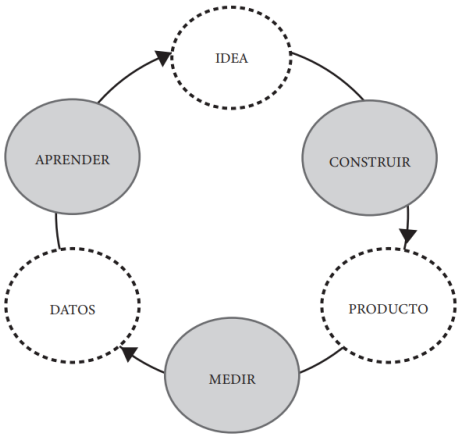

Illustration 5 *Lean Start up circuit, source: Ries (2012).*

When using technologies with a long history in the educational sector or emerging technologies which do not have great experience by educational centers, teachers and students, it is advisable according to (Llamas F., Fernández J, 2017)**: "**You learn in a short time, investing minimal resources. Lean Startup is a methodology aimed at the implementation of innovative ideas".

SCRUM

One of the benefits of using this methodology is that, (Amejiade L, 2016): "It tends to make the processes that influence the development of technology increase in speed and flexibility, always taking into account the times and business rules that give reason for the development of the project" (Amejiade L, 2016).

This methodology is used in development projects of different applications, web pages, among others, i.e. from the IT sector, this methodology is divided by Sprints or iterations.

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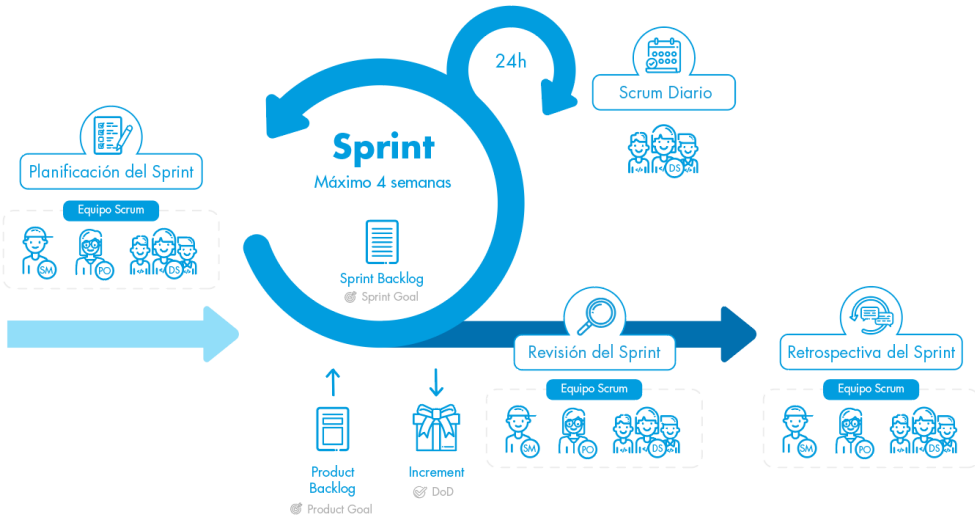

Illustration 6 *Scrum, source: Netmind (2020)*

As presented in Illustration 4 as each phase or increment is completed, (Gutierrez J, 2007): "The result of each Sprint is an executable increment that is shown to the customer. The second important feature is the meetings throughout the project, among them is the daily 15-minute meeting of the development team for coordination and integration".

Design thinking

This methodology favors collaborative and innovative spaces, since, from the beginning, it is important to make decisions taking into account the perspective of each of our end users, from the life cycle named in illustration 4, this can be done from the evaluation stage, according to (Cáceres E, n. f.): "It implies that the agents involved dialogue mutually in empathy with what is expected to receive (customer) and what is expected to design (developers)".

From this section is how end users perceive this pedagogical proposal and if it meets the specific needs of the client, it is important to remember that this space can not leave aside the technologies, be it a computer program, application, digital teaching materials, among others for further evaluation and systematization of this.

The Hasso Plattner Institute of Design at Stanford, makes a slight modification of design thinking, these 5 phases (Visso R, 2019): "They are not necessarily linear, as one can return to previous phases to improve its proposal by having significant new information, discovered during the process or received as feedback from the user", this process is presented in the following illustration 7.

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Design thinking can be modified, adapted and involve certain proposed working methods, such is the case of Stanford University that adapted this methodology for the educational sector and proposes a guide to the creative process with 5 phases (empathize, define, devise, prototype and test) and 19 methods to promote innovation from any institution.

Illustration 7 Phases of design thinking, source pymeup (2019).

Employing such methodology is suggested (Visso R, 2019): "It involves exploring until finding a user group or market segment with unmet or partially met needs, with latent problems whose solution is valued and meaningful to the users".

In the case of this methodology, when the evaluation process is carried out for the second, third or fourth time, it must be evaluated on the action plan indicated by the company, as a result of the immediately previous increment (phase or version of the project), remembering that innovation must be encouraged.

Incremental lifecycle using agile methodologies

To conclude this section of agile methodologies, these 3 are suggested to work from the phases of the life cycle previously presented in illustration 4, taking into account the development, diagramming and construction of that value proposition applying the **lean start up**, the development of programs, applications, web pages or educational platforms implementing the **SCRUM** methodology with the technical

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development team and the evaluation of each of the increments from the teachers, instructors and end users making use of the methods proposed by the **design thinking.**

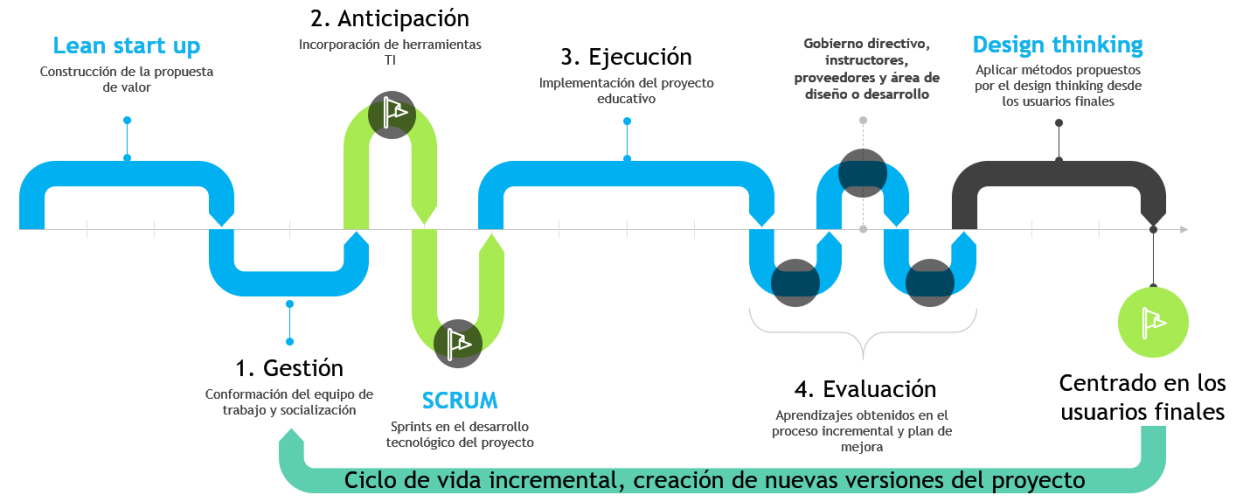
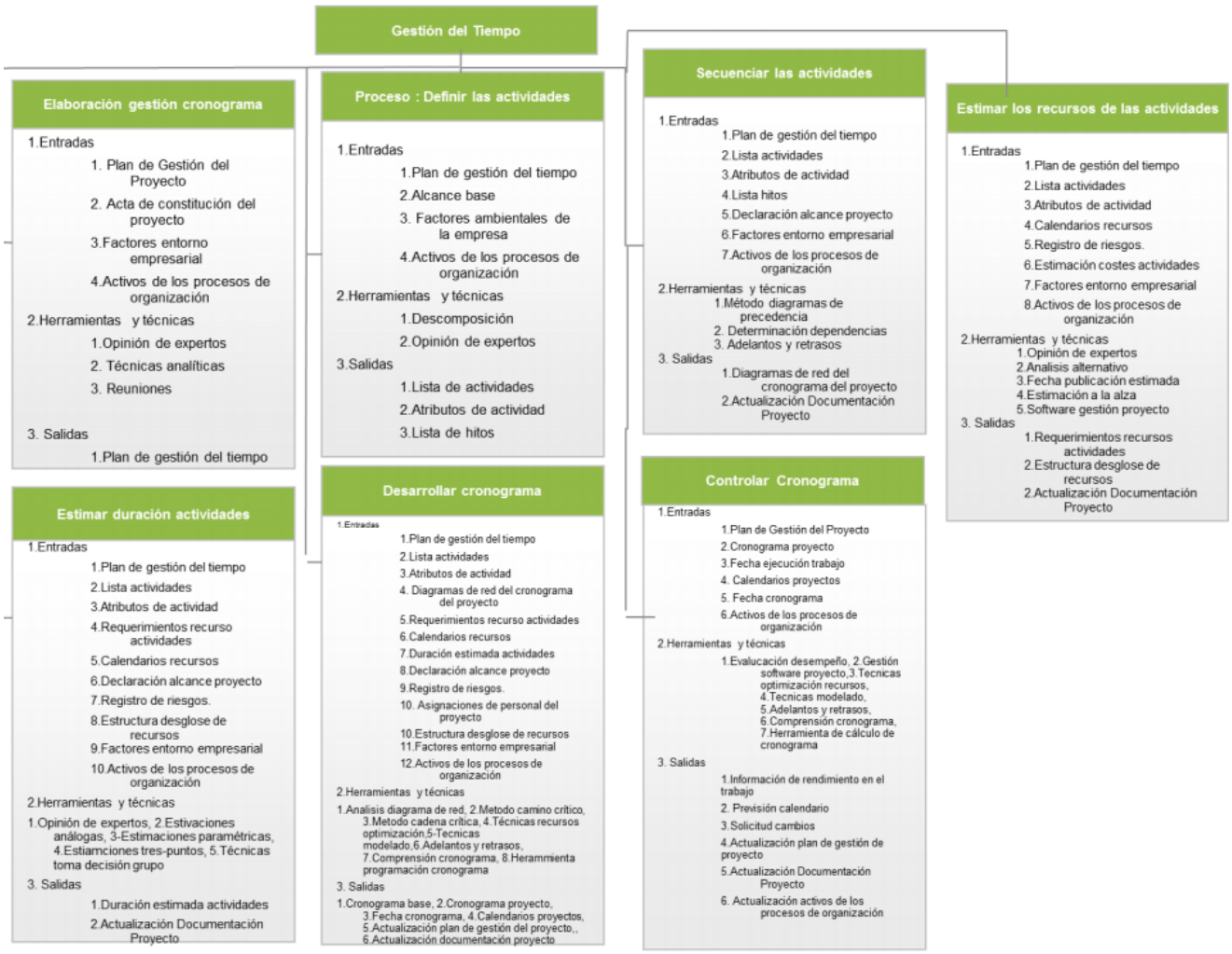


Illustration 8 Appropriation of agile methodologies to the development of educational projects, Source: own elaboration adapting the incremental process.

Time management

Different guides or business references such as ITIL (Information technology infrastructure), PMBOOK (Project management body knowledge) and PMI (Project management institute) propose structures, guidelines or segments based on the time to be assigned to each project.

In the case of the PMI, it is one of the most adapted to this proposal of ICT applied to education, since it is subdivided into 3 categories: Strands, tools and outputs, as shown in the following image:



Inputs, outputs and process tools and techniques (Time management), source: Project management according to PMI (2016).

As directors, project leaders or managers, planning and managing each of our projects, it is necessary to propose and employ various tools for the execution, monitoring and validation of each of the processes, one of the most essential tools in time management is the schedule, where the (Umaña F, 2018): "Process of establishing policies, procedures and documentation necessary to plan, develop, manage, execute and control the project schedule".

As can be seen in this image, time is divided into different categories in this space: Elaboration schedule management, process define activities, sequence activities, estimate resources of activities, estimate duration of activities, develop schedule and control schedule.

It is important to remember that the times must be specified from the beginning and adapted according to the needs of the organization and the context in which it will be carried out. At the same time, a leader, coordinator or manager must check that these activities are being carried out within the parameters provided above, with a clear and precise manual of functions and deadlines.

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From the information provided is to give a section in this chapter that are the times of completion of the project, since from the beginning it should be clear how to start each educational project depending on the technology used or the model proposed by the organization, so this section is divided into:

1) Preliminary construction (Lean start up)

This phase is one of the most important, as it will lay all our project foundations, it will help us to forecast strengths and weaknesses, evaluate the competition (if any), prevent future risks, since many companies or small businesses fail from the beginning, since according to (Llamas F., Fernández J, 2017): "In the business plan, they get funding, develop the product and only after creating and launching it the company gets feedback from customers".

In this specific case, the aim is to make this initiative reach all users and through a small work team build the foundations of this project. It is suggested that this team be multidisciplinary and include the project leader, a coordinator, a development expert, a specialist in ICT applied to education and an instructor.

Responsible parties: Project manager or director, coordinators, experts or academics and instructors.

Estimated time: 2 - 6 months.

2) Work Schedule

The work chronogram must be completely detailed, in which the persons in charge, delivery dates, brochures, instructions, didactic material, hardware, software, financing, among others necessary to carry out the project, must be designated.

These are the (Umaña F, 2018): "Activities, sequences; as well as estimating durations and resources and with this develop a follow-up schedule for the project or phase, likewise Gantt diagrams that integrate and control all the information about the time of the activities", in this section we find a tool that can facilitate each of our processes which is the Gantt diagram, in which are the defined times of each of the activity, the areas in charge, and the process which will be carried out during the life cycle and the increments that are made.

The Gantt chart, presents how we divide each of the activities or processes within the project, we assign to one or more areas of the company for the development of the same and we make clear each of the dates, employing this tool would carry a great, (Umaña F, 2018): "The key benefit of this process is that it provides guidance and direction on how the project schedule will be managed throughout the project".

Responsible parties: Project manager or director,

Estimated time: 2 - 6 months.

3) Pedagogical planning

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Such educational processes using ICT will strengthen the innovation processes from the classroom, the organization or company, however, a solid team of instructors with management of different pedagogical models and learning strategies is required to meet these goals.

This team must be trained in advance, since technologies tend to fail in some cases, which requires that this team of instructors be trained to solve different problems that may arise during the day and avoid future headaches for the project or delays in its execution.

The articulation of ICT in any educational or learning environment, according to (Cortés S., Ordoñéz T, Neira J, 2017): "It is affected from the generation of new learning models, seeking to establish relationships with real life and seeking to implement strategies that increase the levels of concentration and interest of students", said this will favor a space for creativity, participation and collaborative work between each of the members of the organization.

Unlike the previous one, this one requires other totally different formats which are proposed by the same team to carry out the planning of each of the activities, development, feedback and evaluation of the learning process.

Responsibility: Coordinators and instructors.

Estimated time: Estimated duration of the project, depending on the planning proposed by the organization.

4) Development (Scrum)

Nowadays our proposals must be supported by online or downloadable content from different devices (virtual reality glasses, cell phones, tablets and/or computers), it is essential to have digital tools, whether it is a platform, a video tutorial, a web page, a mobile application, an instructive, a pedagogical guide, platforms, among others.

Therefore, a team is required to translate each of these ideas, pedagogical proposals, sequences and activities into a digital environment, where designers and programmers will be in charge of materializing each of these products and at the same time make them pleasant for the context in which they are presented, since they can be focused on a very general population, such as preschool, primary or secondary school children, adults, etc. The understanding of the digital product by the users must be guaranteed and it must generate an interaction with ICT.

Responsibility: Scrum master, programmers, graphic designers and end users.

Estimated time: For each phase or sprint in scrum is a minimum of 2 weeks and a maximum of 4 weeks.

5) Evaluation (Design thinking)

As mentioned above, design thinking is user-centered and its main objective is to innovate such educational processes, through the design phases and their methods.

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Which consists of, (Instititute of design at Stanford, 2017) "It consists of soliciting feedback and opinions about the prototypes that have been created from the same users and colleagues in addition to being another opportunity to gain empathy for the people of which you are designing in another way".

In this space are the instructors who will lead these processes and provide the results to the coordinators and the development team (Scrum) what are the results, thus having all the necessary information to establish other versions or increments in the life cycle of the project.

Responsible parties: Instructors and end users.

Estimated time: Maximum one month.

6) Socialization of processes and incremental phase

Every learning process requires a socialization of the results, which must be led by management and each of the coordinating departments, where each area presents the action plan carried out to date, its results and proposes alternatives for improvement.

The purpose of socializing such results is to generate (Vielma J, 2003) "Relationships and interactions that leave traces in their emotionality and affectivity, as well as in mental elaborations, cognitive structuring, attitudes and behavioral orientation", motivating learning also from the organization or institution and each of its areas.

This in order to carry out the incremental life cycle, (Amejiade L, 2016):
At the end of each iteration, a deliverable or set of deliverables will be completed. Future iterations may improve the deliverables or create new ones. Each iteration builds deliverables with a gradual incremental increase until the phase's exit criteria are met, allowing the project team to incorporate feedback.

From each of the coordinations, the respective notes must be taken and an action plan generated, which will be carried out in the next increment of the project, making the respective improvements and implementing it with each of the end users.

Responsibility: Instructors and coordinators.

Estimated time: 1-2 months.

In conclusion, in the management of educational projects it is necessary to have a strict time control, these are proposed from the same management to all parties, emphasizing effusively the use of ICT, the fulfillment of the objectives and proposing improvements in an incremental way.

From the companies, organizations or institutions, if these innovation processes are not strengthened, the projects may be negatively compromised, due to better proposals in the market, the obsolescence of this, or this no longer has any significant relationship with the end user.

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The times should be adapted and it is suggested to use the Gantt chart, in this way a greater order will be achieved, an assignment of tasks to each of the areas and a total visualization of all the activities and processes generated for the development of the project.

Applicability of ICT in educational environments

ICT in the education sector is growing at an upward and almost exponential rate (Barriga A, 2013): "It should be recognized that a significant number of education systems worldwide are formulating policies to formalize its use in education" and at the same time motivating it from different spaces and institutions at all levels.

This requires incorporating into the work area or classroom: equipment, licenses, applications, platforms and virtual learning environments, among others, which will drive each of the educational strategies, strengthening the learning process and thus ensuring (Castelló F, 2020) "Maximum use of resources, promoting not only efficiency but also creativity and innovation".

These technologies can be categorized into different environments such as ICT teachings, ecologies and environments, E-learning, M-learning, digital competencies and Smart classroom and emerging technologies which have not been tested or do not have much experience in the academic field.

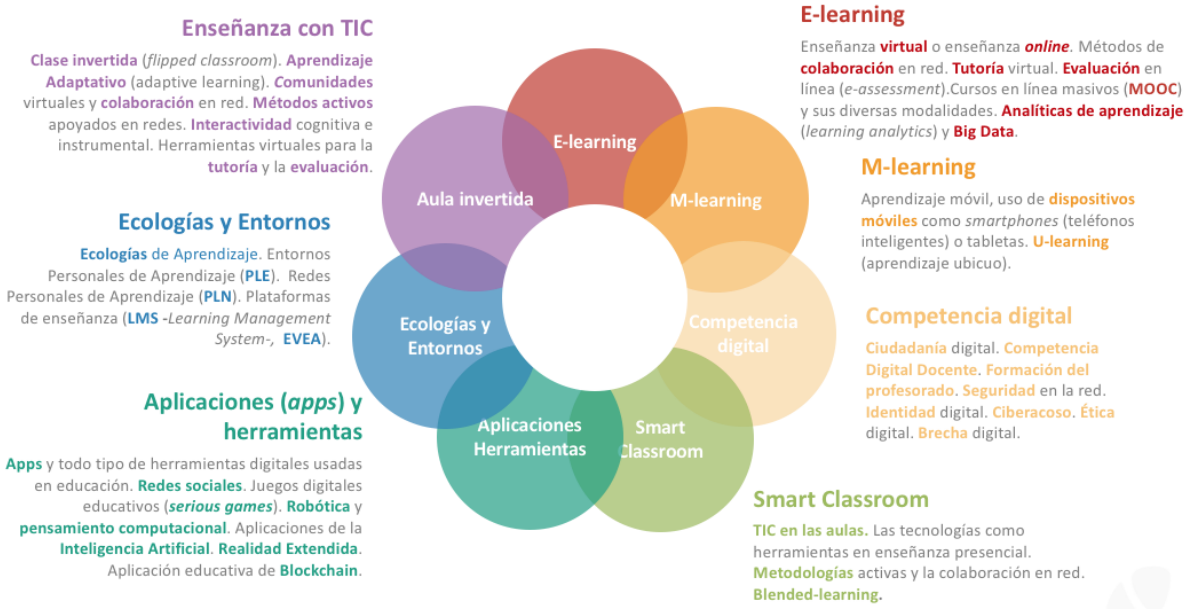

Illustration 10 Trends in educational technology, source: Prendes M. and Cerdán F (2021).

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ICT applied to education have strengthened new pedagogical models, from which propitiate new spaces for innovation, however, such methodologies as flipped classroom, educational communities, network collaboration and different methodologies in education.

Regarding virtual learning environments, (Rayón A., Ledesma R., Escalera S., 2009): "It is required that those who participate in the design of these environments must know all the available technological resources (infrastructure, media, information resources, etc.)". E-learning and M-learning environments are intended to guarantee the access of each of the students, teachers and administrative staff to each of the learning, interactive and multimedia contents. This can be adapted from a web application, an educational platform, desktop or mobile applications.

When we talk about digital competencies is to verify if from an entire pedagogical planning, each of the objectives initially outlined from the first phase, until the last one which is the evaluation of this, guaranteed the collection of the positions of the end users and with them to achieve a process of feedback and improvement consecutively.

And finally, the Smart classroom is a classroom specialized in ICT, which has the necessary infrastructure to develop different pedagogical proposals, whether in robotics, augmented reality, programming, big data, internet of things, home automation, among others.

Educational proposals around ICTs

There are multiple fields in education in which ICT can be applied, as suggested in the report on advanced technologies today, Prendes M. and Cerdán F (2021):

In this section it is necessary to make a strict review of which technology is more suitable to link in the field of ICT, the most emerging technologies are presented today, the organization is able to choose which one is the most related to its pedagogical proposal and involve such technology during its process.

Conclusions

- The methodology proposed in this document works from different approaches, the management of educational projects has even more aspects that can be broken down, adding new phases or sub-phases of those presented above, however, these vary depending on the technologies to be used and the context in which the organization or policies are found.
- Apply the lean start up as the first instance in every project before making the technological, financial, educational and human talent investment. Since the rules of the game and the guidelines with the users related to such projects are defined from the

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beginning, identifying the development of such technologies in the educational sector and their improvement alternatives.

- It is necessary to make an investment at the beginning of our projects and guarantee in what concerns technological infrastructure, payment to suppliers, payroll, leases, licenses, among others, since the greatest deficiency in the development of these is that we do not think about these expenses from the beginning and it can affect the provision of the service or the reliability of the same entity.
- The incremental life cycle helps us to provide new versions of the project, while ensuring that it lasts over time, generating its competitiveness and guaranteeing the collection of each of the significant lessons learned. Through phases or processes of constant updating, strengthening each of the innovation processes and the linking of ICT as an educational strategy.
- Adopting different business management practices or agile methodologies for the development of each of the products, must have a rigorous analysis by each of the team members, this is because these methodologies must be adapted according to the context in which it is located, the mission, vision, values of the company and the objective or goals to be developed.
- Always take into account the point of view of the end users and the suppliers themselves, since they will be an essential element when making decisions, strengthening each of the evaluation and self-evaluation processes within the institution and creating improvement plans.
- The education sector can involve different stakeholders such as institutions, schools, universities, public and private entities, companies, among others, to promote a suitable learning ecosystem, appropriate for the use of ICT at different levels of education and the development of different applied projects.
- ICT applied to education generates new spaces, learning methodologies and management systems in terms of monitoring the educational process of each of the users, in this item it is very important to collect each of these data to take them into account in the action or improvement plan at the end of each incremental phase or version of the project.

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